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INTRODUCTION

The purpose of this report is to group the learning outcomes defined in the first Intellectual Output of the DEFMA project, into six learning units, following specific criteria elaborated according to ECVET principles. Furthermore, the report provides the specifications of each learning unit defined, including the credits for each learning unit, as a set of learning outcomes which can be assessed and which can be accumulated towards a qualification or transferred to other learning programmes or qualifications. The elaborated learning units will be used by the DEFMA partners to further develop the training course. They can also be useful to any VET provider interested in developing customised training materials that may correspond with the DEFMA learning outcomes.

1. GROUPING OF LEARNING OUTCOMES INTO LEARNING UNITS

1.1. What is a unit of learning outcomes

A unit is a component of a qualification consisting of a detailed set of knowledge, skills and competence that can be evaluated, validated and certified. Units enable progressive achievement through transfer and accumulation of learning outcomes defined in knowledge, skills and competence terms. Units of learning outcomes can be specific to a single qualification or common to several qualifications and may also describe so-called additional qualifications which are not part of a formal qualification or curriculum. They are subject to assessment and validation which verify whether the learner has achieved the learning outcomes expected.

1.2. ECVET principles

ECVET stands for European Credit system for Vocational Education and Training. ECVET works hand in hand with the European Qualifications Framework (EQF) to provide greater transparency in European qualifications, promoting the mobility of workers and learners, and facilitating lifelong learning.

Successful ECVET implementation requires that qualifications be described in terms of learning outcomes; with learning outcomes brought together in units;



and units often accumulated to form the basis of qualifications or awards. Assessment, validation and recognition processes must also be agreed among all those participating and should respect existing national, regional, sectoral or institutional practice. Furthermore, ECVET requires the use of units to facilitate the transfer, recognition and accumulation of assessed learning outcomes of individuals who are aiming to achieve a professional profile.

In cases where credit is able to be awarded, a points system might also be considered with points directly attributed to ECVET units and qualifications.

1.3. Methodology for designing learning units

The approach adopted for designing the DEFMA learning units follows the shift to competence and career oriented education and training, in alignment with the research and results obtained in the first Intellectual Output (O1) of the project. It breaks down the overall learning outcomes to individual smaller learning outcomes that may be more easily mapped to the needs and realities of both learners and trainers. The process followed, in compliance with the provisions of the project's Application Form, has been to group and sequence learning outcomes logically in learning units, resulting in individual units that learners can select as being most relevant to their needs. At the same time, VET providers and trainers could take a unit from one course and use it with minor adaptation in another course. The DEFMA learning units design methodology also took into account that corresponding educational resources need to be provided openly for integration in online and face-to-face courses, as well as to be in a MOOC, and avoided tight sequencing and interdependencies between the proposed learning units.

The ECVET recommendation suggests that the description of a unit should include the following information:

- the title of the unit;
- the title of the qualification to which the unit relates;
- the EQF level of the qualification (and, where appropriate, the NQF level);



- the ECVET points associated with the unit;
- the learning outcomes contained in the unit;
- The procedures and criteria for assessment of these learning outcomes, the validity in time of the unit, where relevant.

1.4. Grouping criteria

Grouping criteria, based on European principles

Based on the European principles, a unit of learning outcomes should provide a comprehensive and consistent learning process. The criteria that should and have be taken into consideration when determining the units of learning outcomes for DEFMA are the following:

- Units of learning outcomes can be completed and assessed, as independently as possible from other units of learning outcomes.
- Units of learning outcomes are structured in such a way that the relevant learning outcomes can be achieved in a specific time interval. Units of learning outcomes should therefore not be too extensive.
- Units of learning outcomes include all necessary learning outcomes in order to cover the objectives of the units.
- Units of learning outcomes are designed to be assessable.

Grouping criteria, based on DEFMA targets

Based on the specific requirements and objectives of the DEFMA Project, the partnership also identified another set of grouping criteria that have been taken into consideration alongside the European ones:

- The learning units should correspond to the same set of occupational tasks.
- The learning units should correspond to specific stages in the process of performing a service.
- The learning units should correspond to the same field of skills.



- There should be learning units covering basic/general knowledge of modern environmental technologies and sustainable building services, as well as learning units focusing on expertise, so that VET providers can be flexible in selecting which learning units to integrate.
- The learning units should cover the following topics:
 - Foundations in environmental management and sustainability principles;
 - Overview of environmental and energy legislation for buildings and the impact on FM operation;
 - Latest low & zero carbon generating technologies for buildings;
 - Measuring building environmental performance: building Information Modelling (BIM);
 - Detecting heat losses, water leaks, and air leakages in buildings; rectifying small faults, and carrying out simple maintenances to increase energy efficiency;
 - Comprehending and programming smart building controls to minimize the consumption of resources, such as electricity, gas (or other heating fuels) and water;
 - Communicating the sustainability agenda and “smart” controls to the users of the building.

1.5. DEFMA learning units

Based on the above criteria and the objectives of the project, the partnership defined the following DEFMA learning units:

- Learning Unit 1: Sustainability and environmental issues and their impact on FM
- Learning Unit 2: Energy efficiency and energy management in buildings
- Learning Unit 3: Sustainable buildings
- Learning Unit 4: Building management and intelligent building solutions
- Learning Unit 5: Maintenance and repairs to prevent energy losses
- Learning Unit 6: Health and Safety issues in FM operations



2. LEARNING UNITS' SPECIFICATIONS

2.1. The need for learning unit specifications and methodology

As learning units are the basic building blocks of a curriculum, their specifications define the essential requirements to be met by the corresponding training programme and materials. Therefore, the DEFMA learning unit specifications will be used by the DEFMA partners to further develop the training course, but can also be useful to any VET provider interested in developing customised training materials that may correspond with the DEFMA learning outcomes.

Defining the specifications of the learning units was based on ECVET principles, which denote that each unit may include the following elements:

- EQF level of qualification
- Duration of learning process
- Assessment methods
- Weighting of learning units
- Credits allocation
- Prerequisites to attend each learning unit

2.2. Definition of EQF level

Based on the European Qualification Framework descriptors of levels (see <https://ec.europa.eu/ploteus/content/descriptors-page>), and based on the skills, competence and knowledge to be obtained by learners of DEFMA units, the project partners consulted and concluded that the learning units and the qualification should be aligned with the two highest levels of a VET qualification, that is Level 4 and Level 5. More specifically, Level 4 and Level 5 EQF descriptors for skills, competence and knowledge define the following:



EQF Level	Knowledge	Skills	Competence
Level 4	Factual and theoretical knowledge in broad contexts within a field of work or study	A range of cognitive and practical skills required to generate solutions to specific problems in a field of work or study	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
Level 5	Comprehensive, specialised, factual and theoretical knowledge within a field of work or study and an awareness of the boundaries of that knowledge	A comprehensive range of cognitive and practical skills required to develop creative solutions to abstract problems	Exercise management and supervision in contexts of work or study activities where there is unpredictable change; review and develop performance of self and others

2.3. Duration of the course and learning units

Based on ECVET principles, duration of a course is counted by accumulating the following:

- contact hours: the amount of expected timetabled hours of staff-student contact, including lectures, tutorials, seminars and workshops.
- self-study hours: the study of something by oneself without direct supervision or attendance in a class.
- hands-on hours: practical sessions which can also be supervised.
- assessment hours: the time needed to prepare an assignment, including the time allocated to the exam (if any).

In order to ensure equivalency of formal and non-formal/informal qualifications, the basis for development of ECVET units of learning is notional learning time (NLT), as this is a widespread measure used in the development of formal learning programmes.



'Notional learning hours' are the estimated learning time taken by the 'average' student to achieve the specified learning outcomes of the course-unit or programme. They are therefore not a precise measure but provide students with an indication of the amount of study and degree of commitment expected. Notional learning time includes teaching contact time (lectures, seminars, tutorials, laboratory practicals, workshops, fieldwork etc.), time spent on preparing and carrying out formative and summative assessments (written coursework, oral presentations, exams etc.) and time spent on private study.

The partners determined that the duration of each learning unit will be 20 hours, leading to the total duration of DEFMA course of 120 hours (NLT).

The DEFMA MOOC that will be structured on the basis of the developed units, will comprise materials of 35-50 hours (time required for an average learner to access all materials) and will last approximately 3-4 weeks.

2.4. Weighting and suggested allocation of credits

Credit points or ECVET points are a numerical representation of the overall weight of learning outcomes in a qualification and of the relative weight of units in relation to the qualification. Thus, ECVET points do not represent the objective value or complexity of a profession but an agreed framework of skills evaluation between partners, aiming to facilitate the accumulation and transfer of learning outcomes from one qualifications system to another. It is not intended to replace national qualification systems, but to achieve better comparability and compatibility among them. This convention makes it easier for European Union (EU) citizens to gain recognition of their training, skills and knowledge in other EU countries than their own.

Criteria followed for weighting and points allocation are:

- the relative importance of learning outcomes which constitute each unit;
- the complexity, scope and volume of learning outcomes in the unit;
- the effort necessary for a learner to acquire the knowledge, skills and competence required for the unit;



- similar existing courses among participating countries found during desk research for the first Intellectual Output of DEFMA, and
- the overall and each learning unit's duration.

To enable a common approach for the application of ECVET credits, a convention is used according to which 60 credit points are allocated to the learning outcomes expected to be achieved in a year of formal full time VET. Consequently, one ECVET credit point equates to the learning outcomes achieved through 20 notional learning hours.

Thus, total recommended time for the DEFMA course is 120 NLT, corresponding to 6 ECTS credits.

2.5. Definition of assessment methods

According to ECVET principles, assessment comprises methods and processes used to establish the extent to which a learner has attained particular knowledge, skills and competence of learning units. In this context, tasks that validate the understanding of the learning outcomes by learners have to be developed, giving a clear indication of their coverage and depth.

Common assessment procedures consist of written, oral and practical methods such as case-studies, exams (open and closed book), open-ended and closed-ended tests, projects, practical tasks, self-assessment, simulations, group projects, essays, interviews, presentations, portfolios, assignments, skill demonstration etc.

DEFMA partners, based on their training experience and desk research regarding assessment of similar existing courses in Europe, went through available assessment methods, evaluated and ranked them in order to identify which ones best fit the structure of DEFMA units, and suggested an assessment methodology of 6 (six) assignments (one for each unit), consisting of one case-study with 5 open-ended questions and/or multiple choice test.



2.6. Definition of prerequisites

Prerequisites are any prior knowledge, skills or understanding that the learner is required to have before attending a learning unit, including units within the same course and any optional routes.

Based on the content of the learning units, the basic prerequisite for a learner to meet before undertaking any of the DEFMA units is set as at least one of the following:

- Holds a certificate in facility management, equal to or greater than EQF level 4.
- Has 2 or more years experience as a facility manager.



3. DEFMA COURSE

3.1. Course description

Title	Digital and environmental skills for facilities management
Description	<p>Facility managers, after attending this course will be equipped with all needed skills, knowledge and competence in order to meet current and emerging workplace demands with regards to zero carbon services and technologies.</p> <p>During the course, learners will learn:</p> <ul style="list-style-type: none"> • Basic facts and principles of sustainability and environmental management for improving resource efficiency in buildings • Latest low and zero carbon technologies for buildings • Maintenance and repairs to prevent energy losses • Smart building controls • Communicating the sustainability agenda to the users' of the building • Health and Safety procedures with regard to environmental aspects
EQF level	5
Duration	120 NLT
ECVET credits	6
General prerequisites	<p>One of the following:</p> <ul style="list-style-type: none"> • Certificate in facility management, equal to or greater than EQF level 4. • 2 or more years of proven experience as facility manager.



3.2. Learning units' description

3.2.1. Learning Unit 1

Title	Sustainability and Environmental Issues and their Impact on FM
Description	This learning unit introduces the learner to sustainability and environmental management and provides basic facts and principles that improve resource efficiency in or for buildings, covering different types of FM operations. It introduces to the key EU and national legislation on environmental issues.
Overall Learning Outcome	Learners should understand key concepts of the environmental and sustainability principles in order to develop a coherent and efficient saving energies policy. Also, learners should comprehend what EU and national environmental laws address and know which the main legislation covering the various topics related to energy saving practices for the building industries.
EQF level	4 - 5
Duration	20 hrs NLT
ECVET credits	1
Prerequisites	General
Assessment	1 assignment: case-study (5 open-ended questions and/or multiple choice test)
Learning Outcome 1	Describe the fundamental principles of environmental management and sustainability in relation to Facility Management.
Learning Outcome 2	State at least 3 energy saving measures for buildings.
Learning Outcome 3	Explain how to manage and implement energy efficiency within the buildings in the short- and long-term.
Learning Outcome 4	State the main national and EU environmental policy principles (laws) on energy saving practices for the building industry.
Learning Outcome 5	Advise customers on how to improve resource efficiency in or for buildings.



3.2.2. Learning Unit 2

Title	Energy efficiency and energy management in buildings
Description	This learning unit covers the processes and technologies applied in energy saving and carbon emissions reduction for buildings as well as the impacts from the use of energy saving practices. It introduces the learner to practical and cost effective ways of energy management, such as developing an energy policy and energy management plan.
Overall Learning Outcome	Learners should understand the role of the energy efficiency practices in buildings, appreciating the range of approaches and technologies available in order to select the appropriate strategy. Also, they should understand the importance of communication of the agenda to the users of the building.
EQF level	4-5
Duration	20 hrs NLT
ECVET credits	1
Prerequisites	General+ Learning Outcomes of Learning Unit 1
Assessment	1 assignment: case-study (5 open-ended questions and/or multiple choice test)
Learning Outcome 1	Describe the fundamental principles of environmental management and sustainability in relation to Facility Management.
Learning Outcome 2	Explain no-cost vs. low-cost energy saving measures for buildings.
Learning Outcome 3	Evaluate the impact of integrating energy saving measures in buildings.
Learning Outcome 4	Prepare energy management plan.
Learning Outcome 5	Advise customers on the use and impact of smart energy saving solutions.



3.2.3. Learning Unit 3

Title	Sustainable buildings
Description	This learning unit introduces the learner to the concept of sustainable building and provides basic facts and principles on efficient use of energy, water, and other resources; waste reduction; indoor environmental quality enhancement; operations and maintenance optimization; building rating & certification systems.
Overall Learning Outcome	Learners should develop innovative thinking in the design and operation of buildings and be able to analyse and evaluate sustainable design options for buildings.
EQF level	4 - 5
Duration	20 hrs NLT
ECVET credits	1
Prerequisites	General+ Learning Outcomes of Learning Units 1& 2
Assessment	1 assignment: case-study (5 open-ended questions and/or multiple choice test)
Learning Outcome 1	Explain the concept of sustainable building and the existing building certification systems.
Learning Outcome 2	State the main energy concepts for heating & cooling.
Learning Outcome 3	Explain waste management & reduction processes.
Learning Outcome 4	Describe the ways to enhance the indoor air quality.
Learning Outcome 5	Advise customers on operations and maintenance optimization.



3.2.4. Learning Unit 4

Title	Building management and intelligent building solutions
Description	This learning unit explains how to utilise complex building information & maintenance technology systems and to operate these to ensure the highest building performance.
Overall Learning Outcome	Learners should appreciate the role of the digital innovation for energy efficiency maintenance and quality, health & safety issues in building in order to apply proper solutions to energy saving.
EQF level	4 - 5
Duration	20 hrs NLT
ECVET credits	1
Prerequisites	General + Learning Outcomes of Learning Units 1, 2 & 3
Assessment	1 assignment: case-study (5 open-ended questions and/or multiple choice test)
Learning Outcome 1	Describe the importance of Building Management Systems in Facility Management.
Learning Outcome 2	State the general requirements to implement smart metering technologies in or for buildings.
Learning Outcome 3	Explain the purpose of a building log book and how to develop it.
Learning Outcome 4	Identify health and safety issues for buildings that include energy monitoring technologies and services.
Learning Outcome 5	Advise customers to ensure the correct selection of smart metering system.



3.2.5. Learning Unit 5

Title	Maintanance and repairs to prevent energy losses
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Description	This learning unit introduces the learner to technical issues related to the installation of energy saving technologies and services in new and existing buildings, detecting faults and performing the necessary repairs.
Overall Learning Outcome	Learners should be able to apply the proper tools to detect heat, water and air losses in buildings in order to rectify small faults and carry out simple maintenance to increase energy efficiency. Also, learners should understand the technical skills required to incorporate smart metering technologies in automated home infrastructures.
EQF level	5
Duration	20 hrs NLT
ECVET credits	1
Prerequisites	General + Learning Outcomes of Learning Units 1,2, 3 & 4
Assessment	1 assignment: case-study (5 open-ended questions and/or multiple choice test)
Learning Outcome 1	Describe the main principles and tools for detecting heat, water and air losses in buildings.
Learning Outcome 2	Explain the technical issues related to repair and maintenance of building systems to increase energy performance.
Learning Outcome 3	Identify health and safety issues during repair and maintenance operations.
Learning Outcome 4	Explain the technical issues related to incorporating smart metering technologies in automated home infrastructures
Learning Outcome 5	Evaluate the impact of the interconnection of smart meters with other home infrastructure.



3.2.6. Learning Unit 6

Title

Occupant & Operator Health and Wellbeing

Description	This learning unit introduces the learner to the main health and wellbeing aspects relevant to FM operations that focus on respecting the environment through efficient integrated waste, energy and water management, and managing the carbon emissions generated by FM activities.
Overall Learning Outcome	Learners should understand key rules and requirements for Health & Wellbeing when organising and performing facility management operations, securing total customer satisfaction through the use of innovative technology and organizational excellence in a sustainable and environmental friendly manner.
EQF level	4 – 5
Duration	20 hrs NLT
ECVET credits	1
Prerequisites	General+ Learning Outcomes of Learning Units 1,2, 3, 4&5
Assessment	1 assignment: case-study (5 open-ended questions and/or multiple choice test)
Learning Outcome 1	State the main principles for keeping optimum thermal comfort and indoor air quality.
Learning Outcome 2	Explain potential areas of risk in the workplace and how to take action to minimise the threat.
Learning Outcome 3	Describe environmental safety measures.
Learning Outcome 4	Advise customers on environmental, health and safety questions.