



**BOOSTING THE GREEN FUTURE
VIA UNIVERSITY MICRO-CREDENTIALS**
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DELIVERABLE 2.1 – INTERNATIONAL REPORT
**Incorporation of training in green standards in the
HE via micro-credential courses – current state**



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| Authors and Collaborators | |
|--|---|
| BULGARIA | |
| BURGAS FREE UNIVERSITY /BFU/ - COORDINATOR and Author |  |
| BULGARSKI INSTITUT ZA STANDARTIZACIA /BDS/ - Collaborator |  |
| ROMANIA | |
| ASOCIATIA DE STANDARDIZARE DIN ROMANIA /ASRO/ - Collaborator |  |
| UNIVERSITATEA DE STIINTELE VIETII "REGELE MIHAIL I AL ROMANIA" DIN TIMISOARA /LSU/ - Collaborator |  |
| SPAIN | |
| UNIVERSITAT POLITECNICA DE VALENCIA /UPV/ - Collaborator |  UNIVERSITAT POLITÈCNICA DE VALÈNCIA |
| LITHUANIA | |
| MYKOLO ROMERIO UNIVERSITETAS /MRU/ - Collaborator |  Mykolas Romeris universitetas |

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INTRODUCTION

In recent years, a trend towards diversification of education provision by higher education institutions can be observed. In addition to traditional bachelor, master or doctoral degree programs, various new short, more flexible, learner-centered forms of education and training that fit the needs of a wider range of learners have been offered. Public and private providers offer different forms of short-term education and training targeting various groups of learners.

In the European Union, this is the response to the changes on the labor market, where a growing number of adults, with a higher or lower education degree, will have to reskill and upskill to fill the gap between the competencies acquired through initial formal learning and emerging knowledge and skills needed. In particular, the COVID-19 crisis has resulted in a substantial increase in demand for various forms of flexible on-line continuing education and training offered by higher education institutions and other providers.¹

These alternative forms of learning are offered under different names², leading to confusion and problems with their understanding, recognition and appreciation by prospective learners and employers. This has resulted in an effort to address this issue and develop measures that would allow interested stakeholders to better understand and recognize the value of various forms of short education and training programs and the resulting credentials, for which the term “micro-credentials” is currently increasingly commonly used.

Although the development of various forms of micro-credentials is primarily market-driven, they are beneficial not only for professionals who would like to update their competences or acquire new competences that would give them a better position on the labor market. Micro-credentials, especially those offered by higher education institutions (HEIs), bring benefits to students enrolled in traditional degree programs, complementing, or supplementing these programs, in particular through enhancing students’ opportunities to develop transferable skills useful for their future careers.

Micro-credentials also create new opportunities for various groups of non-traditional students – life-long learners. They address the needs of those who would like to enhance their personal competencies³ and create pathways into tertiary education for various groups of learners from disadvantaged backgrounds. With the demographic changes observed in Europe, it is of a key importance to create the education offer for elderly people that would allow for active ageing in

¹ D. Orr, M. Pupinis, and G. Kirdulyte. Towards a European approach to micro-credentials: a study of practices and commonalities in offering micro-credentials in European higher education, NESET report, Publications Office of the European Union, Luxembourg 2020.

² Micro-credentials and Bologna Key Commitments State of play in the European Higher Education Area. MICROBOL, February 2021.

³ M. Edwards, L.M. Sanchez-Ruiz, and C. Sanchez-Diaz. Achieving Competence-Based Curriculum in Engineering Education in Spain, Proceedings of the IEEE, 97 (10), pp.1727-1736 (2009). doi: 10.1109/JPROC.2009.2026064.

the digital age. Therefore, offering various short-term forms of learning certified by micro-credentials can be seen as the essential part of the “third mission” of universities and their social responsibility.

Micro-credentials have the high potential of social impact. They allow people to maintain and acquire various competences that enable them to participate fully in society, ensure their personal, social, and professional empowerment, and thereby create better lives and better opportunities for all. Therefore, micro-credentials are high on the agenda of various political initiatives taking place at the European level. This is reflected in several documents of the European Commission, including:

- the communication on achieving the European Education Area by 2025⁴
- the updated Digital Education Action plan⁵
- New Skills Agenda for Europe⁶

Several research projects on micro-credentials have been supported by the European Commission, including MICROBOL (Micro-credentials linked to the Bologna Key Commitments) and MicroHE⁷, resulting in reports presenting, inter alia, problems with the development of the European approach to micro-credentials.

Another initiative of the European Commission is the establishment of the Micro-Credentials Higher Education Consultation Group, whose task is to propose a common definition and the EU standard for constitutive elements of micro-credentials. The report of this Consultation Group⁸, published in December 2020, has been an essential element of the consultation process initiated by the European Commission in May 2021.

On 16 June 2022, the Council of the European Union (EU) adopted a Recommendation on a European approach to micro-credentials for lifelong learning and employability.⁹ The Recommendation seeks to support the development, implementation, and recognition of micro-credentials across institutions, businesses, sectors, and borders. An effective culture of lifelong learning is key to ensuring that everyone has the knowledge, skills and competences they need to thrive in their personal and professional lives.

Micro-credentials certify the learning outcomes of short-term learning experiences, for example a short course or training. They offer a flexible, targeted way to help people develop the knowledge, skills, and competences they need for their personal and professional development.

⁴ Communication on Achieving the European Education Area by 2025, COM(2020) 625 final, European Commission, Brussels. 30.09.2020.

https://ec.europa.eu/education/resources-and-tools/document-library/eea-communicationsept2020_en

⁵ Digital Education Action Plan 2021-2027: Resetting education and training for the digital age, European Commission. 2020. https://ec.europa.eu/education/education-in-the-eu/digital-education-action-plan_en

⁶ European Skills Agenda for Sustainable Competitiveness, Social Fairness And Resilience, European Commission, 30.06.2020. <https://ec.europa.eu/social/main.jsp?catId=1223>

⁷ <https://microcredentials.eu> (accessed on January 23rd, 2023)

⁸ A European Approach to Micro-Credentials: Output of the Micro-Credentials Higher Education Consultation Group. December 2020. <https://ec.europa.eu/edu>

⁹ A Recommendation on a European approach to micro-credentials for lifelong learning and employability. 2022. <https://education.ec.europa.eu/education-levels/higher-education/micro-credentials>

The Recommendation provides building blocks including a definition, standard elements for describing micro-credentials, and principles for designing and issuing micro-credentials. As a result, micro-credentials can be developed, used, and compared in a coherent way among Member States, stakeholders and different providers (from education and training institutions to private companies) across different sectors, fields and borders. It will support the building of trust in micro-credentials across Europe.

The Recommendation will support the development and uptake of high-quality and transparent micro-credentials and outlines key areas for action in this field in education and training and labor markets policies. This will enable people to learn new skills in a tailored way, inclusive for all. The European approach to micro-credentials is a key component of the Commission's vision to achieve a European Education Area by 2025.

It is expected that a significant progress will be made as result of the European Universities Initiative, with European Universities developing and testing micro-credentials, thereby paving the way for other higher education institutions to follow. In fact, several European Universities alliances, including European Consortium of Innovative Universities (ECIU) and Young Universities for the Future of Europe (YUFE), have already reported some achievements in this area.

High expectations regarding the contribution of the European Universities to the development of micro-credentials have been emphasized in a recent European Commission document for the meeting with rectors of European Universities¹⁰, where one of its 6 sections is devoted to the European approach to micro-credentials.

Micro-credentials include certificates, digital badges, licensees and apprenticeships, the latter equating to full qualifications in Europe. Micro-credentials become a means of creating efficient lifelong learning opportunities, making skills visible and portable, regardless of how they were earned. Micro-credentials also enable traditional higher education institutions to meet student and workforce demand while capturing new revenue streams.

The climate change is ranked among the most serious problems facing the world today not only from European but from a global perspective. Education and training, like all sectors, must take action to respond to this planetary crisis.¹¹

Equipping learners and educators with the knowledge, skills and attitudes needed for a greener and more sustainable economy and society is set by European Commission as a pivotal priority for all EU Member States who have to create a shared understanding of the deep and transformative changes needed in education and training for sustainability and the green transition.

¹⁰ Background note: Targeted consultation with rectors of European Universities, 27 April 2021, European Commission, Directorate-General for Education, Youth, Sport, and Culture

¹¹ <https://education.ec.europa.eu/focus-topics/green-education/learning-for-the-green-transition>

Green standards are associated with the production of products that have a low carbon footprint, using methods and processes for improving the environment, increasing energy efficiency, and enhancing safety and property protection.

Incorporation of training in green standards in the higher education via micro-credential courses will answer the demand from learners for short and flexible forms of learning, and from industry and employers for verified skills-based credentials to satisfy the needs of the new world of work.

This document forms part of the deliverables from a project called "Boosting the green future via university micro-credentials" /B-Green-ED/ which has received funding from the European Union's ERASMUS+ program.

This document is the synthesis report of the national reports, developed by the B-Green-ED partner countries - Bulgaria, Lithuania, Romania, and Spain, about the current state and identified needs and gaps regarding the incorporation of training in green standards in the HE via micro-credential courses.

The general approach of this study has been to apply a blend of methods for linking results from the international and European level sources analysis results with the analysis results obtained at the national level for all partner countries. The process of data collection was based on different methods such as bibliographical research, policy scans, internal data secondary research.

The research activities at national level were conducted from December 2022 until January and were focused on the following aspects:

Policy regarding incorporation of training in standards in HE with a special focus on green standards – national and institutional dimensions;

Approaches and HE initiatives related to development of micro-credential ecosystem in – national and institutional projections.

In each of the national reports, which are provided separately but have to be considered annexes, i. e. complementary integral parts of this document, as result of the research and analysis at institutional level the partner universities have specified the scientific domains and priority directions in which they will develop micro-credential courses tailored to their concrete needs and educational contexts.

The authors of the National Reports provided the information on which the results and comments presented in this international report, developed by the Burgas Free University, Bulgaria, are based.

Part 1. Policy and approaches regarding incorporation of training in standards in HE with a special focus on green standards – national and institutional dimensions

Fundamental concepts and definitions

A **standard** is a set of guidelines and criteria against which a product, service, system or process can be judged. It defines requirements for those or describes a particular method or procedure. Common standards are created through consensus processes by standardizations organizations. **International Standards Organization (ISO)** develops worldwide standards that frequently become basis for industry norms and provide for certification. ISO defines a standard as: "a document, established by consensus, approved by a recognized body that provides for common and repeated use as rules, guidelines, or characteristics for activities or their results".

Requirements found in standards may either be prescriptive (identifying methods of achievement) or performance based (stating expectations of end results). Consensus based standards, those developed through a formal, voluntary consensus process that is exemplified by an open and due process have immediate buy-in, government support, and international influence. Many of the green product standards available today are proprietary or regulatory requirements that have been developed outside of the formal consensus process of standard development. These types of requirements may be more or less stringent than consensus standards and can include some level of transparency and public comment. However, many of these types of formal requirements are trusted because they are associated with a group that has strong environmental credentials.

A **certification** is a confirmation that a product meets defined criteria of a standard. ISO defines certification as: "*any activity concerned with determining directly or indirectly that relevant requirements are fulfilled.*"

Green product certifications are intended to outline and confirm that a product meets a particular standard and offers an environmental benefit. Many product labels and certification programs certify products based on life-cycle parameters, making them multi-attribute programs. These parameters include energy use, recycled content, and air and water emissions from manufacturing, disposal, and use. Others focus on a single attribute, such as water, energy, or chemical emissions that directly impact Indoor Environmental Quality (IEQ).

Green building codes continue to be developed and adopted that seek to push the standard of building design and construction to new levels of sustainability and performance. Codes come in two basic formats: prescriptive and performance, with outcome-based becoming a developing third option. A Prescriptive path is a fast, definitive, and conservative approach to code compliance. Materials and equipment must meet a certain level of stringency, which are quantified in tables. Performance-based codes are designed to achieve particular results, rather

than meeting prescribed requirements for individual building components. Outcome-based codes for example, establish a target energy use level and provide for measurement and reporting of energy use to assure that the completed building performs at the established level.

The unique difference between codes and building rating systems is that codes are mandatory. As green codes become adopted on a widespread basis, their impact will change the building environment rapidly and extensively. When undertaking a project, whether it is new construction or a renovation, check to see if there is a state or local green code that will dictate the direction and scope your project must take.

A **green product certification** is considered most respected when an independent third-party is responsible for conducting the product testing and awarding the certification. Third-party means they are independent of the product manufacturer, contractor, designer, and specifier. Third party labels and green product certification programs can be helpful in evaluating the attributes of green products because they validate that the product meets certain industry-independent standards. They can also offer greater assurance to consumers, designers, specifiers, and others that a product's marketing claims accurately reflect its green attributes. As a result, green product certifications are on the rise as market conditions change and the demand for greener products continues to increase. It is important to note that greenwashing, which is defined as the use of green claims that are not true or are unverifiable but used to sell products or a corporate image, has become commonplace as companies try to stay competitive in the green marketplace.

Although the international standardization community has not issued so far, a formal definition of “green standards”, for the purposes of this report, we take into consideration the most popular domains that have impact on the green targets, e.g. building codes; product manufacturing; energy consumption and efficiency; environmental management, protection and quality, circularity, etc.

There isn't a national policy or regulation regarding the training in standards in HE institutions in **Bulgaria**. There isn't a national policy or regulation regarding the training in standards with a special focus on green standards either.

Despite the clear political orientations towards a green transition in **Romania** there are still no regulations regarding the introduction of training in green standards into the university curriculum.

Currently, there is no national policy or regulation regarding the training in standards in HE institutions in **Spain**. There is no national policy or regulation regarding the training in standards with a special focus on green standards either.

The 17 SDGs are adapted to the national context and incorporated into national legislation and strategic documents in **Lithuania** such as the Strategy for Progress "Lithuania 2030" aims to ensure that the country's progress and economic development is based on the principles of

sustainable development and the green growth concept. It emphasizes the need to develop technologies that minimize environmental impacts and ensure sustainable, resource-efficient growth. Next Generation Lithuania, 2021-2027 highlights the changes needed to accelerate high value-added creation, digitization, the Green Deal, climate change prevention, better education, health and social services, a fairer and more crisis-resilient economy. The objectives are set out in the Government Program and Action Plan.

Current state regarding the provision of training in standards in Bulgaria, Romania, Spain, and Lithuania

The current state in **Bulgaria** regarding the provision of training in standards is as follows:

14 out of 54 Universities (25,92%) in Bulgaria have an active membership in different Technical Committees of the Bulgarian Institute for Standardization (BDS). The Technical Committee is a BDS working body responsible for a specific area(s) of standardization. The Technical Committees for Standardization are established and closed by the Technical Boards for Standardization. The work on standardization is carried out with the active assistance of the members and experts of the technical committees for standardization at BDS (BDS/TC). At present, 78 technical committees at BDS (BDS/TC) are actively working in the various sectors of the industry. The areas of activity of BDS/TC overlap about 80% of the technical committees of CEN, CENELEC, ISO and IEC.

In **Romania**, the current state regarding the awareness of standards and standardization among universities is as follows:

31 out of 88 Universities (35,22%) in Romania have an active membership in different Technical Committees of the Romanian Standards Association (ASRO). Technical Committees are entities without legal personality, attached to the National Standardization Body. The Technical Committees of ASRO consist of groups of experts representing economic stakeholders interested in the standard-drafting process, in various areas of activity, coordinated by a representative of ASRO.

The constituency of the Technical Committees must ensure an unbiased representation of the stakeholders in the specific fields: producers, users, consumers, authorities, etc.

Each Committee has a Chair and a Secretary. The aim of the Technical Committees consists of drafting standardization works nationwide and participating in the works of the European and international standardization bodies, in the field of activity specific to each Committee. The ASRO/TCs are under the Standardization Council surveillance.

There are 151 technical committees at ASRO (ASRO/TC), That are actively working in the various sectors of the industry: approx. 100 TCs related to the general standardization domain, and 51

TCs are in the electrotechnical domains. The areas of activity of ASRO/TC overlap about 93,6% of the technical committees of CEN, CENELEC, ISO, and IEC.

The distribution of members in ASRO's Technical Committees, by category, is as follows: 10,3% are research institutions, and 11,36% are represented by universities.

Despite there is no national policy or regulation regarding the training in standards in HE institutions in **Spain**, industries use ISO standards on a regular basis to check the suitability of their activities.

Una Normalización Española (UNE) is the only Standardization Organization in Spain, designated by the Ministry of Economy, Industry and Competitiveness before the European Commission. UNE promotes the development of the quality infrastructure, promoting the transfer of knowledge and the strengthening of companies. UNE represents the interests of Spanish companies in European and international standardization organizations.

UNE has a catalog in Spanish of more than 33,500 standards, which mostly adopt European and international standards prepared with the contribution of the Spanish sectors. UNE adopts ISO standards through the ISO strategy 2016-2020.

The ISO Strategy 2016-2020 was based on a solid foundation and will guide the organization in its decisions over the next five years. In particular, the strategy will help the organization to respond to a future where: • Technological, economic, legal, environmental, social, and political challenges will require analysis and continuous improvement of the ISO system; • Stakeholder engagement and challenges to ISO intellectual property will continue to be both a key opportunity and risk for ISO.

The 2016-2020 Strategic Plan focused on six strategic directions for ISO during the period 2016-2020. This was a living document, where strategic directions were adjusted as necessary to reflect new assumptions. These six orientations are interdependent and the relationship between them is represented on the next page. The ISO Strategy 2016-2020 also served as the basis for the ISO Action Plan for Developing Countries 2016-2020, which addresses specific issues of ISO's work with developing countries.

UNE works in cooperation with the European Committee for Standardization (CEN) and the European Committee for Electrotechnical Standardization (CENELEC). Together with the European Telecommunications Standards Institute (ETSI) CEN represent the three European Standardization Organizations (ESOs) recognized under EU law (Regulation 1025/2012). They are the exclusive providers of voluntary European Standards and related products and services.

UNE's associative base is made up of more than 500 members who represent practically the entire business fabric of Spain. Due to its associative nature, any entity and natural or legal person, public or private, that has an interest in the development of standardization can be a

member of the Spanish Association for Standardization, UNE. Among them are the main business associations, leading companies in Spain and a good representation of Public Administrations at all levels.

The current state in **Lithuania** regarding the provision of training in standards is as follows:

The National Standardization Body manages the standardization information system, which collects Lithuanian standards and standardization publications, standards and standardization publications of the international standardization bodies and European standardization organizations of which it is a member. Lithuanian higher education institutions strive for continuous and systematic improvement of the quality of study, research and administration processes. In order to improve the quality of studies, first of all, a quality management system adapted to the specifics of the activities of higher education institutions, complying with the requirements of the international ISO 9001 standard, is implemented, implementing the standardized requirements for quality assurance formulated by the European Association of Universities; the aim is to achieve continuous improvement of studies, science and other areas of university activities, based on the criteria and measures of the global assessment model for quality management, the European EFQM performance excellence model or the general evaluation model developed and adapted for the improvement of the performance of public-sector organizations, or in accordance with it.

Approaches for delivery of training according to standards in partner universities

Burgas Free University (BFU), applies two approaches in the delivery of training according to standards:

The first approach is related to upgrading the existing system of offered educational courses with short modules according to standards. In this case, the training is only for university students and there is no possibility to issue a separate document.

The second approach involves the development of micro-credential courses on standards for students and external users. The developed standards courses are part of the offered qualification courses of the university and end with the issue of a certificate where the equivalent in the corresponding ECTS is documented.

In **Life Sciences University "King Michael I" (LSU)** from Romania there is a continuous focus on introducing the standardization and standards in curricula. The study programs are periodically reviewed, and commissions are established for the purpose of managing this process at the level of the faculties. The review aims to bring the study programs in line with the market dynamics of the academic and professional qualifications in the country and abroad, and representative employers are also actively involved in this review process. There are no training courses fully related to standards, but some topics are covered by technical standards related to study

program specialization. These courses are part of the education plan and are not completed with a separate additional certificate.

The **Universitat Politècnica de València (UPV)** applies GreenMetric¹². The university environmental ranking par excellence has recognized the Universitat Politècnica de València (UPV) as one of the 150 universities most committed to sustainability and the environment. GreenMetric is the benchmark ranking in the field of university sustainability and its impact, in terms of awareness and results, is internationally recognized.

Greenmetric was originally developed by the University of Indonesia (UI) in 2010 and 95 universities from 35 countries participated in its initial edition. Greenmetric is based on the following six criteria (which include a total set of 37 indicators):

- energy efficiency and fight against climate change
- waste management
- water resources
- infrastructure
- promotion of non-polluting transport
- environmental education

In its latest edition - UI GreenMetric World University Rankings 2022, which results have recently been published, UPV occupies, specifically, the 147th position, improving 39 positions concerning the previous year despite the increase in the number of institutions analyzed: 1050 universities, 94 more than in 2021.

At a national level, UPV is in the eighth position in the ranking, recognizing it as the best technical university in Spain and the best university in the Valencian Community in this field.

Especially in three of these criteria (energy efficiency and the fight against climate change, waste management and environmental education), according to GreenMetric, UPV is considered among the 100 best universities in the world.

For the assessment of energy efficiency and the fight against climate change, the GreenMetric experts analyze, among others, the following indicators:

- the use of energy-efficient electrical equipment
- the implementation of the smart building program
- the number of renewable energy sources on the different campuses
- the use of electricity by the campus population
- the ratio of renewable energy production over the total energy consumption
- the existence of greenhouse gas emission reduction programs

¹² <https://greenmetric.ui.ac.id/rankings/overall-rankings-2022>

- the ratio of the total carbon footprint by the campus population
- the number of innovative programs carried out during the Covid-19 pandemic
- the university's climate change impact programs

Concerning waste management activities, the following items are evaluated:

- waste recycling programs
- actions against paper and plastic waste
- treatment of organic and inorganic waste, toxic waste
- wastewater treatment

Regarding environmental education, GreenMetric analyses the following issues:

- the number of sustainability-related student organizations
- the number of sustainable community service projects
- the funding for sustainability research as a ratio of the total funding
- the number of sustainability-related start-ups
- the existence of university programs to address the pandemic
- sustainability-related events
- cultural activities
- sustainability-related publications
- the existence of a sustainability website and reports

The Universitat Politècnica de València (UPV) provides specific training activities, designed for students, administrative staff, and teaching staff. Further information can be found on the following web page:

https://intranet.upv.es/pls/soalu/ama_pl.ver_periodos?P_VISTA=intranet&P_IDIOMA=c

UPV also provides access to the full catalogue of ISO standards through its web portal:

https://polibuscador.upv.es/discovery/fulldisplay?docid=alma990004519640203706&context=L&vid=34UPV_INST:bibupv&lang=es&search_scope=BBDD&adaptor=Local%20Search%20Engine&tab=BUS_GENERAL&query=sub,exact,Normativa%20técnica%20--%20Bases%20de%20datos,AND&mode=advanced

Besides, UPV provides the access to *AENORMás*, the platform that allows online access to the full text in PDF format of the UNE standards subscribed to by the UPV Library. The Library provides the UPV university community with the full text, through *PoliBuscador*, of the complete collection of UNE standards in force and cancelled, prepared and adapted by AENOR.

UPV has its own *Long-Life Learning Centre (CFP)* which offers a wide range of courses for students, companies, administrations, and the general public. Currently, no courses on training

in standards are offered at the CFP, however it is the perfect structure to include training courses, micro-credentials, or any kind of educational activity in online, hybrid or onsite standard training.

Mykolas Romeris University (MRU) from Lithuania does not apply training courses directly related to the standards approved by the Standardization Body.

Part 2. Approach to micro-credential courses - national and institutional dimensions

National regulations and procedures for the provision of micro-credentials in HEIs

There are no regulations and procedures in **Bulgaria** specified at national and institutional level regarding micro-credential courses and their approval, certification, and recognition. Since 1990, the principle of academic autonomy in the management of universities as a legal institute has been introduced in Bulgaria.

Higher education institutions develop and approve, in dialogue with staff users, specialties and qualification characteristics, curricula and programs for training and upgrading the qualifications of specialists with higher education on the basis of the established mandatory state requirements and criteria for recognition of completed education and acquired qualifications and determine the forms of education of the students; organize and carry out in dialogue with users the activity to increase the qualification and requalification of specialists with higher education and confirm the educational content of the training.

There are no regulations and procedures specified at national and institutional level regarding micro-credential courses and their approval, certification, and recognition in **Lithuania**. Since 1991, the principle of academic autonomy in the management of universities as a legal institute has been introduced in Lithuania. Higher education institutions develop and approve, in dialogue with staff users, specialties and qualification characteristics, curricula and programs for training and upgrading the qualifications of specialists with higher education on the basis of the established mandatory state requirements and criteria for recognition of completed education and acquired qualifications and determine the forms of education of the students; organize and carry out in dialogue with users the activity to increase the qualification and requalification of specialists with higher education and confirm the educational content of the training.

By virtue of the prevalence that institutions have in the field of education in **Romania**, they must have an initiative role, by adopting an action plan that includes specific educational actions and policies, in the approach regarding the implementation of the certification system through micro-credentials. Thus, at the level of the institutions (Ministry of Education, National Authority for Qualifications (ANC), the Romanian Agency for Quality Assurance in Higher Education (ARACIS), the Executive Unit for the Financing of Higher Education, Research, Development, and Innovation (UEFISCDI) and higher education institutions members, a series of directions of action have been identified:

- At the level of the Ministry of Education it is going to be released in March 2023 a new Education Law which will ensure the legislative framework of adopting micro-credentials in the Romanian higher education system and exploring the possibilities of financing specific actions for the adoption of micro-credits;
- The National Authority for Qualifications (ANC) – must provide the tools of integration of micro-credits into the National Qualifications Framework. Currently, in Romania is implemented the National Register of Qualifications (RNC) which, in the frame of micro-credits approach, need an extension like a National Register of Micro-Certifications synchronize by the adaptation of the ECTS credit system;
- The Romanian Agency for Quality Assurance in Higher Education (ARACIS) has to develop methodologies for accreditation and evaluation of micro-study programs;
- The Executive Unit for the Financing of Higher Education, Research, Development and Innovation (UEFISCDI) has to adapt the Integrated Educational Register (REI) and the Single Matriculation Register (RMU) in order to integrate micro-certifications from higher education into the personal educational paths of students and graduates;
- Universities must develop common methodologies for the automatic recognition of certified learning through micro-certification and micro-credentials.

In **Spain**, the term “micro-credential” has been officially included for the first time in the HE specific legislation by two Royal Decrees¹³ approved in 2021. However, the concept of micro-credential is only introduced but it is not fully developed.

The Spanish National Accreditation Agency (ANECA) published in July 2021 a Framework Document about Quality Assurance of Micro-credentials¹⁴. This document provides some insights about the status and definition of micro-credentials in Spain. In this document, ANECA provides two definitions of the concept of Micro-credentials:

Short definition: A micro-credential is (the record of the results of) a brief learning experience, the reliability of which is backed by transparent quality assurance procedures.

Long definition: A micro-credential is (the record of the results of) a short learning experience linked, where appropriate, to a qualifications framework, and validated, in any case, by an assessment. Micro-credentials may be designed and issued by various providers in different learning environments and will be awarded for learning experiences characterized as being relevant (having a clear objective), easy to accumulate by supporting flexible learning pathways, having guidance services, and being centered on the learner. Micro-credentials must ensure their

¹³ Real Decreto 640/2021, de 27 de julio, de creación, reconocimiento y autorización de universidades y centros universitarios, y acreditación institucional de centros universitarios.

Real Decreto 822/2021, de 28 de septiembre, por el que se establece la organización de las enseñanzas universitarias y del procedimiento de aseguramiento de su calidad.

¹⁴ https://www.aneca.es/documents/20123/49576/MICROCREDENCIALES_Informe_V3.pdf/db424827-b464-d41d-ae09-717eb95e5742?t=1660907214565

quality in accordance with agreed standards in the relevant sector or field of activity, in accordance with principles of transparency, authenticity, portability and recognition that reinforce the reliability and trust of the micro-credential.

In Spain, there is currently a high concern about who may be a micro-credentials provider, as universities will not be in exclusive capacity of issuing micro-credential certificates. Following ANECA, micro-credential providers may be:

- Institutions and organizations of education and training
- Research, development and innovation institutions and organizations
- Public organizations and institutions
- Private organizations and institutions
- Employers, businesses, and industries
- Public employment services
- National, regional and local authorities
- Social partners (organizations that represent workers and employers)
- Professional associations
- Civil society organizations
- Community centers
- Organizations and private agents
- Other institutions, agencies, entities, etc., not included above

In line with the definition of micro-credential, the format to describe it will include, at least, the following elements:

- Identification of the person who learns
- Title of the micro-credential
- Country or region of dispatch (they can be several)
- Provider that issues the micro-credential (there can be several)
- Expedition date
- Objectives of the micro-credential
- Learning outcomes
- Entity, institution, body, company, in which the learning has been carried out (if different from the provider)
- Volume of theoretical work necessary to obtain the learning results (in ECTS credits when applicable)
- Volume of practical work required to obtain the learning outcomes (in hours)
- Level (and, where appropriate, cycle) of the learning experience, where applicable, in accordance with the European Qualifications Framework or the Qualifications Framework of the European Higher Education Area.

- Type of evaluation that has validated the learning results
- Form of participation of the person learning in the learning experience
- Quality assurance procedures that support the micro-credential

Additionally, when appropriate, other elements will be included such as:

- Prerequisites to participate in the learning experience
- Qualification obtained in the evaluation
- Supervision of the person learning
- Verification of the identity of the issuer and the learner

Incorporation of training in green standards in the higher education system via micro-credential courses in Spain appears to be essential to improve their application in Spanish industries. Vocational training programs in Spain have not traditionally included skills related to sustainability, energy efficiency and renewable energies. In many cases workers in the construction sector lack formal qualification and are under-skilled in terms of energy efficiency and sustainability. This limits the effectiveness of energy efficiency measures due to the disconnection between the design of buildings or their renovation and the actual building, maintenance, and renovation.

Therefore, new micro-credentials on standards (and green standards) must be designed and implemented in the HE system in Spain in the next future. In the case of universities, the certification of their Internal Quality Assurance System (IQAS) configured in accordance with Royal Decree 640/2021 to ensure the quality of their academic offer, including micro-credentials, also constitutes a requirement that the university centers must meet to achieve institutional accreditation. In turn, this facilitates the quality assurance procedures of university education established in Royal Decree 822/2021 (verification and modification of study plans for titles official degrees, follow-up, and renewal of the accreditation of official titles, IQAS report on permanent training master's degrees).

The delivery of micro-credentials by providers not traditionally related to teaching and in unusual fields can be an innovative commitment of great social, cultural, and economic value. In this space there is much that remains to be discovered and to be said. That is why efforts are being made to build an internal quality assurance model. The search for these models in collaboration with national and international entities of public and private scope, referents in the social, cultural, technological, economic, etc., results an innovative work whose fruits will be of great interest to all kinds of suppliers and all kinds of learners.

The quality assurance of micro-credentials must be carried out in accordance with the following references established in this regard, as appropriate in the scope of each provider:

- The quality assurance principles of the qualifications that are part of the national qualification frameworks or systems correlated with the European Qualifications Framework (MEC), defined in Annex IV of the Recommendation of the Council of the European Union on the Framework European Qualifications for Lifelong Learning (2017/C 189/03).
- The criteria and guidelines for quality assurance in the European Higher Education Area (Standards and Guidelines for Quality Assurance in the European Higher Education Area, ESG).
- European Reference Framework for Quality Assurance in Vocational Education and Training (European Quality Assurance in Vocational Education and Training, EQAVET).
- Other European quality assurance instruments that reinforce society's confidence in micro-credentials.

Burgas Free University is certified according to the quality standards of the International Organization for Standardization (ISO). In 2005 BFU was certified under ISO 9001:2000 and in 2010 - under ISO 9001:2008. All the University's main activities have been certified, as well as its degree programs: education of students in Bachelor, Master and PhD programs, qualification, research, and international relations activities. Burgas Free University is accredited by the National Evaluation and Accreditation Agency (NEAA). In 2017 it achieved a new six-year accreditation with a capacity for training 7000 students with a rating of 9.03 (nine point three hundredths). NEAA is a government authority which recognizes the license of universities to provide higher education services by evaluating the quality of their main activities: educational process, research, international relations, quality management system, employment of graduates and competitiveness. All the undergraduate and postgraduate degree programs at the University have also been accredited.

Life Sciences University is a state university and includes 6 faculties (Agriculture, Horticulture and Forestry, Management and Rural Tourism, Veterinary Medicine, Animal Resource Bioengineering, Food Engineering) and 29 undergraduate study programs (IF, IFR, ID in final phase), of which 25 programs are in Romanian (23 accredited programs and 2 programs authorized by ARACIS provisionally) and 4 programs are in foreign languages (1 accredited programs and 3 programs authorized by ARACIS), as well as 31 master's degree programs (28 programs in Romanian, 3 programs in English and 1 program in French) according to GD no. 297/2020 and GD no. 299/2020. The university also includes a Department for Teaching Staff Training (DPPD) and 2 doctoral schools (Plant and Animal Resource Engineering and Veterinary Medicine), according to the Senate Decision no. 3210 from 18.05.2012.

The vision of the LSU is in line with the stated principles regarding the development of the European educational space and those included in the development strategy of the European Union for the period 2021-2027, namely:

- A European space more connected to European education, by strengthening strategic partnerships between higher education institutions and encouraging the creation of transnational alliances of European universities, promoting European identity and values;
- A smarter Europe, through innovation, digitalization and skills training for the successful pursuit of a profession;
- A greener, carbon-free Europe through the development of scientific research in the field of renewable energies and low-carbon technologies, resulting in the fight against climate change;
- A Europe closer to the citizens, by capitalizing on the potential of each citizen as a source for the development of society.

In the LSU the structure responsible for quality management is the Quality Management Department. This structure is specialized in coordinating and applying the provisions of the Quality Manual, procedures, criteria, standards, and performance indicators for quality assessment, corresponding to the quality strategy adopted by the Senate and quality management system, implemented, and certified in accordance with SR ISO 9001: 2015. Within the research infrastructure of the LSU recently organized within the Research Institute for Biosecurity and Bioengineering, the foundations of a quality management system documented in accordance with SR EN ISO CEI 17025: 2018 are established, the quality management managers within the research laboratories being coordinated at the DMC level. The body of internal auditors' functions within the DMC for the quality management system with certified competencies, their activity being documented in the Internal Audit procedure. In addition to internal evaluations, the quality management system is periodically evaluated through annual surveillance audits by the SRAC certification body, in accordance with the ISO 9001: 2015 standard. LSU is a partner of the European Food Safety Authority (art. 36 of the CE Regulation no. 178/2002).

Mykolas Romeris University (MRU) – the largest social sciences specialized university in Lithuania, whose most prominent studies and research areas are: law, public security and public administration. The University has capable and significant core educational science, economics, humanities, communication, politics, psychology, sociology, and management areas. By providing students with a high-quality higher education that meets the best European education standards, University train well-qualified lawyers and law enforcement officers, specialists in modern business management, cybersecurity, digital economy and communication specialists, experts in EU and international politics, psychology, innovative social work, education and research workers.

Universities have always been incubators of social change and innovation, encouraging society to move forward. Recognizing its unique position in society, Mykolas Romeris University aims to

set standards for sustainable activities: to become a green university and by example to contribute to solving environmental problems, and to help create a culture of sustainable society by developing a sustainable lifestyle, and to mobilize researchers' creative potential for sustainable progress. Sustainable Activity strategy of the University enunciates the position and goals of University and contributes to implementation of the principles of sustainability in all areas: social, economic, environmental. MRU's sustainability strategy is based on the following key principles: Evidence-based and objectively measurable change; Implementation and maintenance of recognized standards for sustainable operation; Development of internal standards and practices on the principle of a learning organization; Prioritization of optimal activity processes; Development of environmental literacy and environmental citizenship within the university community; Involvement of the university community and stakeholders in the process of creating a sustainable university. Mykolas Romeris University acts under national legislation, international agreements regarding the assurance and enhancement of the quality of the studies, interests and needs of University's stakeholders in order to uphold and develop the culture of quality and the management system of internal studies quality.

The **Universitat Politècnica de València (UPV)** educational activities, as well as its degree programs: education of students in Bachelor, Master and PhD programs, qualification, research, and international relations activities are certified by the Spanish Accreditation Agency (ANECA), with whom UPV maintains close contact and organizes periodic meetings (<https://www.aneca.es/-/visita-de-aneca-a-la-upv>).

Ensuring a proper education and training in sustainable development is crucial to guarantee a proper life quality of the future generations. UPV, as member of the ENHANCE Alliance (<https://enhanceuniversity.eu>) has agreed to develop a micro-credential template that fulfills all the requirements of the EU, following strict Quality Assurance procedures.

During the past two years, UPV has developed the ENHANCE Micro-credentials Template¹⁵, in cooperation with the other universities of the Alliance. this template is in compliance with the Micro-credential official definition made by the European Union¹⁶.

Therefore, UPV Micro-credentials are a small learning experience supported by transparent quality assurance procedures. UPV micro-credentials will continuously be develop in cooperation with industry partners, local governments, and non-profit organizations.

Ranked as the best Technological University in Spain (Shanghai ranking 2022)¹⁷, UPV can provide a set of Green Micro-credentials in the field of: Circular Economy and Waste Management, Green

¹⁵ <https://enhanceuniversity.eu/wp-content/uploads/2022/12/ENHANCE-Template-for-Micro-credentials.pdf>

¹⁶ <https://data.consilium.europa.eu/doc/document/ST-9237-2022-INIT/en/pdf>

¹⁷ <http://www.upv.es/noticias-upv/noticia-13732-arwu-2022-es.html>

and environmental standards in Engineering: Soil, Water and Air Quality, Energy Systems and Renewable Energy Sources, Building Standards.

Approaches and experience in providing micro-credentials in partner universities

At **Burgas Free University, Bulgaria** the micro-credential system is not fully implemented but there is some experience in the delivering of distance certification courses which could be used as a baseline for the development of such a system.

Burgas Free University provides distance courses for retraining and increasing standardization skills for students, as well as for other adult learners. Distance learning is conducted in accordance with the mission, institutional goals, and priorities of BFU, the Strategy for the development of electronic and distance learning in BFU and the internal regulations of BFU.

BFU organizes distance learning to increase the qualifications of specialists with higher education and for continuing and additional training in professional fields for which program accreditation has been obtained.

Distance learning is carried out by the main units of BFU. Its educational and methodological provision is carried out by the main unit that carries out the training.

The organization, planning and implementation of distance learning, as well as its technological and technical provision, is carried out by the University Center for distance learning at BFU.

The university center for distance learning implements its main activities and tasks in accordance with the strategic documents, internal regulations and standards adopted by the management bodies of BFU and the System for evaluation and control of the quality of training and academic staff at BFU.

The university center for distance learning implements its activities and main tasks with the help of the university administration, with the functions of planning, organization and conducting of distance learning being carried out by the "Education" department, and the functions of its technological support - by the "Information provision" department.

The activity of the University Distance Learning Center is under the general management of the Academic Council and the Rector of BFU, supported by a Standing Committee for the Development of Electronic and Distance Learning.

Currently, **BFU** offers some micro-credentials alike distance certification courses for students and external users. Successful graduates receive a certificate of completion where the grade as well as the equivalent of the workload in ECTS is documented.

The management of the distance education programs, with reduced frequency and permanent education within the **LSU** is ensured by the "Department for Distance Education, Reduced Frequency Education and Permanent Education", directly subordinated to the Vice-Rectorate for Education and Quality Assurance. All training activities organized in the distance learning system, take place within the faculties or departments accredited to run university or postgraduate study

programs in the form of organization with frequency in the respective domain. In Life Sciences University, Romania the micro-credential system is not implemented.

The micro-credentials alike course format (called Skills academy in **Mykolas Romeris University** Career Centre) was piloted in spring 2022, offering students 27 academic hours of training, 8 of which are dedicated to working with a lecturer and the rest are self-study. Based on the results of the pilot and the needs of the university community, a list of relevant training courses has been drawn up, which, if selected and successfully completed, will lead to the acquisition of micro-credentials for students. The training offered relates to the development of soft competences with a particular emphasis on the development of career management competences. The micro-credentials currently offered are:

- Self-awareness and Personal Image
- Fundamentals of Personal Career Management;
- From Creativity to Entrepreneurship;
- Personal Efficiency: Time Management;
- Leadership;
- Developing of Critical Thinking;
- Oral and Written English for Job Search and Employment;
- Managing the Job Search Process;
- Physiology of Stress and Genetics of Mood Disorders.

From January 2023, **Mykolas Romeris University, Lithuania** is introducing a micro-credentials system through an online platform. On the platform, the University will present a selection of training courses of different lengths and formats, as well as solutions for career aspirations. A micro-credential is a record of a learner's learning outcomes following a small amount of training. This training is responsive to needs and changes and is designed to provide the learner with specific knowledge, skills and competences that meet the needs of the individual, society and the labor market. Micro-credentials belong to the learner and can be shared and transferred. Micro-credentials give an advantage when presenting a candidate to employers and are recognized by educational institutions because the learning experience is easily recognizable and understandable.

The **Universitat Politècnica de València's** specific training activities are designed for students, administrative staff, and teaching staff. Further information can be found on the following web page: https://intranet.upv.es/pls/soalu/ama_pl.ver_periodos?P_VISTA=intranet&P_IDIOMA=c

UPV has its own Long-Life Learning Centre (CFP) which offers a wide range of courses for students, companies, administrations, and the general public. Currently, no courses on training in standards are offered at the CFP, however it is the perfect structure to include training courses, micro-credentials, or any kind of educational activity in online, hybrid or onsite standard training.

Specific training courses are short-term training activities aimed at expanding or updating knowledge. The duration and access requirements of this type of training are defined by the academic person in charge of the course. These types of courses can have two types of certification, certificate of attendance or certificate of achievement, issued by the CFP as long as



a minimum of 80% of the course hours are attended, for the first case and, in addition, the passing of the final tests, for the second. CFP's Annual Reports can be downloaded at the following webpage: <http://www.upv.es/entidades/CFP/info/910398normalc.html>

Part 3. Provision of training in standards in partner universities

At **Burgas Free University** there are two approaches for the provision of training according to standards. The first approach is related to the modernization of some existing university courses by integrating learning modules aimed at developing awareness and basic understanding of some standards related to the subject. The second approach is related to the development of a certification courses addressed to both university students and adult learners. These two approaches have been successfully approbated so far.

Currently, BFU offers some distance certification courses in standards for students and external users. Apart from that a lot of courses included in the university curricula have been updated and modernized via integration of specific modules related to some domain-related standards into them.

The micro-credentials alike course format (called Skills academy in **Mykolas Romeris University** Career Centre) was piloted in spring 2022, offering students 27 academic hours of training, 8 of which are dedicated to working with a lecturer and the rest are self-study. Based on the results of the pilot and the needs of the university community, a list of relevant training courses has been drawn up, which, if selected and successfully completed, will lead to the acquisition of micro-credentials for students. The training offered relates to the development of soft competences with a particular emphasis on the development of career management competences. The micro-credentials currently offered are:

- Self-awareness and Personal Image
- Fundamentals of Personal Career Management;
- From Creativity to Entrepreneurship;
- Personal Efficiency: Time Management;
- Leadership;
- Developing of Critical Thinking;
- Oral and Written English for Job Search and Employment;
- Managing the Job Search Process;
- Physiology of Stress and Genetics of Mood Disorders.

The Environmental Management System of the **Universitat Politècnica de València (UPV), Spain** collects and processes a large amount of information on the environmental behavior of the university. One of the objectives of the system is to inform and sensitize staff so that they are aware of the real effects that their activities have on the environment and so that they introduce customs into their daily work that minimize the negative impact that these activities may have.

Currently, UPV has three different actions related with environmental planning: Environmental Planning 2022, Environmental Dissemination Plan 2022 and training activities.

Inside its official teaching programs, the following courses about standardization are offered (year 2022) at **Universitat Politècnica de València**:



- Standardization and food legislation (BSc Degree in Food Science and Technology)
- Construction materials: standardization and selection (BSc Mechanical Engineering)

Specialized certification courses in standards

Burgas Free University provides two distance certification courses in standards as follows:

- A distance certification course "Standards for risk management systems - ISO 31000 series" with a duration of 60 hours (three weeks). Successful graduates receive a certificate of completion;
- A distance certification course "Standards for information security management systems - ISO/IEC 27000 series" with a duration of 60 hours (three weeks). Successful graduates receive a certificate of completion.

Universitat Politècnica de València has its own Long-Life Learning Centre (CFP) which offers a wide range of courses for students, companies, administrations, and the general public.

Specific training courses are short-term training activities aimed at expanding or updating knowledge. These types of courses can have two types of certifications, certificate of attendance or certificate of achievement, issued by the CFP as long as a minimum of 80% of the course hours are attended, for the first case and, in addition, the passing of the final tests, for the second. CFP's Annual Reports can be downloaded at the following webpage:

<http://www.upv.es/entidades/CFP/info/910398normalc.html>

Integration of training modules in standards into disciplines from current university curricula

There are modules in standards incorporated in different university courses offered only to students at **Burgas Free University**. These modules do not present the standards in their entirety. They only give basic information and guidance on the standardization process and the standards.

Purpose and scope of application of standards are mentioned, and information is given on how to find the given standard and apply it if needed.

Courses that have integrated modules for relevant standards are:

- Multimedia technologies
- Information sharing policy
- Product and price policy
- Software products in tourism and hotels
- Sales management
- Information security
- Applied software technologies
- Multimedia technologies
- Business process modeling
- Encryption and protection of information
- Web Technologies and Applications

- Electronic control, measurement, and monitoring systems

In all the six faculties of **Life Sciences University** there are study programs which present in their curricula, courses with modules related to general principles for specific standards. Basic information is given, mainly related to: knowing, understanding and acquiring the terms and nomenclature of the standards; ability to make correlations that allow documentation, implementation of a specific standard; acquiring some general knowledge regarding the method of standard selection; acquiring general skills regarding the use of standardized methods of analysis.

Examples of courses with integrated information related to standards are:

- Procedures in testing laboratories
- Quality control of agro-food products
- Quality management
- Renewable resources of raw materials
- The impact of climate change in forestry
- Sustainable rural development management
- Contaminants in horticultural products
- Hygiene and food technology
- Inspection and control of food products of animal origin
- Laboratory diagnosis
- Packaging, labeling and design in food industry
- Traditional and ecological products
- Inorganic and organic residues in products food
- Biotechnological installations

Courses at **Mykolas Romeris University** in which modules on relevant standards have been integrated are:

- Strategies for the delivery and management of social services
- Management of public sector organizations
- Cybersecurity policies in Europe and other regions
- Information Security

Specific training activities are designed for students, administrative staff and teaching staff. Further information can be found on the following web page:
https://intranet.upv.es/pls/soalu/ama_pl.ver_periodos?P_VISTA=intranet&P_IDIOMA=c

UPV also provides access to the full catalogue of ISO standards through its web portal:
https://polibuscador.upv.es/discovery/fulldisplay?docid=alma990004519640203706&context=L&vid=34UPV_INST:bibupv&lang=es&search_scope=BBDD&adaptor=Local%20Search%20Engine&tab=BUS_GENERAL&query=sub,exact,Normativa%20técnica%20--%20Bases%20de%20datos,AND&mode=advanced

Part 4. Current practices and initiatives for greening the curricula and training in the partner universities

The courses that **Burgas Free University** offers address the issues related to the implementation of the green deal and the greening of the economy. Developing courses on green standards requires access to specialized documents as well as curriculum redesign. Universities are limited and cannot make separate courses on green standards. Micro-credential courses are a flexible and dynamic solution for providing knowledge about green standards. There are two good examples of certification micro-credential courses in standards, offered at Burgas Free University. Currently, the University doesn't offer courses focused on green and environmental standards.

In UI Green Metrics only 11 Romanian universities are listed. **Life Sciences University, Romania** is not presented in this ranking. However, in LSU sustainability practices are encouraged, the transition to a green campus begins with implementation of the project "Renewable Energy Sources and Circular Economy in an Academic Community as an Example for Smart Sustainable Development RO-ENERGY-0038, financed by Innovation Norway SE-, 2014-2021 call. The project aims to install a combined heat and power co-generation plant fueled by renewable sources (i.e., a bio-gas plant from organic feedstock produced in university's teaching farms), and to be coupled with a photovoltaic system. The project will utilize available bio resources, currently being wasted, and vacant roof-top space on university buildings. The University's Management Plan which covers all topics related to transition of green university (sustainability, social responsibility, student demand, cost savings, educational innovation, income generation) provides the frame of developing initiatives which they are able to ensure LSU to become a green university that uses sustainable education methods and sustainability topics to make education more student-centered, problem-based, and practice-oriented.

Mykolas Romeris University was the only UI GreenMetric in 2021 Lithuanian university ranked 197th among the most sustainable universities in Europe.

By implementing the Green Policy, the university aims to: provide knowledge, awareness and skills; build a more sustainable and inclusive society (studies, training and work with schools and communities); shape public opinion and promote and initiate behavioral change for sustainable development; create solutions and initiatives, promoting access and sharing common systems and resources (accessibility, availability, sustainable use); enable lifelong learning lifelong learning, improving its accessibility and sharing university learning resources.

Currently, no courses on training in standards are offered at the Long-Life Learning Centre (CFP) of the **Universitat Politècnica de València, Spain**. CEF is the perfect structure to include training courses, micro-credentials, or any kind of educational activity in online, hybrid or onsite standard

training addressed to students, companies, administrations, and the general public. CFS has well regulated procedures regarding the courses' certification.

Part 5. Scientific domains and directions selected by the universities to develop micro-credentials

Education is crucial for the achievement of sustainable development. The approach of education for sustainable development empowers learners to take informed decisions and responsible actions for environmental integrity, economic viability and a just society for present and future generations.

Identified scientific domains

The results of the analysis of the national reports on the scientific fields in which the universities are interested in developing micro-credentials in sustainable management, green and environmental standards give reason to summarize the following priority domains:

- Circular economy

The circular economy is a model of production and consumption, which involves sharing, leasing, reusing, repairing, refurbishing, and recycling existing materials and products. In this way, the life cycle of products is extended. In practice, it implies reducing waste to a minimum.

When a product reaches the end of its life, its materials are kept within the economy wherever possible. These can be productively used again and again, thereby creating further value. This is a departure from the traditional, linear economic model, which is based on a take-make-consume-throw away pattern. This model relies on large quantities of cheap, easily accessible materials and energy.

Circular Economy is defined as an economic and social system that aims at the production of goods and services while reducing the consumption and waste of raw materials, water, and energy sources. All manufacturing processes of goods or services involve an environmental cost. To minimize this cost, the circular economy promotes the optimization of materials and waste, extending their useful life. In this way, the current linear throwaway system is avoided, and a commitment is made to one that is respectful of the environment and based on prevention, reuse, repair, and recycling.

- Energy

A renewable energy standard (RES) requires utility companies to source a certain amount of the energy they generate or sell from renewable sources such as wind and solar. There are many variants to an RES policy, including clean energy standards (which allow nuclear and low-polluting non-renewable energy sources like natural gas) and renewable goals (which are non-binding). They are sometimes also called renewable portfolio standards (RPS).

Large-scale renewable energy adoption should include measures to improve efficiency of existing nonrenewable sources which still have an important cost reduction and stabilization role. A

resilient grid with advanced energy storage for storage and absorption of variable renewables should also be part of the transition strategies.

- Bioeconomy

According to the United Nations Food and Agriculture Organisation (FAO)¹⁸, the bioeconomy is "the production, use and conservation of biological resources, including related knowledge, science, technology, and innovation to provide information, products, processes and services to all economic sectors with the aim of moving towards a sustainable economy".

- Environment

Environmental standards are implemented for the treatment and maintenance of the environment. Environmental standards can include prohibition of specific activities, mandating the frequency and methods of monitoring, and requiring permits for the use of land or water. Standards differ depending on the type of environmental activity.

Environmental standards should preserve nature and the environment, protect against damage, and repair past damage caused by human activity¹⁹.

- Building

Buildings have extensive direct and indirect impacts on the environment. During their construction, occupancy, renovation, repurposing, and demolition, buildings use energy, water, and raw materials, generate waste, and emit potentially harmful atmospheric emissions. These facts have prompted the creation of green building standards, certifications, and rating systems aimed at mitigating the impact of buildings on the natural environment through sustainable design.

Building codes in Spain are the responsibility of the Ministry of Transport, Industry and Urban Agenda. Spain has been the first European country to make the implementation of solar thermal energy obligatory in new and refurbished buildings.

- Social responsibility

Social responsibility in relation to responsibility for the environment in which the family and society are situated raises new issues. Knowledge of the standards of social responsibility will encourage a new attitude among learners, both to the methods used in the work environment and to reality itself.

¹⁸ <https://www.fao.org/common-pages/search/en/?q=bioeconomy>

¹⁹ Pinkau, K. (1998). Environmental Standards: Scientific Foundations and Rational Procedures of Radiological Risk Management. Springer Science & Business Media B.V. pp. XVII–XXXIII, 1–45. ISBN 978-1-4419-5027-7.

Specified directions for the development of university micro-credential courses

Some summarized data and information about the selection done by the partner universities regarding the scientific domains and concrete directions for micro-credential courses is provided below.

BFU specified as priority domains for provision of micro-credential courses in the management of the Circular Economy, green and environmental standards in Engineering and Exploitation of Energy Systems, and in Electronics and Communication of Renewable Energy Sources.

Due to the constantly changing requirements of the work market, **LSU** has promoted in recent years a dynamic evolution of study programs in terms of quantity and quality, aiming to correlate their content with the requirements of business representatives to reduce the gap between the specific (professional and transversal) competencies acquired because of completing the study programs and those required by the labor market. The aim is to corroborate the contents of the disciplines with the expectations of the representatives of the economic community, professional associations and representative employers in the fields related to the study programs.

MRU can offer microcredit courses related to circular education management, green and social responsibility standards in the social work and education systems, regarding the environmental sources.

During the past two years, **UPV** has developed the ENHANCE Micro-credentials Template²⁰, in cooperation with the other universities of the Alliance. this template is following the Micro-credential official definition made by the European Union²¹.

Therefore, UPV Micro-credentials are a small learning experience supported by transparent quality assurance procedures. UPV micro-credentials will continuously be develop in cooperation with industry partners, local governments, and non-profit organizations.

Ranked as the best Technological University in Spain (Shanghai ranking 2022)²², UPV can provide a set of Green Micro-credentials in the field of: Circular Economy and Waste Management, Green and environmental standards in Engineering: Soil, Water and Air Quality, Energy Systems and Renewable Energy Sources, and Building Standards.

In the following table the information and data about the identified scientific domains and the selected directions for the development of micro-credential courses provided by the B-Green-ED partner universities is systematized.

In the right column of the table are provided descriptors specifying the areas for upskilling and reskilling related to the transition to green economy selected by the universities which to be considered by the European standards bodies (BDS and ASRO) in order particular standards (both international and European) to be suggested for the further development and implementation of micro-credentials.

²⁰ <https://enhanceuniversity.eu/wp-content/uploads/2022/12/ENHANCE-Template-for-Micro-credentials.pdf>

²¹ <https://data.consilium.europa.eu/doc/document/ST-9237-2022-INIT/en/pdf>

²² <http://www.upv.es/noticias-upv/noticia-13732-arwu-2022-es.html>

| Scientific Domain | University | Micro-credentials (Development directions) | Descriptor |
|-------------------------|------------|---|---|
| Circular Economy | BFU (BG) | Circular Economy business models | The diffusion of innovative business models such as recycle /reuse business model is supported and incentivized by quality and safety standards, circular design standards, production process standards. |
| | UPV (ES) | Circular Economy and Waste Management | Production of goods and services while reducing the consumption and waste of raw materials, water, and energy sources. Environmental protection and optimization of materials and waste. |
| | LSU (RO) | Advanced functional materials | Implementation of efficient recycling processes and technologies, with low consumption of energy and limited pollution. |
| Energy | BFU (BG) | Electronics and Communication of Renewable Energy Sources | Renewable energy standards, renewable portfolio standards, environmental protection, production process standards. |
| | BFU (BG) | Engineering and Exploitation of Energy Systems | Energy savings on the demand side, generation efficiency at production level and fossil fuel substitution by various renewable energy sources and low carbon nuclear |
| | LSU (RO) | Energy and mobility | Modern energy generation technologies with low or zero emissions - the development of technologies and energy conversion systems from renewable energy sources (biomass) with the implementation of measures for increasing energy efficiency, increasing system flexibility, prioritizing energy consumption clean and optimization of user consumption. |
| | UPV (ES) | Energy Systems and Renewable Energy Sources | Renewable energy is energy derived from natural sources |

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|--------------------|----------|---|--|
| | | | <p>that are replenished at a higher rate than they are consumed. Sunlight and wind, for example, are such sources that are constantly being replenished. Transitioning from fossil fuels (coal, oil, and gas), which currently account for the lion's share of emissions, to renewable energy is key to addressing the climate crisis.</p> |
| Bioeconomy | LSU (RO) | | <p>Development of varieties/hybrids/ideotypes of plants and animal breeds better adapted to the new challenges in agriculture and forestry, such as climate change, biotic and abiotic stressors.</p> <p>Safe and sustainable food for a healthy diet - It includes the development of sustainable foods based on healthy dietary concepts, consistent with nutritional/sensory needs of consumers, with quality standards and related to lifestyle locally.</p> <p>Exploitation, in cascade, of natural resources, valorization of by-products and waste from the agri-food sector and non-food industries, systems of agricultural production and livestock breeding resilient to climate change, reducing nutrient losses along the chain food, reducing the environmental footprint of activities in the bioeconomic sector.</p> |
| Environment | UPV (ES) | Green and environmental standards in Engineering: Soil, Water and Air Quality | <p>Environmental protection and human environment. The human environment is distinct from the natural environment. The concept of the human environment considers that humans are permanently</p> |

| | | | |
|------------------------------|----------|--|---|
| | | | interlinked with their surroundings, which are not just the natural elements (air, water, and soil), but also culture, communication, co-operation, and institutions. |
| Building | UPV (ES) | Green Building Standards | Building standards regulations are promoted to ensure buildings are safe, efficient, and sustainable. |
| Social Responsibility | MRU (LT) | Andragogical technologies and safe environment | To meet the concept of a sustainable and green society, the response of workers and organizations to the main issues of society becomes important. A responsible learning citizen can build a learning society and a sustainable and green environment. |
| | MRU (LT) | Social responsibility and career management | Career management and careers guidance services and environmental responsibility. |
| | MRU (LT) | Social responsibility in family work | The family has a variety of functions: generational, socializing, economic, emotional, social, etc. The family as a system and the people who make it up face a variety of problems: poverty, violence, addictions, infidelity, economic failure, etc. |

Conclusions

Results from the analysis of the information documented in the national reports regarding the incorporation of the training about standards in HEIs confirm the constataions from the gap analysis conducted by CEN, CENELEC and ETSI, the three European Standards Organizations, committed to promoting and supporting education about standardization, that in this aspect Europe is lagging the other regions of the world.

All universities reported that they have some activities related to deepening the knowledge and understanding about some specific standards, usually connected to concrete subject domain. However, these activities are fragmented, and the impact is limited. The most common approach is integrating modules related to specific standards within existing disciplines of the university curriculum. Due to the limited number of teaching hours and the fact that access to the detailed descriptions of the standards is not open and free, usually, these modules present only general information about the standards and some basic concepts and paradigms, which makes them not sufficient for building the necessary in-depth understanding in the students.

Only two universities - BFU (BG) and UPV (ES), reported that they offer courses specifically designed to provide education in standards. The experience of these universities should be considered in the process of the B-Green-ED micro-credentials development.

All partners have documented that there are any regulations about HE micro-credentials in their countries.

The UPV (ES) as a member of ENHANCE Alliance²³ - alliance of ten European research-intensive universities, has experience in the provision of micro-credential courses. For the design of such kind educational offers UPV uses the common ENHANCE Micro-credentials Template.

MRU (LT) also declared that from January 2023 at the university is launched a micro-credentials platform.

The experience of these partners is of great importance and should be considered during the design and development of B-Green-ED micro-credential courses.

In terms of greening the curriculum by providing micro-credentials focusing specifically on sustainable management, green and environmental standards, all universities explain that they do not have enough experience, but all identify this as a key priority.

²³ ENHANCE Alliance: <https://enhanceuniversity.eu/>

Being a part of university training opportunities, micro-credentials should always be developed and approved according to local university policies and procedures. They have to be consistent with institutional mission and strategic goals.

Micro-credentials are designed to meet market needs and consequently they should be informed by current data from appropriate markets / businesses.

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