Micro-credentials in Construction

D4.1 Report with Analysis of Micro-credential Provision and Quality Assurance for a Green Skills Micro-credentialing Ecosystem in the Construction Sector

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Author(s)	George Bekiaridis, Active Citizens Partnership
Contributor(s)	TECMINHO, PONTYDYSGU, DUTH, CICCOPN, CASAIS, ARANSA, VBB NORD, PEDMEDE, BNB, UNIR
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Abbreviations

Abbreviation	Full Name
API	Application Programming Interface
CEF	Connecting Europe Facility
CSV	Comma-Separated Values
EBSI	European Blockchain Services Infrastructure
ECTS	European Credit Transfer and Accumulation System
EDC	European Digital Credentials for Learning
eIDAS	Electronic Identification, Authentication and Trust Services
ELM	European Learning Model
EQF	European Qualifications Framework
ESCO	European Skills, Competences, Qualifications and Occupations
GDPR	General Data Protection Regulation
GreenComp	European Green Competences Framework
IMS	IMS Global Learning Consortium (now 1EdTech)
JSON	JavaScript Object Notation
LMS	Learning Management System

Abbreviation	Full Name
NexU	NexU Software (for EDC sealing)
NQF	National Qualifications Framework
OCB	Online Credential Builder
OER	Open Educational Resources
RPL	Recognition of Prior Learning
TSP	Trust Service Provider
VC	Verifiable Credential

1. Executive summary

This report presents a comprehensive analysis of micro-credential provision and quality assurance for the Green Circle green skills micro-credentialing ecosystem in the construction sector. It constitutes the second deliverable of Working Package 4 and builds directly upon the technology analysis conducted in Task 4.1, which concluded that the Europass European Digital Credentials for Learning (EDC) infrastructure represents the most suitable core platform for the project.

The report is organised into five thematic sections. Section A examines the technology choices facing institutions in creating, managing, and issuing micro-credentials, drawing on evidence from EU-funded open-source projects. Section B develops a comprehensive quality assurance model grounded in the Council Recommendation on a European approach to micro-credentials [1] and the MicroBol common framework [2], defining the rules and processes that govern credential release and the technical solution architecture. Section C analyses transferability and interoperability, with particular attention to the role of Europass, the European Learning Model (ELM), and the open standards that underpin cross-border recognition. Section D addresses governance and administrative processes, defining the authority structures, stakeholder roles, and procedural frameworks that determine who may develop and issue credentials within the Green Circle ecosystem. Finally, Section E provides a detailed analysis of the practical steps required to issue an EDC within the Green Circle context.

The report concludes that a robust, trusted, and scalable micro-credentialing ecosystem can be established by anchoring the technical infrastructure in the Europass EDC platform, applying the MicroBol quality assurance framework adapted to the construction sector context, ensuring full compliance with W3C Verifiable Credentials and eIDAS standards for interoperability, and establishing a multi-stakeholder governance model that places the Green Circle Consortium in a coordinating role while delegating accreditation authority to an independent quality assurance body. The models and procedures described herein are intended to serve as a blueprint for the project's pilot phase, with the understanding that they will be refined into a sustainable, long-term business model in subsequent work packages.

2. Introduction and Context

2.1. The Green Transition Imperative in Construction

The European construction sector employs approximately 12.7 million people, representing 6.1% of the total EU workforce [3]. It is simultaneously one of the largest contributors to greenhouse gas emissions and one of the sectors most urgently required to transform its practices in response to the European Green Deal [4]. These regulatory imperatives translate directly into skills demands, requiring a profound and rapid evolution in the competencies of the construction workforce.

Traditional qualification systems, while valuable, are often insufficiently agile to respond to the speed and granularity of this skills change. Micro-credentials (MCs)—defined by the Council of the European Union as "the record of the learning outcomes that a learner has acquired following a small volume of learning" [1]—offer a complementary pathway. Their flexibility and focus make them particularly well-suited to the construction sector. While the sector includes many self-employed tradespeople, it is also characterised by highly structured vocational training systems, such as the German dual system, which produces a high diversity of specialised skilled workers. For this context, MCs can serve as a valuable tool for upskilling and reskilling, acting as enhancements to existing curricula, as stackable stand-alone learning units, or as refreshers for lifelong learning.

2.2. The Green Circle Project

The Green Circle project (Erasmus+ ERASMUS-EDU-2023-PI-FORWARD, project number 101132905) is a 36-month initiative running from December 2024 to November 2026. The consortium brings together eleven organisations from Portugal, Spain, Germany, and Greece, spanning vocational training centres, universities, construction companies, and industry associations. The project's central objective is to establish a micro-credentials ecosystem for green skills development in the construction sector, creating the infrastructure, content, and governance frameworks necessary for workers and jobseekers to acquire, validate, and demonstrate competencies essential for the green transition.

This report constitutes Deliverable D4.1 of Working Package 4 (Micro-credential Development and Quality Assurance). It builds upon task 4.1, which conducted a systematic comparative assessment of EU micro-credentials systems and concluded that the Europass EDC infrastructure, complemented by the MicroBol framework, the ENIC-NARIC recognition networks, and the Council Recommendation framework, provides the optimal foundation for the Green Circle ecosystem.

2.3. Scope and Structure of this Report

This report addresses four interconnected dimensions of the Green Circle micro-credentialing ecosystem. The technology choices analysis (Section A) examines the platforms and systems through which micro-credentials will be created, made available, managed, and issued, drawing on evidence from comparable EU-funded projects. The quality assurance model (Section B) defines the rules, processes, technical architecture, and visual design requirements that govern how credentials are released to earners. The transferability and interoperability analysis (Section C) examines how credentials will move across institutional, sectoral, and national boundaries, with particular attention to the Europass ecosystem. The governance analysis (Section D) defines the authority structures and administrative processes that determine who may develop and issue credentials within the ecosystem.

3. Section A: Analysis of Technology Choices for Micro-credential Provision

3.1. The Technology Decision Framework

The selection of technology for a micro-credentialing ecosystem is not a purely technical decision. It is a strategic choice that determines the trustworthiness, reach, and longevity of the credentials issued. The D4.1 analysis identified seven major EU systems and frameworks relevant to the Green Circle project, evaluating them across six dimensions: technical compatibility, policy alignment, implementation complexity, cost considerations, scalability potential, and long-term sustainability. The results of that comparative assessment are summarised in the table below.

System	Technical Compatibility	Policy Alignment	Implementation Complexity	Cost	Scalability	Sustainability	Overall
Europass EDC	9.5/10	9.5/10	8.0/10	9.5/10	9.0/10	9.5/10	**9.2/10**
MicroBol Framework	8.5/10	10/10	7.5/10	9.5/10	8.5/10	8.5/10	**8.5/10**
Council Recommendation	7.5/10	10/10	8.5/10	10/10	9.0/10	9.0/10	**8.0/10**
EBSI Infrastructure	8.5/10	9.0/10	5.5/10	7.5/10	7.5/10	7.5/10	**7.5/10**
Credentify Platform	7.5/10	7.5/10	6.5/10	8.5/10	6.5/10	6.0/10	**7.0/10**
ENIC-NARIC Networks	6.0/10	9.5/10	7.0/10	7.5/10	6.5/10	8.5/10	**6.5/10**

Source: Adapted from Green Circle Task 4.1 Comparative Assessment, 2025.

> *Scoring Methodology: The scores presented are based on the expert evaluation conducted by the authors of T4.1. A scale of 0 (no alignment/very poor) to 10 (full alignment/excellent) was used to assess each system against the criteria. The evaluation rubric considered factors such as standards compliance (e.g., W3C, ELM), alignment with EU policy (e.g., Green Deal, Council Recommendation), ease of adoption for non-technical partners, long-term operational costs, and potential for pan-European scaling.*

The Europass EDC infrastructure emerged as the clear recommendation for the core platform, scoring 9.2 out of 10 overall. The following subsections describe the key technology components of the recommended architecture in detail.

3.2. Europass European Digital Credentials for Learning (EDC)

The Europass EDC infrastructure is the European Commission's flagship initiative for digital credential management. It provides a comprehensive, end-to-end service for creating, issuing, viewing, storing, sharing, and verifying digital credentials across Europe. The platform's technical architecture is built upon the European Learning Model (ELM), a multilingual data model with over 480 properties that enables the capture of all learning-related data, whether obtained in formal, non-formal, or informal learning contexts [5].

The EDC infrastructure's compliance with W3C Verifiable Credentials v1.1 standards ensures interoperability with international credentialing systems and future-proofs the platform against evolving technical standards. Its security model is built upon electronic seals from Trusted Service Providers operating under the eIDAS Regulation, providing the highest levels of credential authenticity and integrity. It is important to note that while the platform is free to use, the required eIDAS electronic seal must be purchased from a commercial Trust Service Provider. The automatic verification capabilities detect any modifications to credential content and provide immediate feedback on credential validity—a critical feature for the trust-building that the Green Circle project requires.

For the Green Circle project, the EDC infrastructure offers several particularly significant advantages. Its native integration with the ESCO skills taxonomy enables precise mapping of learning outcomes to standardised European skills and competencies. Its compatibility with the GreenComp framework—the European reference framework for green competencies—enables direct alignment of construction sector micro-credentials with recognised sustainability competency standards. The platform is provided as a free service by the European Commission, eliminating licensing costs and ensuring long-term sustainability through institutional commitment.

The EDC infrastructure offers two implementation pathways that are relevant for the Green Circle project. The **ready-to-use EDC Issuer and Viewer tools** enable immediate deployment without significant technical development, making the platform accessible to consortium partners with limited IT resources. For partners requiring greater customisation and integration capabilities, the **open-source EDC infrastructure** allows complete adaptation and integration into existing learning management systems. While such customisation is outside the direct scope of the Green Circle project, it represents a key avenue for future sustainability and will be explored as part of WP5.

3.3. The European Learning Model (ELM)

The European Learning Model is the data model that underpins the EDC infrastructure and provides the semantic foundation for interoperability across the European credentialing landscape. The ELM is a multilingual ontology—a structured representation of concepts and their relationships—that provides a single vocabulary for describing all aspects of learning in Europe [5]. It operates at four levels: the European Information Model (policy and standards layer), the European Learning Model (general ontology), Application Profiles (concrete use-case specifications), and national or sectoral Extensions.

For the Green Circle project, the ELM's Application Profile for credentials is particularly important. This profile defines the minimum data requirements for a valid digital credential, including the identification of the learner, the awarding body, the learning outcomes, the assessment type, the workload in ECTS credits, and the EQF level. The ELM also supports the description of stackability and integration options, enabling the representation of how individual Green Circle micro-credentials can be combined into larger qualification pathways.

3.4. Case Studies from EU-Funded Open-Source Projects

Several EU-funded projects have pioneered the use of digital micro-credentials in contexts directly relevant to the Green Circle project. Their experiences provide valuable evidence of what works in practice and what challenges must be anticipated.

MASTERY — Micro-credentials Empowering Sustainable Skills

The MASTERY project (Erasmus+ ERASMUS-EDU-2023-PI-FORWARD, project number 101132845) is the closest parallel to the Green Circle project in the EU-funded landscape. It focuses on fostering collaboration between vocational education and industry in sectors including construction, agri-food, wood and furniture, and manufacturing, with the goal of transforming how training needs are addressed through innovation in the validation of green skills and the transferability of micro-qualifications [6]. The project has developed a research report, a policy methodology, kick-start workshops, and a set of micro-qualifications, and has piloted these across its European partner network. Key lessons from MASTERY include the critical importance of industry co-design in ensuring credential relevance, the need for flexible delivery modes that accommodate working adults, and the value of a shared quality framework that enables mutual recognition across partner institutions.

EBSI Micro-credentials Use Case — MicroBlock and DLTnode

The European Blockchain Services Infrastructure (EBSI) has developed a micro-credentials use case that connects two CEF-funded projects: MicroBlock at Tampere University in Finland and DLTnode at Kaunas University of Technology in Lithuania, both members of the European Consortium of Innovative Universities (ECIU) [7]. The use case demonstrates how a Finnish student (Anna) can request an Academic ID and a micro-credential from her home university, apply for a course at a Lithuanian university by sharing these credentials, have them automatically verified and used as enrolment prerequisites, and receive a new micro-credential from the Lithuanian institution that she can then share back with her home university. The EQAR (European Quality Assurance Register for Higher Education) serves as the Trusted Accreditation Organisation, removing the need for a separate national authority. This use case is significant for the Green Circle project because it demonstrates the practical feasibility of cross-border credential exchange and the role of recognised quality assurance bodies in enabling trust without creating bureaucratic barriers.

MiCred Green Skills Pathways

The GreenMiCred Pathways project (Erasmus+, project number 101087539) aims to provide a micro-credential green skills framework to help adults reskill and upskill, improving employment prospects through a dedicated platform [8]. The project has developed a green skills micro-credential framework informed by experts from industry, education, and training, and has created a platform for delivering and issuing these credentials. The project's focus on low-skilled adults and its emphasis on accessibility and guidance services are directly relevant to the Green Circle project's target groups in the construction sector.

4EU+ MICI Project

The 4EU+ MICI project (Micro-credentials for Inclusion) is developing a standardised and flexible system to design, issue, and recognise micro-credentials focused on digital and green skills [9]. The project's emphasis on standardisation and recognition provides useful insights into the institutional and technical requirements for a scalable micro-credentials system.

3.5. Recommended Technology Architecture for Green Circle

Based on the analysis above, the recommended technology architecture for the Green Circle micro-credentialing ecosystem comprises four integrated layers.

The **Core Credential Infrastructure Layer** is built on the Europass EDC platform, which handles all credential issuance, storage, sharing, and verification functions. Consortium partners will establish institutional accounts with the Europass EDC infrastructure and use either the ready-to-use tools or the open-source implementation depending on their technical capacity.

The **Skills and Competency Mapping Layer** integrates the ESCO skills taxonomy with the GreenComp framework and construction sector-specific competency frameworks (including BREEAM, LEED, and national professional standards) to provide precise alignment between micro-credential learning outcomes and recognised European skills classifications.

The **Learning Management and Delivery Layer** encompasses the learning management systems and delivery platforms used by individual consortium partners, which will be integrated with the EDC infrastructure through standard APIs to enable automated credential issuance upon successful completion of assessments.

The **Learner Portfolio Layer** provides learners with a personal digital wallet — integrated with the Europass profile — where they can store, manage, and share their credentials. This layer also supports the visualisation of learning pathways and the tracking of progress towards larger qualification goals.

4. Section B: Quality Assurance Model and Technical Solution

4.1. Foundations of the Quality Assurance Model

The quality assurance model for the Green Circle micro-credentialing ecosystem is grounded in three foundational documents: the Council Recommendation of 16 June 2022 on a European approach to micro-credentials [1], the MicroBol Common Framework for Micro-credentials in the European Higher Education Area [2], and the Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG 2015). Together, these documents establish the principles, standards, and procedural requirements that the Green Circle QA model must implement.

The Council Recommendation defines ten principles for the design and issuance of micro-credentials: quality, transparency, relevance, valid assessment, learning pathway, recognition, portability, learner-centredness, authenticity, and information and guidance. These principles are not aspirational—they are the minimum conditions for a micro-credential to be considered credible and portable within the European context. The Green Circle QA model is designed to operationalise all ten principles within the specific context of green skills in the construction sector.

The MicroBol framework adds a further layer of specificity, providing detailed guidance on how existing European Higher Education Area tools—including ECTS, EQF, the Diploma Supplement, the Lisbon Recognition Convention, and the ESG—can be adapted and applied to micro-credentials. Crucially, MicroBol's multi-stakeholder consensus, endorsed by ministries, universities, quality assurance agencies, and recognition bodies, provides the legitimacy that the Green Circle QA model requires to be accepted across the project's four partner countries.

4.2. Rules and Processes for Credential Release

The process through which a Green Circle micro-credential is released to an earner follows a structured sequence of quality gates, each designed to ensure that the credential accurately and reliably represents a verified learning achievement. The complete process is described below.

Stage 1: Micro-credential Design and Approval

Every Green Circle micro-credential must be designed in accordance with the ELM Application Profile for credentials and must include all mandatory standard elements

specified in Annex I of the Council Recommendation. These mandatory elements are: the identification of the learner; the title of the micro-credential; the country and region of the issuer; the awarding body; the date of issuing; the learning outcomes; the notional workload in ECTS credits; the EQF level (where applicable); the type of assessment; the form of participation; and the type of quality assurance applied. Optional elements — including the grade achieved, integration and stackability options, supervision and identity verification details, and prerequisites — should be included wherever possible to maximise the credential's utility and recognition potential.

New micro-credentials must be proposed by accredited issuing bodies and submitted to the Green Circle Quality Assurance Board for review. The review process involves assessment against the following criteria: alignment with identified green skills needs in the construction sector; mapping to ESCO skills taxonomy and GreenComp competencies; appropriateness of the proposed learning outcomes, workload, and EQF level; validity and reliability of the proposed assessment methodology; and feasibility of delivery by the proposing institution.

Stage 2: Issuer Accreditation

No organisation may issue Green Circle micro-credentials without prior accreditation by the Quality Assurance Board. The accreditation process assesses the applicant organisation against a set of institutional standards covering: legal status and financial stability; quality management systems; staff qualifications and professional development; learning environment and resources; assessment policies and procedures; learner support services; and data protection compliance. Accreditation is granted for a period of five years, subject to annual monitoring and a full re-accreditation review at the end of the period.

Stage 3: Learner Enrolment and Eligibility Verification

Before a learner is enrolled in a Green Circle micro-credential programme, the issuing body must verify their identity and assess their eligibility. Where a micro-credential has prerequisites, the issuing body must confirm that the learner meets these requirements, either through prior qualifications, Recognition of Prior Learning (RPL), or a diagnostic assessment. The identity verification process must comply with the requirements of the eIDAS Regulation and the EDC infrastructure's identity management protocols.

Stage 4: Learning and Formative Assessment

During the learning process, the issuing body must provide regular formative feedback to the learner to support their progress towards the learning outcomes. Formative assessments must be aligned with the summative assessment criteria and must be designed to identify and address any gaps in the learner's knowledge or skills before the summative assessment.

Stage 5: Summative Assessment and Moderation

The summative assessment must be conducted in accordance with the assessment methodology approved during the credential design process. All assessments must be moderated by a second assessor to ensure consistency and fairness. Where the assessment involves practical demonstration of skills, it must be conducted in a controlled environment that allows for objective observation and evaluation. The assessment results must be recorded in the issuing body's learning management system and retained for a minimum of five years.

Stage 6: Credential Issuance via EDC Infrastructure

Upon successful completion of the summative assessment, the issuing body initiates the credential issuance process through the Europass EDC infrastructure. The credential is generated in accordance with the ELM Application Profile, digitally sealed with the issuing body's eIDAS-compliant electronic seal, and delivered to the learner's Europass digital wallet. The learner receives a notification and is provided with instructions for accessing, managing, and sharing their credential.

Stage 7: Post-Issuance Monitoring and Review

The Quality Assurance Board conducts quarterly monitoring of credential issuance data, learner satisfaction surveys, employer feedback, and assessment outcome statistics. Annual reviews assess the continued relevance of each micro-credential against evolving skills needs in the construction sector and the performance of each accredited issuing body. Micro-credentials that no longer meet quality standards or are no longer relevant to industry needs may be suspended or withdrawn.

The following table summarises the key quality gates and responsible parties at each stage of the credential release process.

Stage	Key Activity	Responsible Party	Quality Gate
1	Micro-credential design and approval	Issuing Body / QA Board	ELM compliance; skills alignment; assessment validity
2	Issuer accreditation	QA Board	Institutional standards assessment
3	Learner enrolment and eligibility	Issuing Body	Identity verification; prerequisite confirmation
4	Learning and formative assessment	Issuing Body	Formative feedback; progress monitoring
5	Summative assessment and moderation	Issuing Body / Second Assessor	Assessment validity; moderation sign-off
6	Credential issuance via EDC	Issuing Body / EDC Infrastructure	ELM data completeness; eIDAS seal
7	Post-issuance monitoring	QA Board	Performance metrics; employer feedback

4.3 Digital Badge Design Requirements

The digital badge is the visual representation of the micro-credential, serving as an immediate, recognisable symbol of the learner's achievement. While the rich metadata embedded within the credential provides the verifiable detail, the visual design of the badge itself is critical for shareability, brand recognition, and perceived value. The design of Green Circle digital badges will adhere to the following requirements, which are based on the 1EdTech Open Badges 3.0 specification [10] and established best practices in digital credential design.

Visual Design Standards

All Green Circle digital badges will share a common visual identity to ensure brand consistency and immediate recognition. This identity will be based on a master template that incorporates the Green Circle project logo, a consistent colour palette, and a clear typographic hierarchy. The design will be adapted to signify the specific achievement and its level.

- Dimensions and Format: Badges will be designed on a square canvas and exported as PNG files with a minimum resolution of 600x600 pixels to ensure clarity on high-resolution displays. The master files will be maintained in SVG format to allow for lossless scaling.

- Layout: The design will incorporate a clear outer ring or border to frame the badge and ensure that it is not cropped when displayed in different contexts. A safe margin will be maintained around the edge of the badge to prevent content from being obscured.
- Branding: The Green Circle project logo will be prominently displayed on all badges. The logo of the accredited issuing body will also be included, positioned in a consistent location on the badge template.
- Typography: The text on the badge will be limited to the title of the micro-credential and the name of the earner. The font used will be clear, legible, and consistent with the Green Circle project's brand guidelines. The text will be tested for readability at a size of 64x64 pixels to ensure that it remains legible when the badge is displayed as a small icon.

EQF Level Colour-Coding System

To provide an immediate visual cue of the level of achievement represented by a micro-credential, Green Circle badges will use a four-tier colour-coding system aligned with the European Qualifications Framework (EQF).

EQF Level	Tier	Colour	Rationale
1-2	Bronze	#CD7F32	Foundational / Introductory skills
3-4	Silver	#C0C0C0	Intermediate / Operator level skills
5-6	Gold	#FFD700	Advanced / Technician or Specialist level skills
7-8	Platinum	#E5E4E2	Expert / Managerial or Strategic level skills

This system ensures that employers and other stakeholders can quickly assess the relative value of a credential without needing to read the detailed metadata. The colour will be applied to the outer ring or a significant design element of the badge.

Accessibility Requirements

All Green Circle digital badges will be designed to be accessible to users with disabilities, in accordance with the Web Content Accessibility Guidelines (WCAG). This includes:

- Colour Contrast: The contrast ratio between text and background colours will be at least 4.5:1 for normal text and 3:1 for large text.

- Colour Independence: Colour will not be used as the sole means of conveying information. The EQF level, for example, will be indicated by the colour-coding system but also by the text in the credential's metadata.
- Alternative Text: All badge images will be accompanied by descriptive alternative text that explains the content of the badge for users who are unable to see it.

Open Badges 3.0 Metadata Requirements

In case we need Green Circle digital badges to l be a verifiable credential compliant with the 1EdTech Open Badges 3.0 specification [10]. This means that in addition to the visual image, each badge must contain a rich set of embedded metadata that provides detailed, verifiable information about the achievement. The metadata include all the mandatory elements of the ELM Application Profile for credentials, as well as the following Open Badges-specific fields:

- **@context**: The JSON-LD context, which will point to the Open Badges 3.0 context URL.
- **id**: A unique, persistent, and resolvable URL for the badge assertion.
- **type**: The type of the credential, which will be Assertion.
- **recipient**: An object identifying the learner, including their name and a hashed identifier for their email or Europass profile.
- **badge**: An object describing the achievement, including the badge name, description, criteria (the learning outcomes), and issuer information.
- **issuedOn**: The date the badge was issued.
- **verification**: An object specifying how the badge can be verified.

By adhering to these design requirements, the Green Circle project will ensure that its digital badges are not only visually appealing and informative but also technically robust, interoperable, and trusted across the European credentialing ecosystem.

4.4. Technical Solution Architecture

The technical solution for the Green Circle micro-credentialing ecosystem is built upon the Europass EDC infrastructure and implements the European Learning Model as its data standard. The architecture is designed to be modular, scalable, and interoperable, enabling integration with the diverse range of learning management systems and institutional IT environments represented across the Green Circle consortium.

EDC Issuer Configuration

Each accredited issuing body will establish an institutional account with the Europass EDC infrastructure and configure an EDC Issuer instance. The issuer configuration includes: the institution's legal name and identifier; the eIDAS-compliant electronic seal certificate; the credential templates for each approved micro-credential; and the integration settings for the institution's learning management system. The EDC infrastructure supports both manual credential issuance (via the web-based EDC Issuer tool) and automated issuance (via the EDC API, which can be integrated with learning management systems to trigger credential issuance automatically upon assessment completion).

Credential Data Model

All Green Circle micro-credentials will be structured in accordance with the ELM Application Profile for credentials. The credential data model includes the following key components: the credential subject (the learner, identified by their Europass profile identifier or another verifiable identifier); the issuer (the accredited institution, identified by its EDC institutional account); the achievement (the micro-credential, including its title, description, learning outcomes, assessment type, workload, EQF level, and ESCO skills mapping); the evidence (the assessment results and any supporting documentation); and the validity period (the date of issuance and, where applicable, the expiry date).

Verification Architecture

The verification of Green Circle micro-credentials is handled by Europass EDC infrastructure's built-in verification service. Any party—including employers, educational institutions, and professional bodies—can verify a credential by scanning the QR code embedded in the credential's visual representation or by entering the credential's unique identifier in the Europass verification portal. The verification process checks the integrity of the credential data (detecting any post-issuance modifications), the validity of the issuer's electronic seal, and the current status of the issuing body's accreditation. The result is returned in real time, providing immediate confirmation of the credential's authenticity and validity.

Data Protection and Privacy

The technical solution must comply with the General Data Protection Regulation (GDPR) and the eIDAS Regulation. Learner data is stored in the Europass infrastructure under the learner's control, and issuers do not retain copies of issued credentials beyond what is required for their own records. Learners have the right to access, correct, and delete their data, and to control who can view their credentials. The EDC infrastructure's privacy-by-

design architecture ensures that credential verification does not expose learner data to third parties beyond what the learner has explicitly authorised.

5. Section C: Transferability and Interoperability in the Context of Micro-credentials

5.1. The Transferability Challenge

Transferability—the ability of a micro-credential to be recognised and valued beyond the context in which it was issued—is one of the most critical and most challenging aspects of any micro-credentialing ecosystem. For Green Circle micro-credentials to fulfil their purpose of supporting the green transition in the construction sector, they must be recognised by employers across the four partner countries and beyond, by educational institutions that may wish to grant credit for prior learning, and by professional bodies that regulate access to licensed occupations in the construction sector.

The transferability challenge is compounded by the diversity of national qualification systems, professional licensing frameworks, and quality assurance traditions across Europe. A micro-credential issued by a Portuguese vocational training centre must be comprehensible and credible to a German construction company, a Spanish university, and a Greek professional engineering association. This requires not only technical interoperability—the ability to exchange credential data between systems—but also semantic interoperability—the ability to understand and interpret that data in a consistent way—and legal interoperability, which is facilitated by common recognition frameworks.

5.2. The Europass Ecosystem as the Foundation for Transferability

Europass provides the most comprehensive and widely recognised infrastructure for credential transferability in Europe. The Europass ecosystem encompasses a range of tools and services that collectively address the technical, semantic, and institutional dimensions of transferability.

The **Europass Profile** is a personal online space where individuals can record all their skills, qualifications, and experiences in a standardised format. By storing their Green Circle micro-credentials in their Europass profile, learners make them immediately accessible and shareable with any employer, educational institution, or professional body that uses the Europass platform. The Europass profile is available in 31 languages and is used by millions of Europeans, making it the most widely adopted personal credential management tool in Europe.

The **European Digital Credentials for Learning (EDC)** infrastructure, as described in Section A, provides the technical backbone for issuing and verifying credentials within the Europass

ecosystem. The EDC's use of electronic seals under the eIDAS Regulation means that credentials issued through the platform carry a level of legal assurance that is recognised across all EU Member States. The automatic verification service means that any employer or institution can instantly confirm the authenticity of a Green Circle credential without needing to contact the issuing body.

The **European Learning Model (ELM)** provides the semantic foundation for transferability by establishing a common vocabulary for describing learning outcomes, qualifications, and credentials [5]. When a Green Circle micro-credential is issued using the ELM data model, its content is expressed in a standardised format that can be understood by any system that implements the ELM—including employer HR systems, educational institution admissions platforms, and national qualifications databases. The ELM's multilingual design ensures that credential information can be accurately translated and understood across language boundaries.

5.3. Interoperability Standards and Frameworks

The interoperability of Green Circle micro-credentials is underpinned by a stack of open standards that collectively ensure that credentials can be exchanged, verified, and understood across different systems, platforms, and national contexts.

W3C Verifiable Credentials Data Model

The W3C Verifiable Credentials (VC) data model is the global standard for digital credentials [11]. It defines a common data format for expressing credentials in a way that is cryptographically verifiable, privacy-respecting, and interoperable across different platforms and systems. The Europass EDC infrastructure is fully compliant with W3C VC v1.1, and the forthcoming upgrade to W3C VC v2.0 is planned. The adoption of W3C VC ensures that Green Circle credentials can be verified by any system that implements the standard, including systems outside the Europass ecosystem.

1EdTech Open Badges 3.0

The 1EdTech Open Badges 3.0 specification [10] is the leading standard for digital badges and is fully aligned with the W3C VC data model. Open Badges 3.0 provides a standardised format for embedding rich metadata in digital badges, enabling them to be stored in digital wallets, shared on social media platforms, and verified by employers and educational institutions. The adoption of Open Badges 3.0 ensures that Green Circle badges can be used across the full range of badge platforms and wallets available in the market.

European Qualifications Framework (EQF)

The EQF provides a common reference framework for comparing qualifications across European countries [12]. By assigning each Green Circle micro-credential an EQF level, the project ensures that learners and employers can understand the relative level of achievement represented by the credential, regardless of the national context in which it was issued. The EQF level assignment must be validated by the national qualifications' authority in the issuing body's country.

European Credit Transfer and Accumulation System (ECTS)

The ECTS provides a standardised system for measuring and comparing learning volume across European higher education institutions [13]. By expressing the workload of each Green Circle micro-credential in ECTS credits, the project enables learners to accumulate credits towards larger qualifications and facilitates recognition by educational institutions. The MicroBol framework provides specific guidance on ECTS credit allocation for micro-credentials, recommending a range of 1–5 ECTS credits for most micro-credentials.

ESCO Skills Taxonomy

The European Skills, Competences, Qualifications and Occupations (ESCO) taxonomy provides a standardised classification of skills and competencies that enables precise mapping between learning outcomes and labour market requirements [14]. By mapping each Green Circle micro-credential's learning outcomes to ESCO skills, the project ensures that employers can immediately understand the specific competencies that the credential certifies, and that automated matching between credentials and job requirements is possible.

5.4. Cross-Border Recognition Mechanisms

The recognition of Green Circle micro-credentials across national borders requires engagement with the formal recognition infrastructure of the European Higher Education Area. The ENIC-NARIC networks—the official European infrastructure for qualification recognition—provide the institutional framework within which recognition decisions are made [15]. The Lisbon Recognition Convention provides the legal framework for academic recognition across the European Higher Education Area. While the Convention was designed primarily for full qualifications, the MicroBol framework has developed guidance on how its principles can be applied to micro-credentials.

To move from the theoretical to the practical, the Green Circle project will pursue a concrete, three-step implementation plan to facilitate recognition:

- **Systematic Framework Mapping:** All Green Circle micro-credentials will be systematically mapped to the EQF, ECTS (where appropriate), and ESCO frameworks from the design stage.
- **Proactive Engagement with National Bodies:** The project will proactively engage with the ENIC-NARIC centres in Portugal, Spain, Germany, and Greece to present the Green Circle QA framework and seek guidance on national recognition procedures.
- **Securing Sectoral Endorsement:** The project will work with the Industry Advisory Council to secure formal endorsements from key construction sector professional associations and regulatory bodies in each partner country.

5.5. Interoperability with National Qualification Systems

The four Green Circle partner countries — Portugal, Spain, Germany, and Greece — each have distinct national qualification systems with varying degrees of integration with the European frameworks described above. The following table summarises the key features of each national system that are relevant to the transferability of Green Circle micro-credentials.

Country	National QF	VET Authority	MC Regulatory Status	Key Considerations
Portugal	QNQ (Quadro Nacional de Qualificações)	DGERT / ANQEP	Emerging framework	Strong VET tradition; CICCOPN (consortium partner) is a major construction training centre
Spain	MECES / CNCP	INCUAL / Ministry of Education	Under development (three parallel processes: VET, HE, employment)	High proportion of low-skilled adults; significant informal skills in construction
Germany	DQR (Deutscher Qualifikationsrahmen)	BIBB / KMK	No specific regulation; partial qualifications framework exists	Strong dual VET system; high quality standards; VBB Nord and BNB are consortium partners
Greece	NQF	EOPPEP	Limited formal framework	Low participation in adult training; PEDMEDE and DUTH are consortium partners

Source: Adapted from Green Circle Baseline Establishment on Micro-credentials, 2024 [1].

[1] https://green-circle.eu/wp-content/uploads/2024/11/Green-Circle_Baseline-establishment-on-micro-credentials.pdf

6. Section D: Governance and Administrative Processes

6.1. The Governance Imperative

Governance is the foundation upon which the credibility and sustainability of the Green Circle micro-credentialing ecosystem rests. Without clear governance structures, the ecosystem risks fragmentation, inconsistency, and loss of stakeholder trust. The governance model must define who has the authority to develop and approve new micro-credentials, who may issue credentials, how quality is assured and monitored, how disputes are resolved, and how the ecosystem evolves over time in response to changing industry needs and policy developments.

The governance challenge for the Green Circle project is compounded by its multi-national, multi-stakeholder nature. The consortium spans four countries with different educational traditions, regulatory frameworks, and institutional cultures. The governance model must be sufficiently flexible to accommodate this diversity while maintaining the consistency and rigour necessary for the credentials to be trusted across borders.

6.2. Governance Principles

The governance model for the Green Circle ecosystem is built upon five core principles that reflect the values of the project and the requirements of the European micro-credentials framework.

- **Legitimacy** requires that governance structures and decisions are accepted as valid and appropriate by all stakeholders. This is achieved through multi-stakeholder representation, transparent decision-making processes, and alignment with European policy frameworks.
- **Accountability** requires that those who exercise authority within the ecosystem are answerable for their decisions and actions. This is achieved through clear role definitions, documented decision-making processes, regular reporting, and independent oversight.
- **Transparency** requires that the rules, processes, and decisions of the ecosystem are open and accessible to all stakeholders. This is achieved through the publication of governance documents, accreditation criteria, and quality assurance reports.

- **Responsiveness** requires that the governance structures are able to adapt to changing circumstances, including evolving industry needs, new policy developments, and lessons learned from implementation. This is achieved through regular review cycles and stakeholder consultation processes.
- **Sustainability** requires that the governance model is designed to outlast the initial project funding period and to maintain the ecosystem's value and credibility over the long term. This is achieved through the establishment of a permanent governance body with diversified funding and the development of a long-term sustainability plan.

6.3. Governance Structure

The governance structure for the Green Circle micro-credentialing ecosystem comprises four interconnected bodies, each with distinct roles and responsibilities.

The Green Circle Steering Committee is the highest governance body of the ecosystem. It is composed of one senior representative from each consortium partner organisation and is chaired by the project coordinator (TECMINHO). The Steering Committee is responsible for the overall strategic direction of the ecosystem, the approval of major policy decisions, the oversight of the Quality Assurance Board, and the management of relationships with European institutions and policy bodies. The Steering Committee meets twice annually and makes decisions by qualified majority vote (two-thirds of members present).

The Quality Assurance Board is an independent body responsible for the accreditation of issuing bodies, the approval of new micro-credentials, the monitoring of quality standards, and the resolution of disputes. The Board is composed of seven members: two representatives from the consortium (one from a VET provider and one from a university), two representatives from the construction industry (nominated by industry partners), one representative from a national quality assurance agency, one representative from an ENIC-NARIC network, and one independent expert in micro-credentials and digital credentials. Board members serve three-year terms and are appointed by the Steering Committee. The Board meets quarterly and publishes an annual quality report.

The Industry Advisory Council is a consultative body that provides input on the skills needs of the construction sector and the relevance of the micro-credentials offered

within the ecosystem. It is composed of representatives from construction companies, trade associations, trade unions, and professional bodies from the four partner countries. The Council meets twice annually, and its recommendations are formally considered by the Quality Assurance Board in its credential review processes.

The Technical Operations Group is responsible for the day-to-day management of the EDC infrastructure, the maintenance of the credential registry, the administration of the learner digital wallet system, and the provision of technical support to issuing bodies. It is composed of IT staff from the consortium partners with the necessary technical expertise and is coordinated by the partner with the strongest technical capacity.

The relationships between these governance bodies are illustrated in the following table.

Governance Body	Role	Composition	Decision Authority
Steering Committee	Strategic direction and oversight	Senior representatives of all 11 consortium partners	Final authority on strategic matters; appoints QA Board
Quality Assurance Board	Accreditation, credential approval, quality monitoring	7 members: 2 consortium, 2 industry, 1 QA agency, 1 ENIC-NARIC, 1 independent expert	Accreditation decisions; credential approval; dispute resolution
Industry Advisory Council	Skills intelligence and relevance validation	Representatives from construction companies, associations, unions, professional bodies	Advisory only; formal input to QA Board reviews
Technical Operations Group	EDC infrastructure management and technical support	IT staff from consortium partners	Operational decisions within approved technical parameters

6.4. Authority to Develop and Issue Credentials

The authority to develop and issue Green Circle micro-credentials is distributed across the ecosystem according to a clear framework that balances the need for quality assurance with the need for institutional autonomy and innovation.

Development Authority—the right to propose new micro-credentials—is held by all accredited issuing bodies within the ecosystem. Any accredited organisation may propose a new micro-credential by submitting a design proposal to the Quality Assurance Board. The proposal must include skills needs analysis demonstrating the relevance of the proposed credential, a full ELM-compliant credential specification, a proposed assessment

methodology, and evidence of industry endorsement from at least two construction sector employers. The Board reviews proposals against the quality criteria described in Section B and either approves, requests revision, or rejects the proposal within 60 days of submission.

Issuance Authority—the right to issue credentials to earners—is held exclusively by organisations that have been accredited by the Quality Assurance Board. Accreditation may be granted to the following types of organisations: vocational education and training providers registered with the relevant national authority; universities and other higher education institutions; professional associations in the construction sector with a recognised role in professional development and certification; and private training providers that can demonstrate a minimum of three years of experience in delivering construction sector training and that meet the institutional standards described in Section B.

The following table summarises the accreditation requirements for each type of issuing body.

Issuing Body Type	Minimum Requirements	Accreditation Duration	Re-accreditation Trigger
University / HEI	Institutional IQAS Accreditation by HAHE (ETHAAE); Internal approval by the Quality Assurance Unit (MODIP). (For Greece)	Expiry of the 5-year cycle; Loss of Institutional Accreditation; Adverse monitoring finding; Negative findings in Progress Reports (interim audits every 2 years).	Change of ownership; significant change in scope; adverse monitoring finding
Accredited VET / TVET Provider	National accreditation as a VET provider (e.g., by DGERT in Portugal, BIBB in Germany); Compliance with ISO 9001:2015.	Expiry of accreditation cycle; Loss of national VET accreditation; Adverse monitoring finding.	Expiry of the 5-year cycle; Loss of Institutional Accreditation; Negative findings in Progress Reports (interim audits every 2 years)
Professional Association	Legal status as a recognised professional body for the construction sector; Documented internal QA process for training and certification.	Material change in legal status; Adverse monitoring finding.	Change of governance; loss of professional recognition
Private Training Provider	3+ years experience; qualified trainers; quality management system; employer references	3 years	Any adverse monitoring finding; change of ownership

Source: Green Circle Consortium, 2026.

7. Section E: Analysis of the Steps to Issue European Digital Credentials for Learning (EDC)

7.1. Overview of the EDC Issuance Process

The process of issuing a European Digital Credential for Learning (EDC) through the Europass infrastructure is a structured workflow designed to ensure that every credential is data-rich, secure, and verifiable. For the Green Circle project, accredited issuing bodies will follow this process to award micro-credentials to learners who have successfully met the assessment requirements. The process can be broken down into three main phases: **Preparation**, **Issuance**, and **Delivery** [17].

7.2. Phase 1: Preparation

This initial phase involves all the necessary setup and configuration that must be completed before any credentials can be issued. It ensures that the issuing institution is properly registered, the credential content is defined, and the necessary security components are in place.

Step 1: Acquire an eIDAS Electronic Seal

The cornerstone of the EDC security model is the eIDAS-compliant electronic seal. This is the digital equivalent of an organisation's official stamp and serves to guarantee the origin and integrity of the credential. Each Green Circle issuing body must acquire a Qualified or Advanced Electronic Seal from a recognised Trust Service Provider (TSP) listed on the EU Trusted List. This is a non-negotiable prerequisite for issuing EDCs. The seal certificate contains the verified legal name and identifier of the issuing institution, which is automatically embedded in every credential issued.

Step 2: Register with the Online Credential Builder (OCB)

The designated administrator from the issuing body must create an EU Login account and access the Europass Online Credential Builder (OCB). This web-based tool is where credential templates are designed and managed. The OCB allows for the creation of reusable templates that define the structure and content of the micro-credentials, ensuring consistency and compliance with the European Learning Model (ELM).

Step 3: Create Organisation and Credential Templates

Within the OCB, the administrator will first create a template for their own organisation, including its legal name, identifier, and address. This information is used to populate the "awarding body" fields in the credential. Next, the administrator will create the specific templates for each Green Circle micro-credential the institution is accredited to issue. This involves:

- **Defining the Credential:** Specifying the title, type (e.g., micro-credential), EQF level, and ECTS credits.
- **Linking Claims:** Creating and linking the core claims of the credential, which are typically "Achievements" that describe the learning outcomes and may also include "Activities" (the course itself) and "Assessments" (the evaluation method).
- **Mapping to Frameworks:** Populating the templates with rich metadata, including mapping the learning outcomes to the ESCO skills taxonomy and GreenComp framework.

7.3. Phase 2: Issuance

This phase covers the process of taking a prepared template, adding learner-specific data, and cryptographically sealing the credential.

Step 4: Add Recipient Data

Once a cohort of learners has successfully completed a micro-credential course, the administrator initiates the issuance process from the OCB. The system provides two methods for adding the personal data of the recipients:

- **Web Form:** For small batches, data (name, email/wallet address, grades, etc.) can be entered directly into a browser form.
- **Spreadsheet Upload:** For larger batches, a pre-formatted XLS or CSV template can be downloaded, populated with the data for up to 50 recipients at a time, and uploaded back into the system.

At this stage, the system combines the reusable credential template with the specific data for each individual learner to generate a set of unsigned credentials in JSON format.

Step 5: Install and Run NexU Software

To enable the web browser to access the electronic seal (which is typically stored on a secure USB token or in the local Windows Keystore), the administrator must install and run the NexU software. This open-source tool acts as a bridge between the EDC Issuer web application and the local certificate store.

Step 6: Seal the Credentials

With NexU running, the administrator clicks the “Seal” button in the EDC Issuer interface. NexU prompts the user to select the correct electronic seal certificate and enter the associated password. The EDC Issuer then sends each unsigned JSON credential to the browser, where NexU uses the selected seal to apply the cryptographic signature. This process creates the final, tamper-evident Verifiable Credentials. The system confirms that each credential has been successfully sealed.

7.4. Phase 3: Delivery

This final phase involves sending the sealed credentials to the learners.

Step 7: Send Credentials to Learners

After sealing, the administrator clicks the “Send” button. The EDC infrastructure delivers the credentials to the recipients via their specified email or Europass wallet address. The system provides a confirmation report indicating the delivery status for each recipient.

Step 8: Learner Receives and Manages the Credential

The learner receives an email with a link to their new credential or a notification in their Europass profile. They can view the credential in the EDC Viewer, store it in their Europass digital wallet (or any other compatible wallet), and share it with third parties. It is not mandatory for a learner to have a Europass account; credentials can be received via email and stored as files, remaining independently verifiable. The recipient can verify the credential’s authenticity at any time, confirming the issuer’s identity and that the content has not been altered.

The following table provides a summary of the eight-step issuance process, the tools used, and the key output of each step.

Step	Action	Tool(s) Used	Key Output
1	Acquire Electronic Seal	Trust Service Provider	eIDAS Qualified/Advanced Electronic Seal Certificate
2	Register with OCB	EU Login, Online Credential Builder	OCB account for the issuing institution
3	Create Templates	Online Credential Builder	Reusable, ELM-compliant credential templates
4	Add Recipient Data	EDC Issuer (Web Form / XLS)	Unsigned JSON credentials with learner data
5	Install and Run NexU	NexU Software	Bridge between browser and local seal certificate
6	Seal Credentials	EDC Issuer, NexU	Cryptographically sealed, tamper-evident Verifiable Credentials
7	Send Credentials	EDC Issuer	Credentials delivered to learner email/wallet
8	Learner Receives Credential	Europass Wallet, EDC Viewer	Learner has full control over their verifiable credential

8. Conclusions and Recommendations

This report has provided a comprehensive analysis of the four key dimensions of the Green Circle micro-credentialing ecosystem: technology choices, quality assurance, transferability and interoperability, and governance. The analysis demonstrates that a robust, trusted, and sustainable ecosystem can be established by building on existing European infrastructure and frameworks, adapting them to the specific context of green skills in the construction sector, and implementing a clear governance model that ensures quality, consistency, and stakeholder confidence.

The following key recommendations emerge from the analysis.

Technology: The Europass EDC infrastructure should be adopted as the core platform for credential issuance, storage, and verification. All consortium partners should establish institutional EDC accounts and configure credential templates for each approved micro-credential. The ELM Application Profile for credentials should be used as the data standard for all Green Circle credentials, ensuring full interoperability with the European credentialing ecosystem.

Quality Assurance: The Quality Assurance Board should be established as an independent body with multi-stakeholder representation, and the accreditation process for issuing bodies should be launched as a priority activity in the first phase of the project. The seven-stage credential release process described in Section B should be adopted as the standard operating procedure for all Green Circle credential issuances.

Transferability and Interoperability: All Green Circle micro-credentials should be aligned with the W3C Verifiable Credentials standard, the IMS Open Badges 3.0 specification, the EQF, the ECTS, and the ESCO skills taxonomy. The project should engage proactively with the ENIC-NARIC networks in each partner country to facilitate recognition, and should seek formal endorsement from construction sector professional associations and regulatory bodies.

Governance: The four-body governance structure described in Section D should be established at the outset of the project, with clear terms of reference, decision-making procedures, and accountability mechanisms. The governance model should be designed with long-term sustainability in mind, with a plan for maintaining the ecosystem beyond the project funding period.

9. References

[1] Council of the European Union. (2022, June 16). Council Recommendation on a European approach to micro-credentials for lifelong learning and employability. OJ C 243, 27.6.2022, pp. 10–25. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32022H0627%2802%29

[2] MicroBol Project. (2022). Common Framework for Micro-credentials in the European Higher Education Area. https://microcredentials.eu/wp-content/uploads/sites/20/2022/03/Micro-credentials_Framework_final-1.pdf

[3] Green Circle Project Consortium. (2024). Micro-credentials in Construction: Baseline Establishment on Micro-credentials. https://green-circle.eu/wp-content/uploads/2024/11/Green-Circle_Baseline-establishment-on-micro-credentials.pdf

[4] European Commission. (2019). The European Green Deal. COM(2019) 640 final. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2019%3A640%3AFIN

[5] European Commission / Europass. (2023). Introduction to the European Learning Model. https://europass.europa.eu/en/european-learning-model-stakeholders

[6] MASTERY Project. (2023–2025). Micro-credentials Empowering Sustainable Skills (Erasmus+ 101132845). https://mastery-microcredentials.eu/

[7] European Commission. (2026). EBSI Micro-credentials Use Case. https://ec.europa.eu/digital-building-blocks/sites/spaces/EBSI/pages/584712751/Micro-credentials

[8] GreenMiCred Pathways Project. (2022–2025). Green Micro-credentials Pathways: Upskill and Reskilling Low-Skilled Adults for Lifelong Learning (Erasmus+ 101087539). https://www.navet.government.bg/eng/project-green-micro-credentials-pathways-upskill-and-reskilling-low-skilled-adults-for-lifelong-learning-project-no-101087539-greenmicred-pathways/

[9] 4EU+ Alliance. (2023). 4EU+ MICI: Micro-credentials for Inclusion. https://4euplus.eu/4EU-12.html?newsID=25136

[10] 1EdTech Consortium. (2024). Open Badges 3.0 Specification. https://www.imsglobal.org/spec/ob/v3p0

[11] World Wide Web Consortium (W3C). (2022). Verifiable Credentials Data Model v1.1. https://www.w3.org/TR/vc-data-model/

[12] European Commission. (2017). Council Recommendation on the European Qualifications Framework for lifelong learning. OJ C 189, 15.6.2017. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32017H0615(01)

[13] European Commission. (2015). ECTS Users' Guide. Publications Office of the European Union. https://education.ec.europa.eu/sites/default/files/document-library-docs/ects-users-guide_en.pdf

[14] European Commission / ESCO. (2022). European Skills, Competences, Qualifications and Occupations (ESCO). https://esco.ec.europa.eu/en

[15] ENIC-NARIC Networks. Recognition of Qualifications. https://www.enic-naric.net/

[16] Active Citizens Partnership. (2025). EU Micro-credentials Systems for Green Circle Project: Comprehensive Analysis and Assessment (Green Circle Task 4.1 report).

[17] European Commission / Europass. (2026). How to issue European Digital Credentials for Learning. https://europass.europa.eu/en/how-issue-european-digital-credentials-learning

ANNEX 1

Micro-Credential courses will be piloted in WP5

Course Title	**Green Skills in Construction – Module I**
Micro-credential Title	Circular Economy and Sustainability in Construction
Issuing Institution	CICCOPN- Centro de Formação Profissional da Indústria da Construção Civil e Obras Públicas
Country	Portugal
Course Summary	The Circular Economy and Sustainability in Construction course offers a practical and applied overview of the essential strategies for making construction more efficient, sustainable, and aligned with the industry's current requirements. Over the course of 10 hours, participants explore the fundamental principles of the circular economy, understand the limitations of the linear model, and analyze the environmental impact associated with the materials, processes, and systems used in construction. The training delves into the selection of sustainable materials, low-impact solutions, and real-world case studies illustrating the adoption of circular practices. Innovative construction systems—such as modular and demountable construction—are also covered, along with the integration of renewable energy, including solar thermal and photovoltaic systems, with a focus on their practical application on-site. Participants develop skills in waste management, sustainable planning, life cycle assessment, and the interpretation of environmental indicators, acquiring tools that support responsible decision-making in their daily work. By the end of the course, they will be able to implement strategies that reduce waste, optimize resources, and contribute to greener and more efficient construction projects, thereby increasing the environmental and economic value of these projects.
EQF Level	EQF Level 4
Target Audience	· Team leaders · Line managers · Construction technicians

Learning Outcomes	Analyze the limitations of the linear construction model and compare them with the principles of the circular economy in the context of construction projects. Identify sustainable, recycled, and recyclable materials, selecting appropriate solutions to reduce the environmental impact of construction projects. Apply modular and demountable design strategies to reduce waste and increase the reuse of components on the construction site. Analyze and evaluate renewable energy systems (solar thermal and photovoltaic) according to the technical, construction, and energy efficiency criteria presented. Develop a simplified on-site waste management plan, implementing prevention, reuse, and recycling practices in accordance with legal and operational requirements.
Delivery Mode	online (synchronous) and Face-to-face.

Course Title	**Green Skills in Construction – Module II**
Micro-credential Title	Solar Thermal Energy
Issuing Institution	CICCOPN- Centro de Formação Profissional da Indústria da Construção Civil e Obras Públicas
Country	Portugal
Course Summary	This course offers technical and practical training that equips construction professionals to address emerging challenges in sustainability and renewable energy. Over the course of 16 hours, participants begin the course with a solid understanding of the principles of the circular economy as applied to the construction sector, exploring the environmental impact of the materials, processes, and systems used, as well as innovative solutions to reduce waste, promote resource efficiency, and improve the energy performance of buildings. The program also delves into the field of solar thermal systems, covering different types of collectors, basic hydraulic schematics, sizing methodologies, and technical installation criteria. Trainees also learn to analyze shading, select appropriate equipment, interpret circuits, and apply best practices for installation and maintenance, developing essential operational skills for on-site work. By the end of the course, participants will be prepared to plan, install, and optimize sustainable solutions, adopting practices that reduce costs, minimize environmental impacts, and enhance the technical and ecological value of construction projects.
EQF Level	EQF Level 4

Target Audience	· Team leaders · Line managers · Construction technicians
Learning Outcomes	Identify the different types of solar collectors (flat-plate, unglazed, vacuum tube, and hybrid) and compare their functional characteristics and appropriate applications. Interpret basic hydraulic diagrams and distinguish between thermosiphon systems, forced-circulation systems, collective installations, and integrations with HVAC systems or swimming pools. Calculate the basic sizing of a solar thermal system, determining the location of the collectors, assessing shading, and selecting complementary equipment and accessories. Perform solar thermal system installation procedures, correctly applying materials, connections, and best assembly practices in accordance with technical specifications. Assess the condition of system components (collectors, storage tanks, heat exchangers, hydraulic circuit, and controls) and perform basic preventive maintenance operations
Delivery Mode	online (synchronous) and Face-to-face.

Course Title	**Green and Future Skills in construction**
Micro-credential Title	Certified for handling of Green Skills are needed in construction
Issuing Institution	UNIR
Country	Spain
Course Summary	This is an introductory module suitable for all learners, it covers the key themes and ideas required to understand why Green Skills are needed in construction, an introduction to some of the key ideas, what qualifications are available and what the future holds for Green skills in construction.
EQF Level	3-6
Target Audience	This is an introductory module suitable for all learners. It covers the key themes and ideas required to understand why Green Skills are needed in construction.

Learning Outcomes	By the end of this module, you will: - Explain the core principles of Green Skills and sustainability in construction and Identify key ESCO Green Skills relevant to your role. - Explain the basics of circular and doughnut economics and their impact on construction. - Describe and recognize the importance of sustainability practices and planning in real-world projects. - Begin to reflect on how you can apply these concepts in your current or future work. - Identify key tools, standards, and certifications used to assess and improve sustainability in construction. - Recognise the main European policy and regulatory frameworks shaping sustainable construction and identify emerging trends and outline initial pathways for your own green professional development.
Delivery Mode	Fully online synchronous and asynchronous

Course Title	**Handling of construction and demolition waste on site, and good practices**
Micro-credential Title	Certified for handling of construction and demolition waste on site
Issuing Institution	UNIR
Country	Spain
Course Summary	This is a basic module suitable for all learners, it covers the key themes and ideas required to handle construction and demolition waste on site, what qualifications are available and the role of this green skill in the construction sector.
EQF Level	3-6
Target Audience	This basic module is designed for learners at all levels: from apprentices and site workers to engineers, architects and managers. You will explore the essential concepts, skills and mindsets needed to thrive in a construction sector that is rapidly evolving toward sustainability, resilience, and innovation.

Learning Outcomes	- Upon completion of this course, the learner will be able to classify and code construction and demolition (C&D) waste by applying European Waste Catalogue (EWC) Chapter 17 codes, distinguishing between inert, non-hazardous, and hazardous fractions - Upon completion of this course, the learner will be able to apply on-site waste management practices, including selective demolition, segregation at source, and construction-phase waste reduction strategies. - Upon completion of this course, the learner will be able to evaluate and select appropriate reuse, recycling, and recovery routes for common C&D waste streams, including conditions for end-of-waste status. - Upon completion of this course, the learner will be able to identify and manage hazardous waste streams by completing inventory records and applying compliant handling, labelling, storage, and disposal procedures - Upon completion of this course, the learner will be able to interpret and implement EU and Spanish regulatory requirements using standardised documentation to ensure waste traceability and compliance.
Delivery Mode	Fully online synchronous and asynchronous
Course Title	**Basic Course in Circular Economy and Green Skills**
Micro-credential Title	Basic Course in Circular Economy and Green Skills
Issuing Institution	VBB-Nord (Association for the Promotion of Vocational Training in the Construction Industry North)
Country	Germany

Course Summary	The introductory course on the circular economy provides participants at EQF Level 3 with a practical understanding of sustainability, green skills and the key political and legal frameworks. Interactive learning modules cover key topics, such as environmental issues, resource consumption, linear and circular economic models, and sustainable technologies. Particular emphasis is placed on the role of the construction and manufacturing sectors. Participants gain a basic understanding of sustainable business practices, develop the skills to assess materials and work processes and learn to identify and apply environmentally sound solutions in their day-to-day work. At the same time, they strengthen their skills in personal responsibility, teamwork and reflective practice. A particular strength of the course lies in the way it combines theory with practice. Through group work, case studies and practical exercises, learners apply what they have learnt directly to their own work situations. This not only fosters understanding, but also develops the ability to actively contribute to more sustainable working practices and to better meet the future demands of the industry.
EQF Level	3–4
Target Audience	Road builders, landscaping contractors, civil engineering specialists, support staff and career changers with 6 months' professional experience
Learning Outcomes	Upon completion of the course, the learner will be able to: ● explain the differences between a linear economy and a circular economy and illustrate these using specific examples from the construction or manufacturing sectors. ● to identify which environmental problems and forms of resource consumption occur in their own field of work and to list these in a structured manner. ● assess whether selected materials are suitable for reuse or recycling and derive specific measures for waste prevention from this. ● apply basic green skills to typical professional tasks by identifying and describing sustainable options for action in everyday working life. ● to analyse which legal and political frameworks are relevant to sustainable business practices, and to explain their significance for operational processes.
Delivery Mode	Face-to-face teaching (3 days, 24 hours in total) The course is delivered entirely in person and combines various engaging methods, such as short presentations, group work, discussions, practical exercises and material analysis. This facilitates direct interaction between participants and specifically supports the transfer of knowledge into their own daily work.

Course Title	**Innovative paving surfaces with the 'Klimastein'**
Micro-credential Title	Innovative Paving Surfaces with the 'Klimastein'
Issuing Institution	VBB-Nord (Association for the Promotion of Vocational Training in the Construction Industry North e. V.)
Country	Germany
Course Summary	8-hour one-day course The course "Innovative Paved Surfaces with Klimastein" provides a concise overview of the essential fundamentals for the professional construction and sustainable design of traffic areas. Building on the regulations of the **RSTO and/or MVV**, participants learn about the technical layer structure as well as the requirements regarding load-bearing capacity, water permeability and material usage. **The focus is on the planning and construction of durable, permeable paving surfaces in landscaping and traffic route construction.** In addition, current challenges such as soil sealing, increasing urbanisation and their effects on the water cycle and urban climate are addressed. Participants develop an understanding of ecological interrelationships and recognise the importance of sustainable construction methods. Another focus is on innovative building materials such as water-permeable and climate-active paving systems from various manufacturers. These are evaluated in terms of their technical properties, ecological benefits and practical applications. The course combines fundamental technical knowledge with practical applications and enables participants to competently implement future-proof and sustainable solutions in the field of paving construction. Contents: **1. Professional construction in accordance with RSTO and/or MVV** ● Understanding of the correct technical construction of traffic areas (e.g. roads, paths, squares). ● Knowledge of layer structure, materials, load-bearing capacity and standards. **2. Drainage of traffic areas** ● Understanding the functioning and importance of surface drainage.

	• Distinguish between bound and unbound construction methods in traffic infrastructure. • Planning of gradients, gutters, troughs, swales or sewer connections. **3. Challenges posed by soil sealing & urbanisation** • Recognise how increasing development and soil sealing affect natural water cycles. • Understanding consequences such as flooding, heat islands, loss of infiltration areas and ecological impacts. **4. Evaluating and applying innovative building materials** • Overview of new materials such as permeable pavements, recycled building materials or climate-active surfaces using Klimastein • Evaluation in terms of ecology, cost-effectiveness, rainwater retention, durability and areas of application. **5. Further application examples / potential uses for Klimastein in complex climate systems (rainwater cycle, evaporation, cooling)**
EQF Level	3-4
Target Audience	Road builders, landscaping contractors, civil engineering technicians, support staff and career changers with 6 months' professional experience
Learning Outcomes	**Know What (Knowledge: understanding terms, facts and fundamentals)** • Understanding the correct construction methods • Understanding drainage of traffic areas • Recognising current challenges relating to soil sealing / urbanisation • Selecting modern, sustainable building materials in a targeted manner (knowledge of materials) • Evaluating innovative building materials (knowledge of properties) **Know-how (Application: practical implementation, planning, assessment)** • Be able to plan and assess structures that are durable, safe and cost-effective • Divert water effectively, prevent damage and ensure operational safety • Use modern, sustainable and innovative building materials professionally **Know Why (Understanding: recognising connections, reasons and significance)** • Develop an awareness of sustainable planning and modern drainage concepts (take into account in practice) • Select modern, sustainable building materials in a targeted manner (sustainability considerations)

	• Evaluate innovative building materials (ecological/technical justification)
Delivery Mode	Face-to-face teaching Lecture-based teaching with examples using a 3D model and practical demonstrations, on-site observations, expert talks and exchange of experiences Optional: Experimental mini-labs with infiltration tests using various surface materials. Comparison of water absorption, runoff behaviour and temperature development. Photo and video documentation of damage cases (Problem-Based Learning (PBL) starting with a specific problem: "Why is this car park constantly flooded?" Optional: Visit to a climate trail in the Park der Gärten on 6 May (addition: observation of botany)

Course Title	**Introduction to Nature Based Solutions and other Sustainable Practices for Buildings and Infrastructure resilience**
Micro-credential Title	Nature Based Solutions and Sustainable Practices for Buildings and Infrastructure resilience
Issuing Institution	Democritus University of Thrace (Life Long Learning Center)
Country	Greece
Course Summary	Sustainable construction is achieved not only through "green" products, but through better decisions across the whole life cycle of buildings and infrastructure—from planning and design to construction, operation, maintenance and end-of-life. This introductory micro credential provides technical staff, students and early-career professionals with a practical overview of widely used sustainable practices in civil engineering and construction. Topics include resource efficiency and circularity. Learners are introduced to climate-resilient approaches and how to recognise opportunities for nature-based solutions (NbS) such as permeable surfaces, swales/bioretention, green roofs, riverbank or slope stabilisation and other measures that can complement conventional ("grey") infrastructure for stormwater, heat and erosion challenges. Through simple case scenarios and checklists, participants learn to identify suitable options, understand basic trade-offs (cost, maintenance, performance), and communicate clear sustainability actions within a project team.

EQF Level	EQF Level 4–5 (introductory; accessible to technical staff, and suitable for EQF 6 learners as a foundation course)
Target Audience	Primary: technical staff, site technicians, forepersons, junior site supervisors and municipal works staff involved in building and infrastructure projects (EQF 4–5). Secondary: engineering students (civil, environmental, architectural), junior engineers, and professionals seeking an accessible foundation in sustainable construction practices, including NbS.
Learning Outcomes	Upon completion of this course, the learner will be able to: • Describe core sustainability principles for buildings and infrastructure across the project life cycle (materials, energy, water, biodiversity and resilience). • Identify practical actions that reduce resource use and embodied impacts (accurate quantities, reuse, waste prevention and segregation). • Apply basic low impact site practices to protect the environment during construction (dust/noise control, runoff and spill prevention). • Explain nature based solutions (NbS) and match suitable NbS options to common challenges (stormwater, urban heat, erosion/slope stability), including basic maintenance considerations. • Use a simple screening checklist to compare conventional and sustainable options and communicate co-benefits and trade-offs to a project team.
Delivery Mode	Fully online (asynchronous) with one optional live webinar/workshop for case-based exercises.

Course Title	**Rehabilitation and Life-Extension of Existing Buildings**
Micro-credential Title	Rehabilitation and Life-Extension of Existing Buildings
Issuing Institution	Democritus University of Thrace (Life Long Learning Center)
Country	Greece

Course Summary	This micro-credential develops hands-on competence for rehabilitating existing buildings through repair and strengthening works that extend service life and enable safe continued use. The course emphasises preservation as a green skill: well-executed rehabilitation reduces demolition, construction waste and the need for replacement works. Participants learn step-by-step site procedures for substrate assessment and preparation, application of FRP strengthening systems, and shotcrete repair/strengthening techniques. sessions focus on cementitious repair and strengthening (including shotcrete/repair mortars) and FRP strengthening systems, with demonstrations of additional methods where feasible (e.g., crack sealing/injection, jacketing concepts). Participants practice step-by-step workflows—mixing, application, curing and defect prevention—and carry out basic quality checks and records to minimise rework. The course is designed for technical staff (EQF 4–5) and is also suitable for engineers and students seeking applied understanding of rehabilitation techniques and site quality control.
EQF Level	EQF Level 4-5
Target Audience	Primary: concrete repair technicians, rehabilitation crews, applicators, site technicians and foremen involved in maintenance/repair/strengthening works. Secondary: civil/structural engineers, engineering students and site supervisors who need practical understanding of application procedures and quality control.
Learning Outcomes	• Inspect an existing concrete element and prepare substrates correctly for rehabilitation works (removal of unsound material, cleaning, roughening, moisture control). • Apply an FRP strengthening system following correct preparation, mixing, bonding and curing procedures. • Apply shotcrete for repair/strengthening using correct setup, spraying technique basics and curing practices. • Perform basic workmanship and quality checks (coverage, thickness, defects) and record findings. • Follow health, safety and environmental precautions and explain how life-extension rehabilitation supports reuse of existing buildings.
Delivery Mode	Blended (approx. 30% theory online + 70% face-to-face practical sessions in lab/site).

Micro-credentials in Construction

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Work Package 4 Micro-credential Development and Quality Assurance

Deliverable D4.1 Report with Analysis of Micro-credential Provision and Quality Assurance for a Green Skills Micro-credentialing Ecosystem in the Construction Sector

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