WATTer Skills

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Water Efficiency and Water-Energy Nexus in Building Construction and Retrofit

IO1. Setting the Perimeter of WATTer Skills

Skills for water efficiency technicians and experts

REPORT

ERASMUS+ Programme

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Strategic Partnerships for Vocational Education and Training

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- Agência para a Energia – ADENE (Portugal)
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- Ente per la Formazione e l'addestramento professionale nell'edilizia – FORMEDIL (Italy)
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Content

WATTer Skills definitions

Alphabetical order

- **Black water**. Black wastewater refers to domestic wastewater only in some extent (excludes greywater), including the sewage that produced from toilets or urinals.
- **Drinking water installations, efficient irrigation systems and sanitary network design**. Public water networks used for water transport and supply and building plumbing systems. Sanitary design should encompass strategies and systems for reducing water consumption, as well as recycling rainwater and grey water may be key elements to save water in buildings.
- **Energy and water efficient home appliances.** Equipment and devices with good energy efficiency performance, that can save water and energy in different aspects of the construction and use of the building, especially those that are related to hydraulic and thermal installations.
- **Greywater**. Greywater refers to domestic wastewater only in some extent (excludes black wastewater), also addressed as soap water, including that produced from e.g. baths, showers, faucets, dishwashers or laundry.
- **Heat, cooling and hot water installations and renewable energy systems**. The energy performance of installations is directly associated to water use in the case of hot water production and indirectly to heat control in summer. Air conditioning and heating installations often uses water as a heat transfer fluid, which requires no leaks.
- **Rainwater harvesting**. Rainwater harvesting refers to water that result from the rainfall occurring locally or in the surrounding area and that represent, in general, low pollutant content, and collected in dedicated systems.
- **Regenerated water.** Regenerated water refers to grey water that is treated for reuse purposes, in compliance with the quality standards established for the destination uses.
- **Site conditions**. Site conditions, e.g. climate, orientation, the influence of “heat island” effect, that can be used to enhance energy efficiency related to water efficiency (use and water consumption reduction).
- **Wastewater**. Domestic wastewater refers to the general house effluent coming from the toilets, kitchens, laundry and similar uses (includes backwater and greywater).
- **Water efficiency in green areas and site based passive measures**. Buildings with gardens and green areas, especially single dwellings, can have an intense water consumption and ecological footprint if the climate is not taken into consideration. For instance, it is very important that green areas are composed of native plants and a combination of other materials, such as wood, sand or rock, which minimize the water use. It also needs to be taken into account that trees, vertical gardens, and green roofs can also provide thermo-regulation for the building (envelope and interior).
- **Water efficiency**. Efficient use of the water which is supplied to a building (including alternative sources other than drinking water), considering water conservation measures and the continuous valorisation of the water as a natural resource, also integrating the water-energy nexus. Water efficiency measures in buildings may include water use audits, water-efficient products and smart technologies or recirculation systems (e.g., for hot water). Other measures could refer to greywater reuse, rainwater harvesting, landscape redesign and efficient irrigation systems.
- **Water-energy nexus**. Strong interrelation and interdependence between energy and water consumption. The inefficient management of water corresponds to energy waste and vice-versa, owing that water is critical for energy production while energy is critical for water production and use.

WATTer Skills acronyms

Alphabetical order

DHW	Domestic Hot Water
ECVET	European Credit system for Vocational Education and Training
EQF	European Qualification Framework
NQC	National Qualifications Catalogue
NQF	National Qualifications Framework
NQS	National Qualification System
SWH	Solar Water Heater
VET	Vocational Education and Training
WEE	Water Efficiency Expert
WET	Water Efficiency Technician

1 Introduction

Water scarcity and security is a serious problem for many regions of Europe with some 45% of European territory expected to be facing water scarcity problems by 2030. On the other hand, the damage caused by floods may increase five-fold by 2050. Such situations are driving growing attention and increasing regulation on water efficiency, water security and water management across Europe, both in response to water scarcity problems and to climate change mitigation and adaptation goals. This is happening particularly in cities and buildings (residential, public and commercial buildings, such as hotels, offices, hospitals and schools), considering the economic and environmental benefits of water savings in buildings (estimated in 30% in the European Union - EU), as well as the consequent reduction in energy consumption and CO_2 emissions (which estimated energy savings are equivalent to 3.5 % of total residential energy use in EU), according to data from "The Blueprint to Safeguard Europe's Water Resources" (COM(2012)673). Further to several EU initiatives and the "Closing the loop – An EU action plan for the circular economy" (COM(2015)614) and the Urban Water Agenda 2030, launched by the European Commission in 2016, efforts are underway in the European Commission - EC to promote standards for water efficiency products and systems in buildings, to move towards an EU framework of core indicators for the environmental performance of buildings, including the efficient use of water resources. This framework will set harmonized criteria at European level for evaluating and certifying buildings on their environmental and water use performance. These changes will require new harmonized skills within the water professionals, but also within construction and "green" professionals, as well as market's and consumer's confidence in the adoption of water efficiency solutions for buildings.

The listed concerns require adequate training and capacity building to improve the qualification of the professionals on the market. There is also a clear need to provide the market with a robust, reliable and independent certification scheme, *competence-based evidence scheme*, that will reward competent professionals and purge from the market professionals that do not deliver quality and secure technical installations.

WATTer Skills (Water Efficiency and Water-Energy Nexus in Building Construction and Retrofit, http://watterskills.eu/) (Figure 1) is a European project, funded by the ERASMUS+ programme, which aims to develop, propose and implement a common curriculum, qualification framework and certification scheme at the European level, for training and skills upgrading of construction and green professionals on water efficiency and water-energy nexus for building construction and retrofitting.

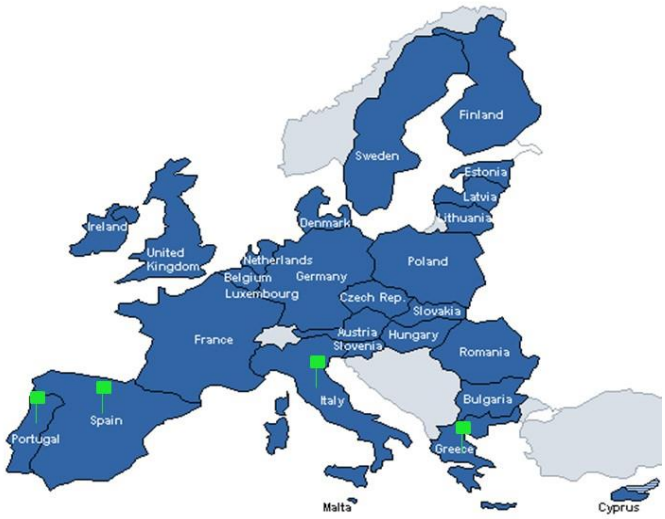


Figure 1 – The 4 countries that participate in the partnership: Portugal, Spain, Italy and Greece.

Therefore, WATTer Skills will:

- Set the perimeter and the WATTer skills map at a European Union (EU) level;
- Develop a common qualification framework and certification schemes based on training and learning outcomes designed for water skills, in line with the European Qualifications Framework (EQF) provisions, able to be adopted and adapted (nationally) for training and qualification of the different types of professionals targeted;
- Develop the training courses curricula and contents for the two professional profiles identified: Water Efficiency Technician (WET) and Water Efficiency Expert (WEE);
- Develop and propose a common certification system based on the European Credit system for Vocational Education and Training (ECVET) training credits capable of being used in all EU countries, fostering mobility and recognition of professionals in the European market.

1 Objectives

The WATTer Skills aims to provide a tool that promotes transparent curricula and training for the development of sustainable and sound practices for water efficiency and its related professionals. The project will contribute for the recognition and transparency of qualifications at EU level and provide an innovative model for competencies for the water efficiency sector. Thereby, the Vocational and Educational Training institutions will have the necessary tools to enhance the skills set as required in the various disciplines and workplaces to workers within the water efficiency field.

This document refers to the first step of the project Intellectual Output I, whose objectives are the following:

- Starting point and definition of the WATTer skills map at a European level;
- General definition of the skills;
- Definition and collection of the monitoring indicators, to compare water efficiency and energy efficiency in buildings (before and after the implementation of the training and qualification system), including data collection of water and energy consumption.

2 Existing qualifications and VET on water

All European countries have their own National Qualification System (NQS). This section identifies, primarily, the qualification/s regarding the existing professions on the water efficiency and water-energy nexus perimeter, and secondly, formal training carried out in each of the project partner countries – Portugal, Spain, Italy and Greece.

2.1 Portugal

The NQS aims at integrating into a single system the vocational training attached to the educational system and the vocational training associated with the labour market, with common instruments and objectives. One key instrument of the NQS is the National Qualifications Catalogue (NQC). It is a dynamic and inclusive system, designed for the undergraduate qualifications, relevant for starting and continuing training, adjusted to the needs of companies and the labour market, considering the existing and emerging activity sectors. The NQC is periodically updated with new or revised qualifications, whereas qualifications may be excluded, to respond both to current and future needs with respect to education, training and employment.

Currently the NQC comprises 274 qualifications, grouped by areas of education and training and by levels of qualifications of the National Qualifications Framework (NQF). For each qualification, the NQC provides an occupational profile, a training NQF standard and a standard for the recognition, validation and certification of (educational and professional) competences. In addition to qualifications in traditional areas of the building sector, such as plumber, painter, floor and wall tiler and mason/bricklayer, as well as qualifications of a more technical/intermediate level, such as project supervisor, draughtsman, instrument man, or measuring surveyor, the NQC also includes qualifications in the area of renewable energy sources, namely solar thermal systems installer, biomass boiler installer, heat pump installer, solar photovoltaic systems installer, wind energy systems installer and bio-energy systems installer (Table 2-1).

Table 2-1 - National qualifications in Portugal

NATIONAL QUALIFICATIONS			
What it is: Qualifications made by National Agency for Qualification and Vocational Education and Training (ANQEP[1]) defined by: knowledge, skills, competences. **Access:** NQC comprises training standards for these qualifications so that they can be accessed by way of a set of education & training modalities, targeted either at young people who have finished basic education and seek vocational qualification – vocational training courses or apprenticeship courses, or adults who do not possess qualifications in a given vocational domain – education & training courses for adults (EFA) and certified modular training.			
TITLE OF THE QUALIFICATION	NQF[2]	EQF	CONTENT
Plumber	2	2	Link
Bricklayer	2	2	Link
Technician specialist in energy rehabilitation and conservation of infrastructures - buildings	5	5	Link
Technician specialist in Energy Management and Control	5	5	Link
Technician installer of Renewable Energies Thermal Systems	4	4	Link

[1] Public entity responsible for coordinating the implementation of youth and adult education and vocational training policies and ensuring the development and management of the recognition, validation and certification of competences system and management of the National Catalogue of Qualifications (NCQ).

[2] National Qualifications Framework: National Qualifications Catalogue reflects the convergence with the European Qualifications Framework and integrates 8 levels of professional qualification, being ANQEP responsible for all of them. Level 6 to 8 correspond to university studies.

ANQEP sets up the Sectorial Councils for Qualification with the aim of updating the NQC, which is the strategic qualifications management instrument of the NQS. These councils are technical-consultative groups in charge of permanently identifying the updating needs of qualifications included in the NQC with a view to matching training with technological progress and sector-required competences, either for starting training or lifelong learning. Qualifications incorporated in the NQC have been structured according to the levels of qualification defined by the NQF. This adopts the principles of the EQF as regards to the description of qualifications in terms of learning outcomes, in accordance with the descriptors associated with each qualification level, promoting qualification comparability as a function of its profile and not as a function of contents or training processes. Qualifications have also been organised as a function of educational and training areas, which in some cases correspond to sectors of economic activity and are defined according to the National Classification of Education and Training Areas (CNAEF) (Table 2-2).

Table 2-2 - Vocational education in Portugal

VOCATIONAL EDUCATION			
What it is: 2 years training. **Access:** public or private option. Dual optional			
TITLE	NQF	EQF	CONTENT
Constructional ironwork fitter-machinist	2	2	
Welder	2	2	
Mason/bricklayer	2	2	
Solar thermal systems installer	4	4	
Draughtsman of refrigeration and air conditioning system	4	4	
Project supervisor	4	4	
Floor and wall tiler	2	2	
Plumber	2	2	

The NQS defines continuing training as any education & training activity developed after leaving the schooling system, or after joining the labour force, which enables the individual to improve his/her professional and relational competences with a view to developing one or more professional activities, better adapting to technological and organisational change and strengthening his/her employability.

The short duration training units (UFCD) of the NQC are the basis for double-certification continuing training, carried out by certified training entities, vocational training centres of the Institute of Employment and Professional Training (IEFP) network or teaching establishments, which constitute the entity network of the national qualifications system. These entities grant qualification certificates, proving that such UFCDs were successfully completed, contributing to obtain a qualification certified by a qualifications diploma.

Additionally, NQS determines that a vocational training certificate governed by law[3] be supplied for all certified training activities not included in the NQC, when such activities are developed by an entity certified for this purpose, or by teaching establishments recognised by the competent ministry – that is to say, training entities belonging to the national qualifications system. In this context, each main training modality is organised, according to each different training component and respective time schedule, as follows:

- Vocational Courses (level 4 of qualification).
- Apprenticeship Courses (level 4 of qualification).
- Education & Training Courses for Adults (EFA) (levels 2 and 4 of qualification).

[3] Ordinance no. 474/2010, of the 8 July.

- Certified Modular Training.

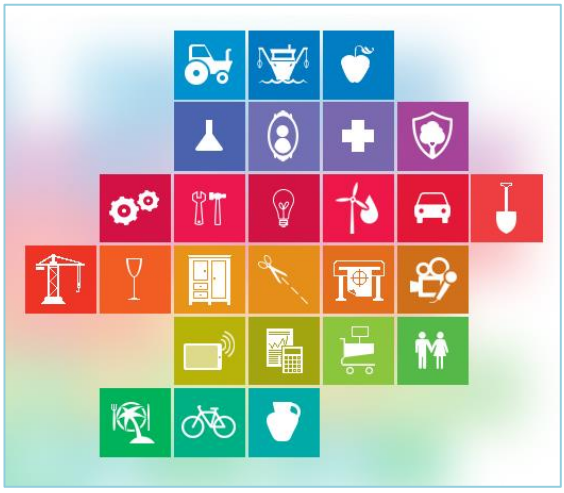
Table 2-3 – Vocational training in Portugal

VOCATIONAL TRAINING			
What it is: between 2800 and 3700 hours training. **How they are trained:** according with the training modality above mentioned			
TITLE	**NQF**	**EQF**	**CONTENT**
Electricity and energy	4	4	Link
Building installation and maintenance	4	4	Link
Metalwork and mechanical engineering	6	6	Link
Building and civil engineering	6	6	Link
Energy certification of buildings	6	6	Link

2.2 Spain

The Professional Qualifications that make up the National Catalogue of Professional Qualifications are ordered by 26 professional families and by levels of qualification taking into account EU criteria. Within this structure, families Building and Civil Engineering and Energy and Water exist (Figure 3-1).

Figure 2-1 – Icons of the 26 professional families of the Spanish Qualification System



In Spain, INCUAL (National Institute for Qualifications) includes the Professional Family: Water and Energy. In terms of transversally of the professional family of Energy and Water is detected an important interaction with the professional families of Building and Civil Works, Electricity and Electronics, Installation and Maintenance, Safety and Environment and Transport and Maintenance of Vehicles, among others (Table 2-4).

Table 2-4 – National qualifications in Spain

NATIONAL QUALIFICATIONS WITHIN ENERGY AND WATER PROFESSIONAL FAMILY			
What it is: Qualifications made by National Institute of Qualifications (INCUAL[4]) defined by: knowledge, skills, competences. **Access:** They are the core base of VET and professional certificates design.			
TITLE OF THE QUALIFICATION	NQF[5]	EQF	CONTENT
Assembly and maintenance of water networks	2	4	Link
Management of the efficient use of water	3	5	Link
Organization and control of the assembly and maintenance of networks	3	5	Link
Energy efficiency in buildings	3	5	Link

The Initial or Regulated Professional Training, corresponding to the professional family of Energy and Water, offers a medium-level training cycle that leads to the degree of Technician, and four higher-level training cycles that lead to the title of Superior Technician. Those related to building industry are presented in Table 2-5.

Table 2-5 – Vocational education in Spain

VOCATIONAL EDUCATION			
What it is: 2 years training. **Access:** public and private option. Dual optional.			
TITLE	NQF	EQF	CONTENT
Technician in Networks and Water Treatment Stations	2	4	Link
Senior Technician in Energy Efficiency and Thermal Solar Energy	3	5	Link
Senior Technician in Renewable Energy	3	5	Link
Senior Technician in Water Management	3	5	Link

As for Vocational Training for Employment, sixteen Certificates of Professionalism are offered in the Energy and Water professional family, of which ten are Level 3, five are Level 2 and one is Level 1. Those related to building industry are presented in (Table 2-6).

Table 2-6 – Vocational training in Spain

VOCATIONAL TRAINING			
What it is: between 230 y 960 hours training. **How they are trained:** public and private option. With practices in companies.			
TITLE	NQF	EQF	CONTENT
Organization and control of the assembly and maintenance of water and sanitation networks and installations	3	5	Link

[4] Public entity in charge of defining the qualifications catalogue at national scope
[5] National Qualifications Framework: Spanish Catalogue has 5 levels of professional qualification INCUAL only work for the 1, 2 3 levels. Levels 4 and 5 correspond to university studies.

Management of the efficient use of water	3	5	Link
Energy efficiency of buildings	3	5	Link
Basic operations in the assembly and maintenance of renewable energy installations	1	2	Link
Installation and maintenance of solar thermal installations	2	4	Link
Organization and projects of thermal solar installations	3	5	Link
Assembly and maintenance of gas networks	2	4	Link
Assembly, commissioning, maintenance, inspection and review of reception facilities and gas appliances	2	4	Link
Assembly and maintenance of water networks	2	4	Link

2.3 Italy

The National Repertory was established in Italy with Legislative Decree no. 13 of 16 January 2013. According to the Decree, the Repertory "constitutes the single reference framework for the certification of skills". The national repertory consists of all the repertoires of education and training qualifications, and of the professional qualifications awarded in Italy by Ministry of Education, University and Research; the regions and the autonomous provinces of Trento and Bolzano; the Ministry of Labour and Social Policies; the Ministry of Economic Development and the other competent authorities in matters of certification of competences referring to qualifications of the regulated professions (Article 5 of Legislative Decree No. 206 of November 9, 2007) and an apprenticeship contract.

The National Repertory recomposes the system of qualifications issued in Italy with reference to the following subsets: University; Secondary school; Education and vocational training; National framework of regional qualifications; Apprenticeship; Professions. Inside the National Repertory of Qualifications there are also profiles that are obtained at the conclusion of a formal educational path (Education) by releasing "national qualifications" after three years or as professional technical diplomas lasting four years.

INAPP (National Institute for the Analysis of Public Policies) has developed the *Atlante labour* in which is described the work process contents in terms of areas of activity (tasks, tasks,) and of potentially deliverable products-services in the performance of work activities. The classification of the economic-professional sectors (SEP) was obtained using the classification codes adopted by ISTAT (National Statistical Institute), concerning economic activities (ATECO 2007) and professions (Classification of Professions 2011). The SEP classification consists of 23 sectors plus a sector called the Common Area. The Common Area collects all those work activities not specifically characterized by a specific sector. *Atlante Labour* is the main technical reference element for the composition of the National Framework of Regional Qualifications (Table 2-7, Table 2-8 and Table 2-9).

Table 2-7 – National qualifications in Italy

NATIONAL QUALIFICATIONS
What: Qualifications, based on national classification of professions Istituto Nazionale delle Statistiche (ISTAT), developed by INAPP (and by a national agreement among Ministry of education, of labour and regions. The national repertory consists of all the repertories of education and training qualifications, and of the professional qualifications awarded in Italy by an organization accredited by region or Government or issued following an apprenticeship contract.

Education and vocational training (VET) which includes paths qualification (three-year) dual training options, five-year technical diploma path: Higher Technical Education and Training – IFTS; Higher Technical Education – ITS; Professional Training Education4 year; Education professional training IeFP 3 year. **Access:** There are other profession regulated by the national law in coherence with the European legislation. Other qualification not included in the first tools and in the national law are regulated by regional legislation.			
TITLE OF THE QUALIFICATION	**NQF**	**EQF**	**CONTENT**
Plumbers in civil construction[6]		3	
Installers of heating system in civil construction		3	
Civil construction technicians and similar professions [7]		5	
Thermal installation technician		4	
Repairers and maintainers of industrial plumbing and heating equipment and systems		4	
Building operator		3	Link
Thermohydraulic plant operator		3	Link
Installers and maintainers for renewable energy sources plants[8]. With 4 standards and one basic modules the same for all 4. - Biomass for energy use Heat pumps for heating and cooling; Solar thermal systems; Photovoltaic and electric systems		4	

Table 2-8 - Vocational education in Italy

VOCATIONAL EDUCATION			
What it is: Education and vocational training (VET) which includes paths qualification (three-year) and dual training options, five years technical diploma path: Higher Technical Education and Training – IFTS; Higher Technical Education – ITS; Professional Training Education4 year; Education professional training IeFP 3 year. **Access:** basic training certificate duration 3 years and diploma obtained after 4 years; diploma of upper secondary education 5 years. Only this profession has been classified in EQF this are national qualification http://www.statoregioni.it/Documenti/DOC_038876_DOC_038876_252%20csr%20-%201%20bis.pdf			
TITLE	**NQF**	**EQF**	**CONTENT**
Organization and management techniques of the IFTS building site	4	4	Linkhttp://nrpitalia.isfol.it/sito_standard/sito_demo/dettaglio_profilo.php?id_profilo=2536
Superior technician for innovation and quality of the house (Construction sector)	5	5	Link

[6] The qualifications included in the above scheme refer to the economic activities of professions regulated by ISTAT codes to which specific named Area of Activities (ADA) are linked. In this case the reference ADA is "Installation / maintenance of heating and plumbing systems (heating, cooling, air conditioning and sanitary systems" - ADA No. 7.57.168

[7] These qualifications refer to the economic activities of professions regulated by ISTAT codes to which specific named Area of Activities (ADA) are linked. In this case, the reference ADA is "Site Management" - ADA no. 07/11/10

[8] Regulated at national level the standard and the training courses

Thermal plant technician (Building sector)	4	4	Link
Building technician (Building sector)	3	3	Link
Thermohydraulic plant operator (hydraulic	3	3	Link
Building Operator	3	3	Link

Table 2-9 - Vocational training in Italy

VOCATIONAL TRAINING (Lazio Region)			
What it is: vocational training (VET) **How they are trained**: Regional Vocational Training, dual training options, Regional Vocational Education			
TITLE	NQF	EQF	CONTENT
Installer and maintenance technician of thermal-hydraulic systems		4	

2.4 Greece

In Greece a methodology for analysing Occupational Profiles (OP) incorporating the learning outcomes approach (those days called 'occupational standards') has been developed since 2006. This was an early effort to create a methodology for modularizing VET curricula and it was part of a broader strategy aiming at upgrading VET in Greece. The methodology was based on job analysis and in particular functional analysis. Greece has chosen the shift from task (used in the past) to function (function provides a broader perception for the content of the outcome). As a result, Greece has today 202 developed job profiles (OPs) based on learning outcomes.

Part of the process was also the establishment of committees consisting of employers and employee representatives' organizations, educationalists and experts from the field of the relevant occupation. The members of the committee jointly signed the National General Collective Labour Agreement in which each proposed occupational profile fits. In the end, the OPs were accredited by the National Organisation for the Certification of Qualifications & Vocational Guidance (EOPPEP) (Table 2-10).

Table 2-10 – National qualifications in Greece

NATIONAL QUALIFICATIONS			
What it is: Occupational Profile (OP), i.e. the job functions and the required knowledge, skills and competencies for exercising an occupation or speciality. **Access:** An Occupational Profile comprises a complete description of a profession (based on job analysis and in particular functional analysis) incorporating the learning outcomes approach.			
TITLE OF THE QUALIFICATION	NQF[9]	EQF	CONTENT
Technician of plumbing installations	4	4	Link

Before completing the remaining tables, it is necessary to provide a brief description of the Vocational Education and Training (VET) system in Greece. The formal initial Vocational Education is provided for free as concerns the

[9] The Hellenic Qualification Framework (HQF) has 8 levels that cover the full qualification range between Primary and Higher education. Each level includes a set of skills, competences and knowledge that determines the learning outcomes. The LOs constitute the qualifications of the corresponding level.

2nd level of non-compulsory education by attending Vocational High Schools (EPAL) or Vocational Training Schools (EPAS) for 2 years. At the EPAL someone can attend at day classes for 3 years or in the evening classes for 4 years. Post-compulsory secondary education also includes the Vocational Training Institutes (IEK), which provide formal but unclassified initial vocational training. These Institutes are not classified as "educational level", because they accept both 1st level and 2nd level secondary school graduates according to the relevant specializations they provide. So, in the following table the identified relevant to the above Qualification specialties taught at EPAS are provided (Table 2-11).

Table 2-11 – Vocational education in Greece

VOCATIONAL EDUCATION			
What it is: Vocational School (EPAS) certificate / specialty. Post Lower secondary education - 2 years of studies. **Access:** Formal initial VE is provided free of charge by Vocational Education Training Schools (EPAS) – or Vocational High Schools (EPAL), according to the specialty - for 2 years.			
TITLE	**NQF**	**EQF**	**CONTENT**
EPAS Specialty: Thermohydraulic facilities and central heating maintenance	4	4	Link
EPAS of OAED[10] Specialty: Craftsmen of thermal and hydraulic installations	4	4	Link

Accordingly, the relevant to the "Technician of plumbing installations" Qualification specialties provided by IEKs are listed in

Table 2-12.

Table 2-12 – Vocational training in Greece

VOCATIONAL TRAINING			
What it is: Initial vocational training (provision of basic vocational knowledge and skills in specialties or specializations) provided by the Vocational Training Institutes (IEK), which can be public or private legal entities monitored by EOPPEP. **How they are trained:** High school graduates receive initial training in IEKs, whereas upper secondary education graduates may supplement their professional knowledge and receive further training in IEKs. In the first case the studies last up to 2 semesters and graduates receive an 'IEK Certificate', while in the 2nd case the duration is of 5 semesters (4 + 1 semester practice or apprenticeship) and graduates receive a 'Specialty Diploma'.			
TITLE	**NQF**	**EQF**	**CONTENT**
IEK Level 1 Certificate's specialty: Water supply - sewage facilities technician	3	3	Link
IEK Level 1 Certificate's specialty: Heating facilities technician	3	3	Link
IEK Diploma specialty: Thermal and hydraulic facilities technician	5	5	Link

[10] The Manpower Employment Organisation (OAED) is active in the field of VET through the operation of 51 EPAS and 29 Postgraduate IEKs. OAED implements the Apprenticeship system in Greece, meaning that the students of EPAS in the morning do their practice in business while in the afternoon they attend theoretical and laboratory courses in the same specialties.

The other pillar of Lifelong Learning is Continuing Vocational Training (CVT), which all vocational training and further training activities organized outside the formal initial vocational training and education system. Providers of Continuing Training are the Vocational Training Centres or Level II Lifelong Learning Centres - LLL (KDVM II), which are focused in specific thematic areas, defined by the institutional framework of their certification. However, according to the existing legislation, the Certificate of Professional Competence awarded to Centres of LLL graduates is not linked (yet) to the National Qualifications Framework, thus no training programmes carried out under this frame have been listed in the above tables.

Regarding to the higher levels of qualifications / studies on Water and Energy issues, it must be mentioned that plumbing installations and hydraulic works are considered as mechanical installations, thus the studies made for designing such kind of installations / works are the subject of Mechanical Engineering. At the same time, the studies for design of heating systems and/or hot water preparation facilities are also the subject of this specialty. In this respect, the higher-level Qualifications related to the Water and/or Energy Efficiency are the following:

- Diploma of Mechanical Engineering (with no fixed HQF level yet – 6 or higher): 5 years tuition in the Mechanical Engineering Departments of the Polytechnic Schools of Greek universities.
- Bachelor's Degree in Mechanical Engineering – or similar (HQF / EQF level 6): A degree that is provided after 4 years of studies to the graduates of the relevant Schools of Technological Educational Institutes (TEIs), which offer higher education programs with a focus on practical and professional skills in subjects such as applied technology.

3 Definition of the WATTer Skills maps at a European level

3.1 Identification of WATTer Skills

This section defines the water efficiency technician and water efficiency expert within the project scope and provides the description of the methodology to identify the WATTer Skills as the water related professionals, as established amongst the participating partners. Targeted at the main professionals involved in water network design and installation in buildings, the training curricula, qualification framework and certification schemes will directly involve the following participants groups, providing two different courses and curricula dedicated to water efficiency in buildings: water network technicians and high skilled professionals. In this context, the proposed definitions were as follows:

- **Water efficiency technician (WET):** The person certified to install, maintain, repair and replace water systems in buildings in compliance with water efficiency requirements, addressing water efficiency and water-energy nexus measures in buildings, considering site conditions, building type and the most adequate systems and layouts, including water and energy efficient home appliances, equipment and devices, water efficiency in green areas and outdoor environment, water network performance and retrofit, installation systems for rainwater harvesting and greywater reuse in line with legislation or standards. The water efficiency technicians envisaged by this new qualification scheme are upskilled plumbers, equipment installers, water supply and drainage maintenance technicians and energy systems installers. For these professionals the scheme proposal of the WATTer Skills project will provide upgrading training, qualification and certification on water efficiency technical skills, resulting in a new output profile and certification scheme of specialized “Water Efficiency Technicians”, to be aligned with EQF and NQF (level 4) as well as on ECVET training credits within the common accreditation system to be developed, allowing for mobility within the EU territory;

- **Water efficiency expert (WEE):** The person certified to design, select, propose and inspect water systems in buildings considering water efficiency requirements, addressing the water efficiency and water-energy nexus measures in buildings, considering site conditions and building type and the most adequate systems and designs, including water and energy efficient home appliances, equipment and devices, planning for water efficiency in green areas and site based passive measures design, water network performance and retrofit, systems for rainwater harvesting and greywater reuse in line with legislation or standards. The water efficiency expert envisaged by this new qualification includes upskilled water systems designers, engineers, architects, technical engineers, technical agents, energy and environmental performance auditors. The upgrading training course and corresponding validation will result in a new output profile of “Water Efficiency Experts” (corresponding to EQF 6), to be included in WATTer skills ECVET accreditation system proposal, allowing for mobility within the EU territory.

In comparison to previous projects like AQUAVET, which term for “water technician” included the skilled tradesperson, responsible for the management aspects of systems used for the circulation of potable (drinking) and hot water from the point of source until its end-use, sewage, and drainage in residential and non-residential applications, the WATTer Skills corresponding term is different because it requires that efficiency measures are considered and applied. Likewise, it focuses on water efficiency and the water-energy nexus in buildings in the construction sector, with the planning and verification of water efficiency measures in buildings and its relation to energy. In AQUAVET, the choice of this term was wide enough to include a range of job titles, such as: plumber, urban sanitation and hygiene specialist, environmental technician, wastewater technician, water quality and wastewater treatment manager, recycling technician, building maintenance staff. In the WATTer Skills project, it may refer to the same range of job titles, but requiring efficiency undertake, addressing the Water Expert Technicians and furthermore extending to Water Efficiency Expert professionals.

Additionally, in WATTer Skills a higher level ‘expert’ is addressed, targeted at professionals of higher education studies that are involved in the design and/or inspection of water circulation systems in buildings, aiming for developing the most efficient design projects both from water and energy consumption points of view.

As background for the design, construction and supervision, four main distinctive working areas need to be considered:

- The designer, who provides the project and guidelines for the installation (included in the WEE profile);
- The installer, who implements what is presented in the project (included in the WET profile);
- The project supervisor, who superintends all areas of building construction and the necessary installations, until the commission process (included in the WEE profile);
- The independent auditor, who is a third-party "client orient professional" that audits and provides diagnosis, benchmarking and identification of saving potential as well as proposition improvement measures and best practices towards water efficiency (included in the WEE profile).

3.2 Methodology to identify WATTer skills

The identification of the water skills and recognition of the learning outcomes is developed considering 2 steps: the description of the job positions and the related tasks to water efficiency and the identification of the competences regarding water efficiency.

Step 1. Description of job positions and their functions / tasks related to water efficiency

The developed methodology to set the perimeter of Water Efficiency Technician (WET) and of Water Efficiency Expert (WEE) qualifications was to firstly **identify tasks related to water efficiency following the construction stages**, taking also into account the construction option of an existing garden. Secondly, the performance of these water tasks is identified.

The project maps the tasks related to water related works needed during the construction and refurbishment of buildings. As a result, two tables that differentiate the tasks related to water linked to an EQF 4 (WET, Table *4-1*) and EQF 6 (WEE,

Table 4-2) were developed, taking into account the following contents:

- Construction system/stage;
- Work functions related to water use in buildings;
- Job position.

Table 4-1 - Step 1. Description of job positions and their functions / tasks related to water efficiency in current job positions

TARGETTED PROFESSIONALS FOR UPSKILLING TOWARDS WATER EFFICIENCY TECHNICIAN (EQF 4)		
CONSTRUCTION SYSTEM STAGE	WORK FUNCTIONS RELATED TO WATER USE IN BUILDINGS	JOB
Sanitation and plumbing installation	- Install, maintain, repair and replace the cold and hot water pipelines and fittings in buildings and plots. - Install, maintain, repair and replace wastewater and rainwater drainage systems in buildings and plots. - Install, maintain, repair and replace water using appliances / fixtures. - Install, maintain, repair and replace the permanent fire-fighting systems with water in buildings or industrial installations.	Plumber

Heating, cooling and hot water installations and renewable energy systems	- Install, maintain, repair and replace all types of domestic hot water (DHW) preparation systems (water heaters). - Install, maintain, repair and replace other heating appliances for home heating, water filled radiators and floor heating piping. - Install the piping systems for air-conditioning in buildings. - Maintain, repair, replace and modernize the piping of air conditioning systems.	
Outdoor (garden, green roofs, vertical gardens and living walls, etc.)	- Carry out the appropriate landscape design. - Choose of the appropriate irrigation system. - Scheduling of the irrigation system.	Gardener

Table 4-2 – Step 1. Description of job positions and their functions / tasks related to water efficiency in current job positions

TARGETTED PROFESSIONALS FOR UPSKILLING TOWARDS WATER EFFICIENCY EXPERT (EQF 6)		
CONSTRUCTION SYSTEM STAGE	**WORK FUNCTIONS RELATED TO WATER USE IN BUILDINGS**	**JOB**
Buildings project design	- Consider the site conditions to propose building type. Design of the building applying thermal passive strategies. - Select the construction materials. - Select the construction techniques. - Design of heating, cooling and DHW production systems, including renewable energy systems. - Design of drinking water installations, irrigation and sanitary systems, including wastewater system. - Propose energy and water efficient home appliances, equipment and devices. - Design of green areas and landscapes. - Propose consumption monitoring systems / devices. - Promote the correct use and maintenance of the building.	Engineer/ Architect
Sanitation and plumbing installation **Heating, cooling and hot water installations and renewable energy systems** **Outdoor (garden, green roofs, vertical gardens and living walls, etc.)**	- Oversee and direct construction of projects from conception to completion. - Oversee all onsite and offsite constructions to monitor compliance with building and safety regulations. - Coordinate of direct construction workers and sub-contractors. - Select tools, materials and equipment and track inventory. - Meet contractual conditions of performance - Ensure quality construction standards and the use of proper construction techniques.	Works superintendent (foreman)

	- Prepare internal and external reports pertaining to job status.	
Building thermal envelope	- Inspect or evaluate building envelopes, mechanical systems, electrical systems, or process systems to determine the energy consumption of each system. - Collect and analyse field data related to energy usage. - Quantify energy consumption to establish baselines for energy use or need. - Compare the energy consumption levels to normative ones. - Identify and prioritize energy saving measures. - Identify any health or safety issues related to planned weatherization projects. - Oversee installation of equipment such as water heater wraps, pipe insulation, weather stripping, door sweeps, or low flow showerheads to improve energy efficiency.	Energy Auditor
Heating, cooling and hot water installations and renewable energy systems		

Step 2. Description of competence units on water efficiency

The next step was to enrich the previous tables with further detailed tasks on water efficiency and water energy nexus *Table 4-3***Error! Reference source not found.**. So that the water tasks in terms of skills (what they can do) necessary to achieve water and energy (related to water use) savings were included, for setting the wide ground to start working on the water efficiency skills map (WATTer Skills map).

Table 4-3 Step 2. Description of competence units on water efficiency for the envisaged Water Efficiency Energy Technician

EQF 4 WATER EFFICIENCY TECHNICIAN		
BUILDING WORK AREAS RELATED TO WATER EFFICIENCY	PROFFESSION	SKILLS NECESSARY TO ACHIEVE WATER AND ENERGY (RELATED TO WATER USE) SAVINGS
Installation, maintenance, repair and replacement of thermo-hydraulic facilities	Plumber Solar thermal systems installer Domestic heat pump installer Small biomass heating installer	- Read the project and provide an estimation of the work to be carried out for the installation of water related infrastructures. - Carry out site survey to compare project data with onsite data of the building in construction. - Evaluate the proposed equipment with onsite data of the building in construction. - Select all the required equipment necessary for the implementation of a thermo-hydraulic system. - Select suitable (certified) materials and components for pipes and fittings, for the implementation of energy and water savings systems. - Effective implementation of the thermo-hydraulic systems, always considering performance improvement. - Select and install adequate thermal insulation materials on pipes.

		- Installation and management of smart-meters and water monitoring equipment (inside the building and downstream to the water utility meter). - Selection and installation of water saving appliances. - Perform hydraulic adjustment and balancing of thermo-hydraulic installations (by using adequate instruments and the necessary data reading). - Identification of new technologies and/or equipment for domestic hot water (DHW) production, particularly with reference to those leading to better energy and/or water savings. - Determination of the energy balance whenever alternative water heaters are considered. - Proper (periodic) cleaning of heating networks. - Provide clear information to potential client regarding the choice of materials and equipment (certified), highlighting energy and water saving potential. - Provide all necessary and relevant information on how consumer behaviour impact water saving and water efficiency.
Installation, maintenance, repair and replacement of wastewater and rainwater handling systems	Plumber	- Read the project and provide an estimation of the work to be carried out for the installation of water related infrastructures. - Carry out site survey to compare project data with onsite data of the building in construction. - Evaluate the proposed equipment with onsite data of the building in construction. - Customised selection and installation of the most suitable water efficient treatment systems. - Installation and management of rainwater harvesting systems (capturing and storage for future reuse) and develop the certification process (if mandatory). - Application of the necessary techniques for reuse of the collected and recycled “grey water”, considering fit-for-use approaches. - Perform installation, commissioning, repair, maintenance and substitution of grey-water recycling systems and develop the certification process (if mandatory).
Outdoor environment design and handling	Gardener	- Read the project and provide an estimation of the work to be carried out for the installation of water related infrastructures. - Carry out site survey to compare project data with onsite data of the building in construction. - Evaluate the proposed equipment with onsite data of the building in construction. - Installation of water efficient landscapes in a way to minimize the need for supplemental water. - Apply techniques to minimise water waste from irrigation runoff or overspray. - Good irrigation scheduling (to achieve water efficiency in the landscape). - Detection and repair of leaks.

Table 4-4 - Step 2. Description of competence units on water efficiency for the envisaged Water Efficiency Expert

EQF 6 WATER EFFICIENCY EXPERT		
BUILDING WORK AREAS	PROFFESSION	SKILLS
Design of / planning for new building construction and/or energy retrofit of existing buildings	Engineer/ Architect	- Carrying out a detailed analysis of the site (including clear indication of where equipment should be positioned), considering aspects such as orientation, site conditions, influence of heat island effect, etc. to propose a building type and an adequate composition and distribution of spatial elements, thermal and hydraulic installations. - Carrying out a climate data analysis for the optimization of water consumption and the implementation of passive heating and cooling strategies: solar gains and shading systems according to the different period of the year, orientation of the windows and roof and facade ventilation holes, etc. - Implementation of a smart building design / retrofit, applying the most efficient strategies to reach the most energy and water saving design along the lifecycle of the building. - Always select materials taking into account the energy and water consumption for the entire lifecycle of the building, considering low impact in its manufacturing process; transportation, construction, use, maintenance, and reuse or disposal. Choice of local, recycled materials or construction products with some energy/environmental improvement. - Foreseeing ecological construction techniques, such as dry construction, industrialized construction, etc. - Whenever adequate, select efficient heating, cooling and domestic hot water systems and consider the introduction of renewable energies to use the natural conditions of the building geographical location. - Carrying out a calculation of water demand and propose strategies and systems for reducing consumption, as well as recycling of rainwater and grey water and promote the certification process (if mandatory). - Design water efficient gardens, green roofs and living walls, with a combination of wood, stone or other inert materials and native plants that also provide thermoregulation for the building (envelope and interior). - Inclusion of monitoring systems of energy and water consumption so the users have enough information to use of the building adequately. - Promotion of the correct use and maintenance of the building giving the user a manual or a BIM model with instructions or information about the use and maintenance of the building.
All types of construction work	Works superintendent (foreman)	- Reviewing the project in-depth to schedule deliverables and estimate costs. - Reviewing the work progress on daily basis. - Planning ahead to prevent problems and resolve any emerging ones.

		- Negotiation of terms of agreements, draft contracts and obtain permits and licences. - Analysis, management and mitigation of risks.
All fields of energy and/or water use in buildings	Energy Auditor	- Determining patterns of building use to show annual or monthly needs for heating, cooling, lighting, or other energy needs. - Performing tests to locate leaks. - Perform technical and economic feasibility analysis of energy saving measures using engineering knowledge, energy production, energy use, construction, maintenance, system operation, or process systems. - Calculation of potential for energy savings. - Recommendation of energy efficient technologies or alternate energy sources.

3.3 Skills maps

The WATTer Skills maps aim to become a common reference for training and qualification of future technicians and experts on water efficiency for building construction and retrofit at a European level. The skills perimeter (i.e., the scope) was the starting point for the definition of this qualification map, which is based on the EQF, having its areas of competence described in terms of learning outcomes (knowledge, skills and responsibility-autonomy). Aligned with the EQF levels, WATTer Skills proposes new areas of competences for the Water Efficiency Technician (EQF level 4) and for the Water Efficiency Expert (EQF level 6) and the corresponding skills.

The skills maps were defined after an analysis of the previous information and identifying main areas of water addressing within the construction stages, where all the tasks were classified. The analysis was done under the following criteria:

- Group the skills as much as possible;
- Group the skills with coherent criteria;
- Try to replicate the same structure in water efficiency technicians and experts;
- Avoid duplications.

These main areas were called “Areas of competences” which have been codified with letters (A, B, C, etc.). The tasks were sorted within the Area of competences and were redefined and categorised under the label “Skills”, codified with the letter of the area of competence that belongs to and with a progressive number (A1, A2, A3…B1, B2, etc.) (Figure 3-1 and Figure 3-2).

Besides the identified skills, the two qualifications will have cross-cutting contents within one of the qualifications or both. Likewise, norms, standards and European/National legislation are considered as horizontal or specific knowledge that will be acquired in both qualifications (WET and WEE).

Two skills maps dedicated to water efficiency in buildings were created:

- EQF 4. Water efficiency technician (WET): Seven areas of competences and 21 skills
- EQF 6. Water efficiency expert (WEE): Four areas of competences and 18 skills

The WATTer Skills map will be submitted to a thorough discussion and improvement with stakeholders and the project advisory board, during 2018 and 2019, before the final proposal of WATTer Skills qualification and accreditation framework.

Figure 3-1 - Water Efficiency Technician Skills Map

	A1	A2	A3	A4	A5
Hydraulic installations[11] and water losses	**Read and correctly interpret** the design for effective implementation of the thermo-hydraulic installations in compliance with water-energy efficiency requirements	**Correct selection and installation** of adequate materials and components of the hydraulic system, including proper construction of pipe thermal insulation	**Installation and management** of smart-meters and water monitoring equipment (e.g., flowmeters)	Hydraulic and pressure **adjustments and balancing** of thermo-hydraulic installations	Indoor leakage identification and control (fixtures or equipment), **repair, replacement and maintenance** of the hydraulic installations (all home water networks)
	B1	**B2**	**B3**	**B4**	**B5**
Domestic hot water systems	**Read and correctly interpret** DHW project designs and layout, considering the performance of the thermo-hydraulic installations and water efficiency fixtures	**Correct selection and installation** of efficient technologies and/or equipment for DHW production and determination of the energy savings resulting from the use of alternative/efficient water heaters	Undertaking of site **survey of the building for the installation** of water heaters systems, including renewable energy sources (RES) based systems[12]	**Installation, testing and commissioning** of water heater systems, including RES based systems	Undertaking the routine service, **fault diagnosis and repair work** of water heater systems, including RES based systems
	C1	**C2**			
Grey water reuse	**Read and correctly interpret** grey water collection project for recycling and domestic re-use	**Correct selection and installation** (including network connection in compliance with legislation and standards), commissioning and proper maintenance of grey water recycling systems			
	D1	**D2**			
Rainwater harvesting	**Read and correctly interpret** rainwater harvesting project (including the required water treatment) for domestic use	**Correct selection and installation** (including network connection in compliance with legislation and standards), commissioning and proper maintenance of rainwater harvesting systems			

[11] Hydraulic installations may include hot and cold water, wastewater, water heater and heating

[12] For example: solar water heater, biomass, heat pumps, gas fired heater, central heating system

	E1	E2	E3
Outdoor installations	**Read and correctly interpret** outdoor landscape design, including techniques to minimise water waste from irrigation runoff or overspray	**Correct selection and installation** (including network connection in compliance with legislation and standards), commissioning and proper maintenance of irrigation and outdoor water use systems, including proper scheduling for optimal irrigation performance	**Detection and repair** of outdoor use system leaks (e.g., green areas and landscapes)

	F1	F2
Selection of appliances and fixtures	**Correct selection** of appliances and fixtures for water & energy savings	**Correct installation** of appliances and fixtures, including repair/replacement and maintenance

	G1	G2
Client orientation	Provide **clear information and guidance** to customer (selection of material/equipment/ appliances/fixtures), including consumer behaviour impact on water savings	Provide of a logbook and **report with all significant occurrences** during inspection of all phases of building construction, before and after the commission process

Figure 3-2 - Water Efficiency Expert Skills Map

	A1	A2	A3	A4	A5	A6
Design a water efficient building	Correct evaluation of the needs and site conditions to **design (system conception and sizing), plan, select and propose** a water-energy efficient system (thermal-hydraulic, DHW, grey water, rainwater harvesting and irrigation systems)	Provide the list of the **suitable material and components and describe their positioning** in the circuit to secure regular functioning of the system	Provide the clear indication of **control and monitoring equipment**, their positioning in the circuit and main functioning parameters	Provide the list of the **tests and other procedures** to secure inspection and commissioning	Provide details of **repair, replacement and maintenance** most likely to occur in the water-energy efficient system (thermal-hydraulic, DHW, grey water, rainwater harvesting and irrigation systems), with clear indication of related costs	Designing of water-energy efficient system for **green areas and landscapes,** and application of circular economy principles in construction
	B1	B2	B3	B4		
Projects supervising	Supervision of whether the **selected components fit the project** requirements and compliance with building safety regulations	Supervision of whether the **selected components are correctly positioned in the circuit** and compliance with building safety regulations	Supervision of whether the **system parameters are set in accordance with the instructions** provided in the project	**Keeping up the contractual conditions of performance**, including a logbook and reporting of all significant occurrences, before and after building commissioning		
	C1	C2	C3	C4	C5	
Water measurement and Water-Energy Nexus	**Collection, verification and analysis procedure definition** for field data related to water-energy use, including alternative sources and RES	**Quantification of water and energy baselines** for water-energy use, reduction or demand assessment	**Comparison of water and energy use requirements** to building safety regulations	**Identification and prioritization** of water-energy saving measures	**Monitoring of the cost-benefits and impacts** from applying water-energy saving measures	
	D1	D2	D3			
Client orientation[13]	**Auditing, diagnosis and baseline** of consumption definition, benchmarking and identification of water-energy saving potentials	**Identification of water-energy efficiency measures** (e.g., appliances, equipment, monitoring systems) to attain water-energy saving potentials	**Promotion of best practices** for the correct use and maintenance of the water-energy efficiency systems			

[13] Independent auditor - third-party "client orient professional" that audits and provides diagnosis, benchmarking and identification of saving potential as well as proposition improvement measures and best practices towards water efficiency.

3.4 WATTer Skills description

Skills map is the process of identifying the specific skills, knowledge, abilities, and behaviours required to operate effectively in a specific trade, profession, or job position. Within the project scope, the proposed qualifications (or specialities) may not be a unique profession or job position, but something transversal amongst different professions and positions.

First, it is crucial to understand the terms of skills descriptions under the water skills that will be defined. As previously referred, the EQF should be considered, since it gives the guidelines to align the definition of the concepts. The skills map may be, therefore, composed by areas of competences and "skills", being these described as the abilities of the student/worker that fulfil the required tasks to each specific skill.

In a second stage of the project, each of the two defined qualifications, WET and WEE, will include the proper sentences that indicate the knowledge, skills and competences required (named *learning outcomes*). This will come with further explanation of the skills map and will be the basis for the future development of training contents and evaluation criteria, to be developed in the next Intellectual outputs.

For further explanation of the skills, it is important to consider the level of the qualifications set in the EQF, which designates 8 levels according to the expected knowledge, initiative, autonomy and responsibility to perform the works. According to the project proposal, water efficiency technician will have EQF level 4 and water efficiency expert EQF level 6 (Table 4-4):

Table 4-4 – Knowledge, skills and responsibility/autonomy under each qualification framework level

	EQF 4	EQF 6
Knowledge	Factual and theoretical knowledge in broad contexts within a field of work or study, including current applicable legislation, standards and norms	Advanced knowledge of a field of work or study, involving a critical understanding of theories and principles
Skills	A range of cognitive and practical skills required to generate solutions to specific problems in a field of work or study	Advanced skills, demonstrating mastery and innovation, required to solve complex and unpredictable problems in a specialised field of work or study
Competences	Exercise self-management within the guidelines of work or study contexts that are usually predictable but are subject to change; supervise the routine work of others, taking some responsibility for the evaluation and improvement of work or study activities.	Manage complex technical or professional activities or projects, taking responsibility for decision-making in unpredictable work or study contexts; take responsibility for managing professional development of individuals and groups

Hereunder, each skill is described in general terms, starting with an action verb in gerund, such as:

- Verbs used for **skills applying knowledge:** apply, practice, demonstrate, show, plan, design, operate, assemble, use, construct, prepare, create, compose, arrange;
- Verbs used for skills applying **communication:** write, illustrate, report, describe, discuss, explain, state, name, express, review, speak, present, interact;
- Verbs used for skills applying **judgmental:** choose, judge, identify, evaluate, analyse, assess, interpret, argue, select, compare, rate, measure, propose, appraise, estimate, examine, categorise;
- Verbs used for skills applying **learning:** evaluate own learning, proceed, study, undertake further studies.

It is important to state that the two skills maps have been defined to integrate the main responsibilities of the technical and expert qualifications, mainly the needed competences for installers (related with the technical qualification) or designers (related with the expert qualification) to interpret, implement or consider water efficiency requirements in building construction and retrofit.

During the course of the project, it became clear the need for an independent figure with the responsibility of superintending the project effective implementation according with the e.g., project, legal or water efficiency requirements (e.g., a third-party inspector dedicated to water efficiency verification). This independent figure (important in the future to assess and guarantee both WEE and WET delivered performance and quality results), who is beyond the scope of the two WATTer Skills qualifications, could be a step further for future projects to address.

Water Efficiency Technician - Skills description

AREA OF COMPETENCE: A. HYDRAULIC INSTALLATIONS AND WATER LOSSES
Skill A.1: Correctly interpret the design for effective implementation of the thermo-hydraulic installations in compliance with water-energy efficiency requirements ***General description:*** Studying building projects and inspecting structures to assess adequacy of material and equipment needs, to establish the sequence of pipe installations, to limit obstructions during the construction phase, following the project layout of the thermo-hydraulic installation and the current rules and regulations, aiming at the improvement of the installations' performance (e.g. minimizing the distances or "runs" between water heaters and fixtures).
Skill A.2: Correct selection and installation of adequate materials and components of the hydraulic system, including proper construction of pipe thermal insulation ***General description:*** Evaluating, selecting, acquiring, storing in the suitable conditions and using (constructing and installing) the most appropriate and efficient materials for the hydraulic system, including the thermal insulation of the piping system, assuring that these materials meet the requirements for successful thermal insulation of the pipes, elbows and joints (e.g. considering the appropriate thickness of thermal insulation materials).
Skill A.3: Installation and management of smart-meters and water monitoring equipment (e.g., flowmeters) ***General description:*** Evaluating, selecting and installing the suitable water monitoring equipment (e.g. smart meters) and control devices in hydraulic installations, considering building water pressure or other onsite conditions, aiming at monitoring/management of the water consumption and maximize savings. Assessment of the maintenance or replacement plan of the smart-meter or the water monitoring equipment, including compliance with regulatory instruments.

Skill A.4: Hydraulic and pressure adjustments and balancing of thermo-hydraulic installations

General description:

Taking the necessary measures and/or corrective actions (i.e. flow restriction to ensure uniform distribution of heat) for achieving the hydraulic adjustment and balancing of the heating installations, securing the correct functioning of the system and thus reducing the losses in heat generation and distribution systems.

Skill A.5: Indoor leakage identification and control (fixtures or equipment), repair, replacement and maintenance of the hydraulic installations (all home water networks)

General description:

Inspecting, assessing, cleaning and repairing/replacing (as part of the regular maintenance of thermo-hydraulic installations activities) the heating network, including the pipe network, water tank, heat exchangers and all other components using appropriate techniques, safeguarding that the system is properly and effectively functioning.

AREA OF COMPETENCE: B. DOMESTIC HOT WATER (DHW)

Skill B.1: Read and correctly interpret DHW project designs and layout, considering the performance of the thermo-hydraulic installations and water efficiency fixtures

General description:

Knowing and being able to identify the new and efficient technologies and equipment - and their respective key characteristics - that can be used for DHW, leading to energy and/or water saving, increased efficiency, reduction of operating costs related to hot water production, and improved the time lapse delivery of hot water, when needed.

Skill B.2: Correct selection and installation of efficient technologies and/or equipment for DHW production and determination of the energy savings resulting from the use of alternative/efficient water heaters

General description:

Being able to identify and/or calculate the energy gains – and the corresponding economic profit - deriving from the use of alternative/efficient DHW production systems for making a well-documented proposal to his clients (both in case of new construction and of retrofit / replacement of equipment)

Skill B.3: Undertaking of site survey of the building for the installation of water heaters systems, including renewable energy sources (RES) based systems

General description:

Realizing a number of necessary checks and controls, including project reading and understanding, onsite visit, prior to the installation of the SWH systems, aiming at the examination of the suitability of the proposed siting of key system components (orientation, tilt, etc.), preparing the site for the installation of the SWH system assuring that it meets safety requirements, reporting possible technical barriers, and confirming that all the tools, materials and equipment required for the installation work are available and are in a safe, usable condition.

Skill B.4: Installation, testing and commissioning of water heater systems, including RES based systems

General description:

Installing in accordance with manufacturer's guidance, regulatory requirements and industry recognized procedures, of all system components for hot water production, including or any other heater system based on RES. Testing the system for hydraulic reliability using the appropriate test equipment and commissioning it in accordance with manufacturer's guidance, statutory requirements and/or industry recognized procedures.

Skill B.5: Undertaking the routine service, fault diagnosis and repair work of water heater systems, including RES based systems

General description:

Undertaking the routine service and maintenance of the whole water heater systems and its component parts (checking the system load pressure, protection against freezing and corrosion, hydraulic adjustments and system controls etc.) aiming at the assurance of its proper and efficient functioning, inspecting for emerging faults' diagnosis, referring of the faults to the system's owner in order to proceed with all the necessary fault rectification works.

AREA OF COMPETENCE: C. GREY WATER

Skill C.1: Read and correctly interpret grey water collection project for recycling and domestic re-use

General description:

Studying of the possible methods for grey-water reuse for domestic water propositions, considering climate conditions (e.g., rainfall), the different possible water end uses and the need for treatment. It is mandatory to understand and guarantee that no interconnections with potable water use exist.

Skill C.2: Correct selection and installation (including network connection in compliance with legislation and standards), commissioning and proper maintenance of grey water recycling systems

General description:

Carrying out water recycling systems installation and commissioning taking into account the factors that influence the choice of grey water. Also, being able to maintain a well-functioning system, ensuring maximum water savings, and in compliance with current legislation and standards.

AREA OF COMPETENCE: D. RAINWATER HARVESTING

Skill D.1: Read and correctly interpret rainwater harvesting project (including water treatment) for domestic use

General description:

Being able to choose the most appropriate and efficient water treatment systems according to the building and weather features and demands of the client.

Skill D.2: Correct selection and installation (including network connection in compliance with legislation and standards), commissioning and proper maintenance of grey water recycling systems

General description:

Carrying out a proper rainwater harvesting installation, taking into account an efficient commission and handover rainwater harvesting (capturing and storage for future re - use).

AREA OF COMPETENCE: E. OUTDOOR

Skill E.1: Read and correctly interpret outdoor landscape design, including techniques to minimise water waste from irrigation runoff or overspray

General description:

Undertaking reviews in the irrigation system to address leaks, runoff and overspray, taking into account what defined within landscape design phase.

Skill E.2: Correct selection and installation (including network connection in compliance with legislation and standards), commissioning and proper maintenance of irrigation and outdoor water use systems, including proper scheduling for optimal irrigation performance

General description:

Being able to irrigation schedule to maintain plant health while conserving water resources, taking into account what defined within landscape design phase.

Skill E.3: Detection and repair of outdoor leaks (e.g. green areas and landscapes)

General description:

Addressing plumbing damaged mechanisms to keep an outdoor space irrigation system safe and efficient.

AREA OF COMPETENCE: F. SELECTION OF APPLIANCES AND FIXTURES

Skill F.1: Correct selection of appliances and fixtures for water & energy savings

General description:

Reading and understanding project parameters and diagrams, choosing the most efficient and adequate materials, selecting correct pipe and fittings sizes and installation according to the elaborated project and safety requirements.

Skill F.2: Correct installation of appliances and fixtures, including repair/replacement and maintenance

General description:

Carrying out the assembly of saving appliances according to the most suitable technique and water saving approach.

AREA OF COMPETENCE: G. CLIENT ORIENTATION

Skill G.1: Provide clear information and guidance to customer (selection of material/equipment/appliances/fixtures), including consumer behaviour impact on water savings

General description:

Matching clients' facilities and the most efficient materials/equipment/appliances/fixtures, in accordance to clients' requirements and expectations (investment, consumption, comfort), indicating in a clear way energy/water savings and payback period. Giving advice to clients in a pedagogical way, providing good practices examples and benefits in the proper use of devices/ equipment/appliances and their maintenance, giving them detailed explanations in case of doubts.

Skill G.2: Provide of a logbook and report with all significant occurrences during inspection of all phases of building construction, before and after the commission process

General description:

Carrying out an inspection of the adequacy of the hydraulic installations and verification of water losses, the domestic hot water network and equipment, the grey water network and equipment, the rainwater harvesting, outdoor and selection of appliances and fixtures. The inspection should be detailed in a logbook with the main significant occurrences, during building construction, before and after the commission process, and with a plan of the follow-up activities that may be conducted, considering water-energy requirements and tailored to the client/customer needs.

Water Efficiency Expert - Skills description

AREA OF COMPETENCE: A. DESIGN A WATER EFFICIENT BUILDING

Skill A.1: Correct evaluation of the needs and site conditions to design (system conception and sizing), plan, select and propose a water-energy efficient system (thermal-hydraulic, DHW, grey water, rainwater harvesting and irrigation systems)

General description:

Designing, planning, selection, proposing of water efficient system and inspecting building (or retrofit in existing buildings) to check on its adequacy to receive the design system, designing of thermal and hydraulic networks, considering the most adequate options on water efficiency, i.e., to ensuring maximum water and energy savings, together with the nexus and the environment conditions (e.g., climate, orientation, building surrounding area and consumer behaviour).

Skill A.2: Provide the list of the suitable material and components and describe their positioning in the circuit to secure regular functioning of the system

General description:

Analysing, selecting and proposing the most suitable materials and components for the optimization of water-energy efficient systems, including the use of passive heating and cooling systems while ensuring maximum water and energy savings, also considering the nexus together with the environment conditions (e.g., climate, orientation, building surrounding area and consumer behaviour).

Skill A.3: Provide the clear indication of control and monitoring equipment, their positioning in the circuit and main functioning parameters

General description:

Analysing, selecting and proposing of most adequate monitoring equipment, including their positioning in the circuit and main functioning parameters, and of RES while ensuring maximum water and energy savings, also considering the nexus together with the environment conditions (e.g., climate, orientation, building surrounding area and consumer behaviour).

Skill A.4: Provide the list of the tests and other procedures to secure inspection and commissioning

General description:

Carrying out the verification and inspection procedures and plan for the building (or retrofit in existing buildings) networks for drinking water, irrigation and sanitary systems, including equipment and devices/products, considering the nexus together with environment conditions (e.g., climate, orientation, building surrounding area and consumer behaviour), particularly the yearly rainfall and water end uses. The choice for water-energy efficient materials, equipment and devices/products, together with knowledge on the required measures to guarantee that no unwanted interconnections take place or the adequate level of treatment considering the different water end uses is required.

Skill A.5: Provide details of repair, replacement and maintenance most likely to occur in the water-energy efficient system (thermal-hydraulic, DHW, grey water, rainwater harvesting and irrigation systems), with clear indication of related costs

General description:

Identification of the adequate procedures and planning of repairment, replacement and maintenance of the hydraulic installations, including the planning of the regular procedures. This will need to address the costs and the selection of "environmental-friendly" building construction materials and ecological construction techniques, based on life-cycle cost analysis and considering the possible lowering impacts of manufacturing process, transportation, construction, use, maintenance, reuse or disposal.

Skill A.6: Designing of water-energy efficient system for green areas and landscapes, and application of circular economy principles in construction

General description:

Planning and designing green areas and landscapes considering autochthonous/native and low-water-use plants, efficient scheduling irrigation programs and adequate "environmental-friendly" maintenance (e.g. restricted to biodegradable fertilizers and pesticides). Reduced runoff and limited energy use should be guaranteed.

AREA OF COMPETENCE: B. PROJECT SUPERVISION

Skill B.1: Supervision of whether the selected components fit the project requirements and compliance building safety regulations

General description:

Inspecting and revising the building water-energy system installation, and whether it is fit to the project requirements, considering the most adequate options on water-energy efficiency while attesting for compliance with building and safety regulations, including environment conditions (e.g., climate, orientation, building surrounding area and consumer behaviour).

Skill B.2: Supervision of whether the selected components are correctly positioned in the circuit and compliance with building safety regulations

General description:

Inspecting and revising the building water-energy system components, and whether if they are correctly positioned in the circuit, considering the most adequate options on water-energy efficiency while attesting for compliance with building and safety regulations, including environment conditions (e.g., climate, orientation, building surrounding area and consumer behaviour).

Skill B.3: Supervision of whether the system parameters are set in accordance with the instructions provided in the project

General description:

Inspecting and revising the building water-energy system parameters, and whether if they are set in accordance with the instructions provided in the project, considering the most adequate options on water-energy efficiency while attesting for compliance with building and safety regulations, including environment conditions (e.g., climate, orientation, building surrounding area and consumer behaviour).

Skill B.4: Keeping up the contractual conditions of performance, including a logbook and reporting of all significant occurrences, before and after building commissioning

General description:

Respecting of the contents of the contract bearing in mind the obligation to respect the laws and the good practices indicated by the manufacturers, to achieve the minimum quality standards. Monitoring of the quality, effectiveness and efficiency of materials and labour standards, to verify the levels of service quality achieved with reference to the objectives (quality levels achieved) to be achieved. Keep a logbook for reporting of the significance occurrences during construction.

AREA OF COMPETENCE: C. WATER MEASUREMENTS AND WATER-ENERGY NEXUS

Skill C.1: Collection, verification and analysis procedure definition for field data related to water-energy use, including alternative sources and RES

General description:

Collection, verification and analysis procedure for the definition of field data related water measurements and water-energy nexus, including water-energy performance indicators, to evaluate the profile use with respect to several conditions, e.g., public and private works, renovations, new buildings, geographical location, demand.

Elaborating synthetic cards for the collection of real data. Calculating the water-energy performance parameters and deviation from actual water-energy performance of the system in the analysed building.

Skill C.2: Quantification of water and energy baselines for water-energy use, reduction or demand assessment

General description:

Analysing the collected data and the average consumption statistics of the specific sector of reference. Based on observable demand profile and the environmental context, establishing which water-energy demand can be considered for the future years with reference to the different categories use. Establishing the guidelines for the correct use of water and energy. Identifying with precision the potential causes of waste and proposals to mitigate them.

Skill C.3: Comparison of water and energy use requirements to building safety regulations

General description:

Analysing the collected data of water and energy consumption in the different environments of use (public, private, industrial, etc) and compare them with the maximum levels of consumption established by the current norm of the reference Country and of the reference Region. Identifying critical points and "best practices" to create “educational guidelines” to reduce consumption levels in the various sectors of economy through a consumer education package that is responsible for the final use.

Skill C4: Identification and prioritization of water-energy saving measures

General description:

After analysing the collected data, identifying the critical issues and make a real water-energy balance. Establishing priorities for intervention based on the major critical issues and suggest remedies for any inadequacies found, acquiring useful elements to identify the reduction of water waste and energy products determined within the specific employment sectors. Improve the consumption conditions by encouraging savings, recovery and reuse of water and energy resources, both in residential and non-residential contexts.

Skill C.5: Monitoring of the cost-benefits and impacts from applying water-energy saving measures

General description:

Evaluating the achievable water-energy savings by avoiding additional charges for customers/clients; identifying the critical points that, by size and potential savings, are more interesting for specific interventions; highlighting the technologies available on the market to implement water efficiency and energy efficiency programs based on cost / benefit analysis; facing efficiency with an integrated approach that considers all the energy processes of a sector: energy vectors (electricity, gas, water, etc.), the related environmental parameters (temperature, humidity, luminosity, CO2, etc.) and process parameters (compressed air, calories, level, status, etc.). Drawing from it the useful synergies for achieving efficiency results.

AREA OF COMPETENCE: D. CLIENT ORIENTATION

Skill D.1: Auditing, diagnosis and baseline of consumption definition, benchmarking and identification of water-energy saving potentials

General description:

Undertaking of an auditing program for complete diagnosis, identification of the criticalities and identification of the water-energy baseline, to the definition of the water-energy saving potentials. Selecting and proposing monitoring devices to reduce the consumption of water and energy in relation to the environment and the area of use. Proposing unique monitoring systems able to control all energy vectors (electricity, gas, water, etc.), the related environmental parameters (temperature, humidity, luminosity, CO2, etc.).

Skill D.2: Identification of water-energy efficiency measures (e.g., appliances, equipment, monitoring systems) to attain water-energy saving potentials

General description:

Undertaking of an auditing program for complete diagnosis, identification of the criticalities and identification of the water-energy baseline, to attain previously defined water-energy saving potentials. Identifying the new equipment and technologies available on the market to implement energy efficiency programs based on cost / benefit analysis and selection of the right solution based on the needs and the intervention environment.

Skill D.3: Promotion of best practices for the correct use and maintenance of the water-energy efficiency systems

General description:

Based on auditing and recognition of best practices, identify the most applicable water-energy efficiency measures and the corresponding correct use and maintenance procedures. Providing continuous and planned procedures for the control and use of archived data necessary for the conservation or realignment of the water and energy performance of a building. Drawing up a proper maintenance plan that includes a procedure for the planned processing of actions, verifications and any feedbacks referring to distribution networks, treatment plants, domestic hot water production systems, home automation monitoring and consumption control systems.

4 Monitoring of results and indicators

After the skills map definition and identification of the areas of competence for the two professional categories, key performance indicators may be used to assess the project effect and impact, during the project and onwards (to be assessed during pilot training and by the qualified professionals). Apart from defining the project's baseline, it will be useful to measure the success of the project implementation outcomes. In addition to general project effect and impact indicators, the project may use performance indicators to assess "efficiency", herein identified as Performance indicators related to water efficiency. This will be assessed throughout the project development and revised accordingly.

The definition of monitoring metrics and indicators aims to compare water and energy efficiency in buildings before and after the implementation of training and the qualification system was proposed, with the expected effect indicators on society, impact indicators and performance indicators related with water efficiency. This will be useful to define the project baseline and to measure the success of the project implementation outcomes.

4.1 Effect indicators

They are the immediate consequences of training and development of competences on trainees, companies or society. They represent the matching between training actions and participants' requirements (Table 4-1).

Table 4-1 - Indicators (what to measure and formula) to assess the matching between training actions and participant requirements.

What to measure	Formula
Rate of participants enrolled	Nº of applicants/ Nº of vacancies offered
Abandonment rate	Nº dropouts / Nº of registered trainees
Success rate	Nº of trainees who passed the exam / Nº of people enrolled

4.2 Impact indicators

They represent the expected change in the participants once the training has finished. They are usually measured in medium and long-term, due to an amount of time is required to measure the salary improvement, work conditions, employability, etc. (Table 4-2).

Table 4-2 - Indicators to assess the expected change in the participants

What to measure	Formula
Nº of stakeholders involved	Nº of stakeholders per country and project years
Nº of views to the project website	Nº of views per project years
Nº of attendees participating in the public events held within the project	Nº of attendees / (organised public events. project years)
Nº of European languages in which WATTer Skills learning materials will be developed	Nº of languages/ Nº of official languages of the consortium

4.3 Performance indicators related to water efficiency

This kind of indicators measure the impact of carrying out water efficiency actions during the project implementation. This information should be provided per each country (Table 4-3, Table 4-4 and Table 4-5).

Table 4-3 – Indicators to assess the impact of implementing equipment and water saving devices/products

What to measure	Formula
Percentage of products (taps, showers, faucets) with the best level of efficiency*	Nº of products with highest efficiency rating in the market / total Nº of products in the market
Percentage of equipment (e.g., dishwasher) with the best level of efficiency*	Nº of equipment with the best level of efficiency / total Nº number of equipment

* Considering the national labels available for these products and, from 2020 on, the European label being developed by JRC/EC or industry's voluntary agreement (Unified Water Label, being developed by the European Bathroom Forum), depending on the one to be approved by the EC in 2019.

Table 4-4 – Indicators to assess consumption levels

What to measure	Formula
Consumption per capita	Litres measured in the flowmeter / (person.day)

Table 4-5 – Indicators to assess the level of new water sources

What to measure	Formula
Percentage of water reused	Litres of total water reused/ litres of total water consumed
Total of rainwater harvested	Litres of total water harvested/ litres of total water consumed
Total of wastewater reused	Litres of total wastewater reused/ litres of total water consumed

5 Final considerations

In this first report of the WATTer Skills project, the perimeter and the skills maps, necessary for the development of the two qualifications – water efficiency technician (WET) and water efficiency expert (WEE) were identified. These correspond to the starting point and definition of the WATTer Skills map at a European level, towards the development of the two qualifications (the WET and the WEE). Also, a set of indicators was proposed to compare water efficiency and energy efficiency in buildings, including data collection for water and energy consumption.

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