Green JOBS

RFCS RESEARCH PROJECT

Leveraging the competitive advantages of end-of-life underground coal mines to maximise the creation of green and quality jobs

Grant Agreement 101057789

Deliverable 5.3

Training and re-skilling plans for the transition from coal to renewable energy sectors

Co-funded by the European Union

Research Fund for Coal & Steel

Authors

Omar Alexánder León García, Universidad de Oviedo

Deliverable 5.3	
Due date of Deliverable	30.11.2025
Start - End Date of Project	01.07.2022 – 31.12.2025
Duration	3.5 years
Deliverable Lead Partner	UNIOVI
Dissemination level	Public
Work Package	WP 5
Digital File Name	D5.3 Training and re-skilling plans for the transition from coal to renewable energy sectors
Keywords	Reskilling, Training Programmes, Renewable Energy, Transferable Competences, Skill level

Disclaimer

Table of contents

List of Figures

List of Tables

Executive Summary

The shift from coal-based economies to renewable energy systems represents both a technological and a social challenge. In former coal regions, the decline of mining has left communities facing the urgent need for economic alternatives and re-employment opportunities. A just transition requires equipping former mining workers with the skills needed to access new green jobs and actively contribute to the energy transition.

This deliverable addresses that challenge by presenting a set of training and re-skilling programmes tailored to support the transfer of competences from coal mining to renewable energy sectors. While coal mining relied on technical expertise in equipment handling, electrical and mechanical maintenance, process operation, and safety protocols, many of these skills are directly applicable to technologies such as solar, wind, hydropower, green hydrogen, and energy storage. Recognising and leveraging these transferable competences allows training initiatives to be designed efficiently, minimising costs and reducing time to qualification.

The programmes proposed in this deliverable are structured across different educational levels to ensure inclusiveness and accessibility. At vocational and apprenticeship levels, they provide practical training for operational roles. In continuing education, they target supervisory and technical positions, while at university level they introduce cross-sectoral programmes designed to prepare graduates for complex, multidisciplinary challenges.

All programmes are aligned with the European Qualifications Framework (EQF), ensuring both academic recognition and professional relevance. Their modular and flexible structure, built on micro-credentials where appropriate, enables progressive skill acquisition and supports lifelong learning. The deliverable provides a comprehensive framework for transforming existing mining competences into future-oriented capabilities for the renewable energy sector.

1 INTRODUCTION

The transition towards a renewable and sustainable energy system is not only a technological challenge but also an educational one. Beyond the deployment of new infrastructures, the success of the energy transition depends on the availability of a skilled workforce capable of operating, maintaining, and optimising emerging technologies. In regions historically reliant on coal mining, this challenge acquires a critical socio-economic dimension: offering pathways for former mining workers to reintegrate into the labour market through targeted education, re-skilling, and up-skilling programmes.

Coal mining has historically required competences in equipment handling, electrical and mechanical maintenance, safety protocols, process operation, and logistics. Although developed in a fossil-based context, many of these skills are transferrable to renewable energy systems such as solar, wind, hydropower, green hydrogen, and energy storage. Recognising and leveraging this transferability enables the design of training pathways that are more efficient, reducing costs and time to qualification while ensuring inclusiveness in the transition process.

The objective of this deliverable is to design training and re-skilling programmes that translate previous analytical work on occupational profiles into concrete educational frameworks. By providing modular, scalable, and EQF-aligned programmes, the deliverable ensures that workers at different educational levels can access meaningful learning opportunities. The approach adopted for programme design is structured around a set of key tasks:

- Identification of training needs: aligning coal mining competences with renewable energy requirements to define skills gaps.
- Definition of learning pathways: establishing vocational, technical, and academic routes tailored to low-, medium-, and high-skilled profiles.
- Design of modular structures: creating programmes based on micro-credentials and modular units that enable flexible progression and lifelong learning.
- Integration of cross-sectoral programmes: incorporating university-level degrees and postgraduate studies that provide advanced and multidisciplinary expertise in renewable energy systems.
- Reference to EQF standards: ensuring compatibility with the European Qualifications Framework to facilitate recognition and transferability across contexts.

Together, these tasks ensure that the proposed programmes are both practical and future-oriented. At vocational schools and apprenticeships, they provide operational training for roles such as plant operators, technicians, and assistants. In continuing education, they focus on supervisory, maintenance, and process optimisation competences. At university level, they introduce cross-sectoral academic programmes such as a Bachelor's Degree in

Degree in renewable energy and sustainability engineering and a Postgraduate Programme in Advanced Renewable Systems Integration, both designed to equip graduates with the capacity to design, manage, and optimise complex energy systems.

The guiding principles of this design are threefold: leveraging transferable competences to reduce the learning curve for former coal mining workers; ensuring flexibility and modularity so that training can be adapted to diverse learner profiles and industry dynamics; and maintaining alignment with industry needs and academic standards, guaranteeing both professional relevance and educational recognition.system.

2 METHODOLOGICAL FRAMEWORK

The development of training and re-skilling plans for former coal workers under the GreenJOBS project follows a structured methodology aligned with European standards and best practices in vocational education and training. The framework ensures that all proposed programmes are adaptable, recognisable, and transferable across EU Member States, supporting a just and inclusive transition to renewable energy sectors.

This deliverable builds directly upon the findings of Deliverable 5.2, which analysed the occupational profiles of coal sector workers, mapped them against renewable energy value chains, and identified competence gaps and potential for re-skilling. The present document focuses on the translation of those analytical findings into actionable training plans, aligned with European education and labour frameworks.

The methodology combines several European tools and frameworks: the EQF, the European Skills, Competences, Qualifications and Occupations (ESCO) classification of skills and occupations, the microcredentials initiative, the learning outcomes approach, and quality assurance mechanisms (Commission, 2019). Microcredentials, in particular, are recognised for their potential to connect people's skillsets with labour market demand in a rapidly changing world of work (Cedefop, 2024) These elements provide a coherent basis for designing modular, flexible training paths that meet labour market needs and are tailored to the profiles of ex-coal workers.

2.1 Alignment with the European Qualifications Framework (EQF)

The EQF is used as the main reference system for assigning levels to each training programme. This enables comparison of qualifications across countries and helps identify appropriate educational levels for each target group. It supports both vertical progression (e.g., from vocational to higher education) and horizontal transferability (e.g., between sectors such as mining and renewable energy). This flexibility is further enhanced by the integration of microcredentials, which offer agile, targeted learning opportunities that can be stacked and recognised within the broader EQF structure, thus supporting a more responsive and personalised upskilling pathway (Cedefop, 2023; Pouliou, 2024).

Each training plan developed in this deliverable is referenced to an EQF level (typically ranging from Level 2 to Level 8) reflecting the complexity of the learning outcomes expected in terms of knowledge, skills, and autonomy/responsibility. The table 2-1 summarizes the key characteristics of each EQF level, including the type of knowledge, required skills, degree of autonomy, and typical job roles associated with each stage of professional development.

Table 2-1. EQF Levels and their application in Training Programs

EQF Level	Type of Knowledge	Type of Skills	Degree of Autonomy and Responsibility	Typical Roles
Level 2	Basic factual knowledge of simple principles in a field of work or study.	Basic cognitive and practical skills needed to use relevant information.	Works under direct supervision in structured environments.	Assistant technician, entry-level operator.
Level 3	Knowledge of facts, principles, processes, and general concepts.	Ability to apply skills to complete tasks and solve routine problems.	Limited responsibility; some autonomy in familiar tasks.	Maintenance technician, logistics worker.
Level 4	Factual and theoretical knowledge in broad contexts within a field.	Cognitive and practical skills to solve specific problems.	Can work independently with limited supervision; may supervise others.	Field technician, quality inspector.
Level 5	Broad, specialised, factual and theoretical knowledge.	Skills to develop creative and adaptive solutions.	Manages processes; takes responsibility for technical decisions.	System integrator, plant supervisor.
Level 6	Advanced knowledge in a field involving critical understanding.	Skills to solve complex problems and make informed decisions.	High autonomy; responsible for people, resources, and project outcomes.	Project engineer, energy consultant.
Level 7	Highly specialized knowledge at the forefront of a field, including critical awareness of interdisciplinary connections.	Advanced skills to solve complex, unpredictable problems with innovative approaches; integrates research into practice.	Full autonomy; leads strategic decision-making, manages teams/resources, and assumes accountability for organizational outcomes.	Senior engineer, research manager, policy advisor, director of operations.
Level 8	Mastery of the most advanced knowledge in a field, contributing to original research/thinking	Transformative skills to develop new paradigms, synthesize ideas across disciplines, and guide groundbreaking solutions.	Highest autonomy; responsible for visionary leadership, ethical standards, and shaping the future of the field.	CEO, university professor, chief scientist, top-tier consultant.

Source: Adapted from (Cedefop, 2017)

This structured approach ensures three key benefits:

1. Transparency – Employers and learners can clearly understand the expected competencies at each level.

2. Consistency – Qualifications remain comparable across different education systems in the EU.

3. Flexibility – Workers can leverage Recognition of Prior Learning (RPL) to validate their experience and transition into new roles with targeted upskilling.

Progression pathways enable individuals to build on their competencies and move across levels or sectors throughout their careers.

In a broader context, the EQF is recognised not only as a technical tool but as a transformative meta-framework that unifies and modernises qualifications throughout the European Union. Adopted by the European Parliament in 2008, the EQF promotes transparency, rationalisation, and comparability of qualifications across Member States, especially where national systems are diverse and fragmented (Coles, 2007; Méhaut & Winch, 2012). This modernisation effort is increasingly interacting with new forms of credentialing, as evolving qualification systems begin to incorporate microcredentials to enhance their agility and responsiveness (Cedefop, 2023).

The EQF shifts the focus from formal educational inputs to learning outcomes, defining what people know, understand, and are able to do (regardless of how or where that learning was acquired). In this sense, the EQF not only promotes transparency but also enables the recognition of informal and non-formal learning, a key factor in just transition processes.

2.2 Use of ESCO for Competence and Occupation Mapping

The ESCO classification is a multilingual vocabulary that identifies and categorises skills, competences, qualifications, and occupations relevant for the EU labour market and education and training (Commission, n.d.-b). This classification enables the precise identification of skill transferability between former coal mining occupations and emerging roles in the renewable energy sector. Its granular structure, which distinguishes between essential and optional skills, allows for the tailoring of training programmes to specific occupational profiles.

Furthermore, ESCO's integration into platforms such as Europass enhances the visibility and transparency of these competencies for both learners and employers, supporting informed career decisions and mobility across the EU (Commission, 2022). In this context, the ESCO classification system is applied to:

- Identify relevant occupations in the renewable energy sector.
- Map transferable skills from coal mining jobs.
- Define the competence requirements for new roles.

As a multilingual and standardised vocabulary, ESCO facilitates the construction of occupation-to-occupation transition matrices, which have been crucial in:

- Determining which mining roles are most suitable for reskilling into renewable energy occupations.
- Identifying competence gaps to be addressed through targeted training.
- Distinguishing the core and optional skills required for each target role.

This approach ensures that all proposed training programmes are labour-market oriented, aligned with current occupational standards, and supportive of just transition goals.

Significantly, the classification of occupations used in this deliverable is based on the outputs of Deliverable 5.2, which systematically mapped key occupations across the coal and renewable energy value chains, which categorises occupations according to energy technology (e.g., wind, solar, geothermal, hydrogen, batteries), stages in the value chain (e.g., manufacturing, installation, O&M), and skill level (high, medium, low). This foundational analysis underpins the selection of occupations for which training programmes are proposed in this document.

2.3 Microcredential-Based Modular Approach

The training plans are designed using a microcredential-based modular structure, in line with the European Council Recommendation on Microcredentials (2022). This approach responds to the increasing demand for flexible, accessible, and labour-market-relevant learning opportunities (Cedefop, 2024), particularly in the context of just transitions, where workers must quickly adapt to evolving sectoral needs. This model allows for:

- Short, targeted training modules that focus on specific skills or knowledge areas, aligned with occupational profiles and EQF levels.
- Flexible learning formats, including online, hybrid, and in-person delivery, facilitate access for adult learners, workers in remote areas, and those with family or work commitments.
- Stackable learning paths, enabling learners to progressively combine microcredentials over time to achieve a full qualification or diploma.

To ensure clarity, consistency, and quality, each training module incorporates the following key components:

- Clearly defined learning outcomes, in accordance with EQF descriptors (knowledge, skills, autonomy/responsibility).
- Estimated workload, expressed in hours or credits, to ensure transparency and comparability.
- Assessment criteria and methods, to validate the acquisition of competences, whether through practical demonstrations, tests, portfolios, or simulated tasks.

This modular approach delivers significant advantages by enabling:

- Supports rapid upskilling and reskilling, crucial for workers transitioning from the mining sector to the renewable energy sector.
- Facilitates RPL, allowing learners to validate previous experience and avoid redundancy.
- Promotes lifelong learning by enabling individuals to return to training throughout their careers without needing to commit to full-length programmes from the outset.
- Enhances mobility across sectors and countries, as microcredentials can be documented, shared, and recognised independently.

Furthermore, the use of microcredentials aligns with the European digital credential framework, which allows for secure digital documentation of learning achievements, increasing employability and transparency for employers, especially in emerging and rapidly evolving sectors such as geothermal energy, offshore wind, or battery technologies.

In the context of the training plans included in this deliverable, microcredentials are not standalone alternatives to full diplomas, but rather building blocks that can either lead to a comprehensive qualification or be used independently to certify critical competences.

This aligns with the perspective that microcredentials hold significant potential in vocational education and training (VET) by focusing on equipping learners with specific employability skills, moving beyond their traditional association with higher education (Pouliou, 2024). This makes them highly adaptable tools for just transition strategies, ensuring that both immediate job market needs and longer-term career development are addressed. The successful implementation of microcredentials depends on their ability to combine agility with credibility, ensuring they are both responsive to labour market needs and robustly integrated into evolving national qualification systems (Cedefop, 2024).

2.4 Competency-Based Curriculum Design (Learning Outcomes)

All training programmes are structured using a learning outcomes approach, as recommended in the EQF and ECVET (European Credit System for Vocational Education and Training) frameworks.

The ECVET is one of the key EU instruments designed to help individuals transfer, recognise, and accumulate their assessed learning outcomes to achieve a qualification or participate in lifelong learning through flexible and individualised learning pathways (Commission, n.d). This ensures that the training is not defined by time or content alone, but by the competences actually acquired by the learner. Each module or programme includes outcomes under three categories:

- Knowledge (theoretical and factual)
- Skills (cognitive and practical)
- Responsibility and autonomy (personal and social competences)

This competency-based methodology delivers three key benefits for learners and institutions alike:

- Facilitates modular certification and recognition of learning.
- Encourages learner-centred teaching and assessment.
- Supports the development of skills that are directly applicable in the workplace.

2.5 Quality Assurance and Recognition of Prior Learning

The design of the training plans incorporates elements of EQAVET (European Quality Assurance Reference Framework for Vocational Education and Training), a framework designed to promote a culture of quality improvement in VET and to enhance transparency, consistency, and trust in VET systems across the EU (Commission, n.d.-a). Key elements integrated from this framework include:

- Relevance to labour market needs.
- Learner satisfaction and outcome tracking.
- Continuous improvement based on feedback and monitoring.

Moreover, the methodology includes provisions for Recognition of Prior Learning (RPL). Many former coal workers already possess valuable skills in machinery operation, maintenance, safety, and systems control. Where applicable, the training plans are designed to:

- Allow validation of existing competences.
- Offer tailored pathways that avoid redundancy.
- Reduce training duration and costs for experienced workers.

3 STRUCTURE OF TRAINING PLANS

3.1 Overview of Template and Key Components

Each training plan follows a standardized template designed to ensure consistency, comparability, and alignment with European frameworks such as EQF and ESCO. The key components of the training plan include:

- Key Occupation: Specifies the target role aligned with labour market needs in the renewable energy sector.
- Training Programme Title: Describes the nature and focus of the training intervention.
- Mining Profile: Indicates the typical coal-related occupation from which the learner might be transitioning.
- Energy Technology: Specifies the relevant renewable energy domain (e.g., wind, solar, geothermal).
- EQF Level: Defines the expected complexity and autonomy level in terms of knowledge, skills, and responsibility.
- Training Description: A concise explanation of the purpose, scope, and goals of the programme.
- Modules / Microcredentials: Lists learning units that can be delivered as stackable microcredentials to facilitate flexible, progressive learning.

This template ensures traceability across profiles and levels, supports modular learning, and helps learners and institutions understand where each programme fits within broader qualification pathways.

3.2 Common structure across renewable energy technologies

Despite differences in technical requirements across renewable energy technologies (wind, solar, geothermal, etc.), the training plans maintain a common structural approach to promote standardisation and mobility. The shared elements include:

- Microcredential-Based Modular Design: All training programmes are divided into discrete modules which can be delivered and certified independently, allowing for lifelong learning and rapid upskilling.

- ESCO-Based Competence Mapping: Core and optional competencies for each programme are derived from the ESCO classification, ensuring labour market relevance.
- Learning Outcome Focus: Programmes emphasise practical and measurable learning outcomes, as per the EQF's learning-outcome approach.
- Flexible Delivery Modes: Modules can be delivered in-person, online, or hybrid formats, enhancing accessibility for adult and displaced learners.

This structural uniformity ensures that despite technological differences, learners benefit from consistent training quality, and employers can interpret qualifications easily across sectors.

3.3 Classification by Skill Level (High, Medium, Low)

Training plans are categorised according to the skill level required for the corresponding occupation, using a simplified classification of:

Low Skill Level (EQF 2–3): Basic tasks performed under supervision; suitable for entry-level workers transitioning from general manual or plant operations. Example: Assistant in the operation of pumps and geothermal circuits.

Medium Skill Level (EQF 4–5): Roles requiring technical skills, autonomy, and problem-solving. Example: Solar panel installer technician or Wind systems supervisor.

High Skill Level (EQF 6+): Professional or engineering-level positions demanding comprehensive knowledge and responsibility. Example: Energy efficiency engineer or Solar system design specialist.

This classification supports better matching of learners to appropriate pathways based on their background, aspirations, and recognition of prior experience.

3.4 Education Levels Covered (VET, Adult Learning, University)

The training plans span across a wide range of educational domains, facilitating a just transition for workers from diverse educational backgrounds:

- Vocational Education and Training (VET): Focused on practical, hands-on learning for technical and operational roles; usually aligned with EQF levels 2–4.
- Adult Learning/Upskilling Pathways: Targeted short-term training and microcredentials tailored for displaced coal workers and adult learners seeking rapid integration into renewable energy roles.

- Higher Education/University Programmes: Longer academic programmes, particularly relevant at EQF level 6 and above, for professional and managerial roles.

This diversity ensures that both entry-level and highly experienced workers can find accessible and relevant learning opportunities aligned with their individual needs.

Finally, Figure 1 presents a complete framework for training program design. It begins with a list of program components, detailing the key elements of each course, from its purpose to the technologies and competencies involved. It then organizes these programs into a tiered system based on skill level, ranging from foundational to advanced. This structured approach connects each program component to a specific educational pathway, creating a clear guide for career progression.

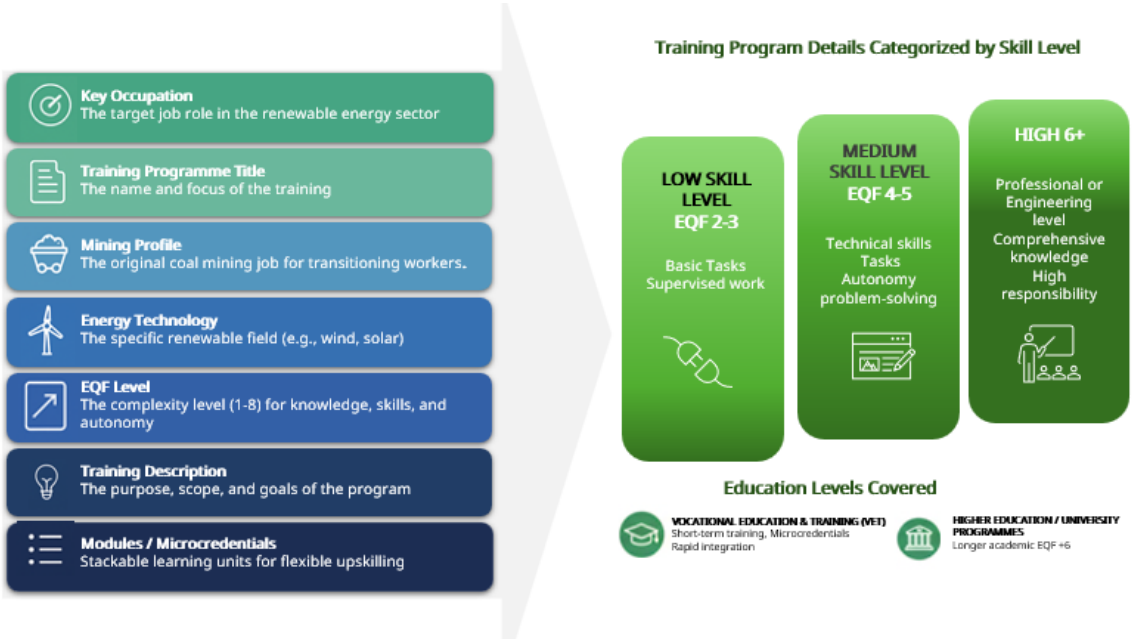

Figure 3-1. Training program details categorized by skill level

4 TRAINING PLANS BY RENEWABLE ENERGY SECTOR

This section outlines the proposed training plans for key renewable energy sectors (RES) relevant to a just transition from mining activities. The programmes have been designed following a modular, microcredential-based approach, aligned with EQF levels and prioritising skills transfer from mining to clean energy value chains. Each renewable energy sector is described in terms of target occupations, skill gaps, and thematic focus areas, supported by training pathways that allow for both rapid upskilling and lifelong learning.

The following subsections provide the detail by energy source.

4.1 Wind Energy

The wind energy sector stands out as a major pillar in the renewable energy transition, offering considerable employment potential for former coal workers. This is due to the sector's reliance on industrial maintenance, mechanical assembly, technical inspection, and safe operation at heights, all areas where mining workers already possess foundational experience. Roles such as wind turbine technicians, onshore maintenance workers, and installation coordinators often require a mix of practical know-how, physical resilience, and safety awareness, competences familiar to mining environments.

To facilitate this transition, the training plans for wind energy have been aligned with the EQF, ranging from EQF Level 2 (entry-level assistant roles) to Level 5 (technicians and supervisors). These plans follow a modular and microcredential-based structure, allowing displaced workers to acquire industry-relevant skills through short, stackable courses. This design supports progressive learning, enabling individuals to enter the sector quickly and continue building towards full qualifications while working.

The structure also recognises prior learning (formal, informal, or non-formal), making it easier for workers to validate their existing competences and reduce training time. In this way, the wind energy training strategy contributes to both economic inclusion and workforce mobility.

The training content focuses on key thematic areas such as mechanical and electrical maintenance, safety and rescue protocols, logistics and assembly of turbine components. Targeted profiles include wind turbine assistants, maintenance technicians, rotor blade inspectors, project supervisors, and advanced wind technicians. These profiles have been carefully selected to match real labour market needs and to align with the most transferable competences from the coal sector. Table 4.1 below provides an overview of the proposed training programmes by target occupation, EQF level, and technical focus.

Table 4-1. Wind Energy Training Programmes

Key Occupation	Training Programme	Mining Profile	EQF Level	Training Description	Modules / Microcredentials
Wind Turbine Assistant	Assistant in Wind Turbine Ground Operations	General plant assistant, shaft worker	2–3	Basic training for supporting wind turbine operations at ground level, including logistics and safety.	• Basic wind safety and PPE (personal protective equipment) • Manual handling and logistics • Ground signal communication
Maintenance Technician	Wind Turbine Maintenance Technician	Electrical or mechanical maintenanc e worker	4	Training in troubleshooting and maintaining mechanical/electrical systems in wind turbines.	• Electrical systems basics • Mechanical diagnostics • Preventive maintenance routines
Rotor Blade Inspector	Blade Damage Inspection and Minor Repairs	Surface technician, mechanical assistant	4	Specialized training for visual and ultrasonic inspection of rotor blades and minor structural repairs.	• Blade inspection techniques • Composite repair methods • Working at height certification
Wind Project Supervisor	Supervisor for Onshore Wind Farm Operations	Foreman, crew coordinator	5	Planning, supervising, and reporting on wind turbine installation and maintenance tasks.	• Project coordination • Health and safety leadership • Technical documentation
Advanced Wind Energy Technician	Advanced Design and Integration of Wind Energy Systems	Requires prior engineering background	5	Advanced technical training in wind turbine system optimisation, including SCADA-based monitoring, performance improvement, and integration into electrical networks. Focus on practical design tools and operational data analysis	•SCADA systems and performance data analysis (Supervisory Control and Data Acquisition) •Grid connection and compliance •Wind farm layout and optimisation tools

As an example, Table 4.2 describes a structured training plan for transitioning mining workers to the wind energy sector as Assistant in Wind Turbine Ground Operations.

Designed for general plant assistants and pit workers (EQF levels 2-3), this 120-hour hybrid program combines online learning with hands-on experience, culminating in three stackable microcredentials. The curriculum focuses on safety, logistics, and communication, building on miners' existing skills in manual handling and risk awareness while providing a clear pathway to advanced positions (e.g., Wind Turbine Technician). Recognition of Prior Learning (RPL) accelerates access for experienced workers, ensuring an efficient transition to careers in the renewable energy sector.

Table 4-2. Outlines examples of training plans designed for the wind energy sector

Programme Title	**Assistant in Wind Turbine Ground Operations**			
Key Occupation	Wind Turbine Assistant			
Target Mining Profile	General Plant Assistant, Shaft Worker			
Renewable Energy Sector	Wind Energy			
EQF Level	2–3			
Total Duration	120 hours (4 weeks full-time / 8 weeks part-time)			
Delivery Mode	Hybrid (Online + In-Person Practical Training)			
Certification	3 Microcredentials (1 per module)			
Training Objectives	1. Enable safe, effective ground-level support in wind energy operations. 2. Facilitate the transition of coal workers to the renewable sector. 3. Provide stackable training for progressive upskilling.			
Learning Outcomes	1. Use PPE and follow wind farm safety protocols. 2. Assist in logistics and manual handling of components. 3. Apply ground signalling techniques to coordinate with technical teams.			
Assessment Methods	1. Knowledge Test (30%) 2. Practical Demonstration (40%) 3. Team-Based Scenario (30%)			
Recognition of Prior Learning (RPL)	Available for relevant mining experience in safety procedures and logistics operations.			
Progression Pathway	Leads to mid-level training (e.g. Wind Turbine Technician – EQF 4)			
Module Title	**Description**	**Duration**	**Key Competencies Acquired**	**Microcredential Awarded**
Wind Safety and PPE	Covers identification of site-specific hazards, correct use and inspection of personal protective equipment (PPE), fall protection systems, and emergency evacuation protocols. Emphasises wind-farm-specific safety standards and procedures.	40 hours	• Identify and mitigate common safety risks on wind energy sites • Select and use appropriate PPE correctly • Execute emergency procedures safely and efficiently	Certificate in Wind Safety and PPE

Manual Handling & Logistics	Trains learners in the basics of logistics support for turbine operations. Includes manual lifting techniques, tool and part handling, transportation, storage, and material flow at turbine sites.	40 hours	• Apply correct lifting and material handling techniques • Support warehouse, storage, and onsite logistics • Assist with loading, unloading, and transport coordination	Certificate in Logistics Support
Ground Signal Communication	Focuses on communication protocols between ground and turbine teams. Includes the use of standard hand signals, radio procedures, and coordination techniques during installation and maintenance.	40 hours	• Execute hand and radio signals accurately • Communicate effectively in a technical team • Ensure safe coordination of turbine assembly or service tasks	Certificate in Signal Operations

The detailed training plans for the remaining wind energy programmes, including Wind Turbine Maintenance Technician, Blade Damage Inspection and Minor Repairs, Supervisor for Onshore Wind Farm Operations, and Advanced Design and Integration of Wind Energy Systems, can be found in Appendix A.

4.2 Photovoltaic Energy

Photovoltaic Energy (PV) is one of the most accessible entry points into the renewable energy workforce, especially for individuals transitioning from manual or semi-skilled occupations. Installation, cabling, basic electrical work, and system maintenance are all areas that align closely with the skills and habits developed in mining-related activities such as equipment handling, fieldwork, and compliance with safety protocols.

The modular training plans for this sector have been mapped to EQF levels 2 through 5, depending on the complexity and responsibility associated with each role, from entry-level installers to solar system supervisors. Each module is linked to a specific learning outcome and microcredential, ensuring that learners can demonstrate their competence in a tangible and recognised way.

The use of microcredentials is particularly valuable for PV, as it allows rapid workforce deployment through short-term training, while also offering flexibility for continued education. In addition, the combination of theoretical modules (e.g., photovoltaic principles) with practical content (e.g., mounting systems or electrical safety) ensures a balance between knowledge acquisition and hands-on training.

The main thematic areas in these programmes include PV systems installation, maintenance, electrical safety, and operational management. Target occupations range from auxiliary PV installers and maintenance technicians to PV systems specialists and plant supervisors. Table 4.3 summarises the main training pathways, target profiles, EQF levels, and their core content.

Table 4-3. Photovoltaics Energy Training Programmes

Key Occupation	Training Programme	Mining Profile	EQF Level	Training Description	Modules / Microcredentials
Auxiliary PV Installer	Auxiliary in Solar Panel Installation	Mining Helper, Surface Operator	2–3	Basic assembly of solar module structures, preliminary wiring, and assistance to senior installers during on-site works.	•Structural assembly • Basic wiring • PPE and use of hand tools
Residential PV Installation Technician	Residential Photovoltaic Panel Installation	Electrical Technician, Maintenance Assistant	3	Installation of small-scale PV systems for residential and rural areas, integrating structural and basic electrical components.	•Basic electricity • Structural mounting •Inverter cabling •Electrical safety regulations
PV Maintenanc e Technician	Maintenance in Photovoltaic Systems	Plant Technician, Electrical Operator	3–4	Inspection, cleaning, and preventive maintenance of PV systems, including basic troubleshooting and electrical checks.	•Panel cleaning • Connection checks •Voltage verification •Preventive maintenance
PV Systems Specialist	Installation and Maintenance of Solar Systems	Electrician, Mechanic	4	Advanced installation, configuration, and performance optimisation of PV systems, including grid integration.	•System design •Inverters •Grid connection •Predictive maintenance
Photovoltaic Plant Supervisor	Photovoltaic Plant Supervisor	Plant Foreman	5	Management of plant operations, staff coordination, SCADA monitoring, and compliance with regulatory frameworks.	•Team leadership •Electrical regulations •SCADA systems • Management skills

The comprehensive training frameworks for the photovoltaic energy sector, encompassing programmes such as Auxiliary in Solar Panel Installation, Residential Photovoltaic Panel Installation, Maintenance in Photovoltaic Systems, Installation and Maintenance of Solar Systems, and Photovoltaic Plant Supervisor, are meticulously detailed in Appendix B. All programme emphasizes practical skills, safety protocols, and industry-relevant competencies, ensuring seamless integration into the photovoltaic workforce while supporting progressive upskilling and recognition of prior learning..

4.3 Geothermal Energy

Geothermal energy systems require a unique mix of mechanical, hydraulic, and geological expertise. This sector is especially well-suited for mine workers with experience in subsurface operations, pumping systems, drilling, and equipment maintenance. Moreover, the strong emphasis on safety and thermal control in geothermal plants echoes many of the procedures already familiar to mining professionals.

To bridge the transition into geothermal roles, the proposed training plans are organised by EQF levels, typically between Level 2 (auxiliary operators) and Level 5 (plant technicians or drilling coordinators). These are delivered in modular formats, enabling workers to gradually build knowledge in areas such as heat transfer, geothermal circuits, or environmental compliance. Each module is designed to stand on its own as a microcredential, which can be accumulated toward a more advanced diploma or certification.

This approach facilitates flexible and adaptive learning while allowing for specialisation in either shallow or deep geothermal systems. In particular, the microcredential system supports the requalification of workers already familiar with similar infrastructure and equipment, enhancing labour market integration and sector mobility.

The geothermal training content focuses on critical thematic areas including geothermal plant operation, preventive maintenance, drilling supervision, and applied geology. Target occupations range from geothermal operations assistants and low-enthalpy plant operators to maintenance technicians, drilling specialists, and applied geologists. These have been selected to leverage the most transferable skills of coal-sector workers, aligning with a progressive upskilling pathway. Table 4.4 below summarises the geothermal training programmes according to target occupations, EQF levels, and specific technical focus.

Table 4-4. Geothermal Energy Training Programmes

Key Occupation	Training Programme	Mining Profile	EQF Level	Training Description	Modules / Microcredentials

Geothermal Operations Assistant	Assistant in Operation of Geothermal Pumps and Circuits	Pump Technician, Plant Operator	2–3	Introduction to geothermal plant operations, focusing on pump systems, closed circuit operation, and basic safety protocols.	• Closed circuits • Basic safety • Preventive maintenance • Meter reading
Low-Enthalpy Plant Operator	Basic Operation of Geothermal Plants	Machinery Operator, Drilling Technician	3	Operation of low-enthalpy geothermal systems, including safety procedures, temperature monitoring, and fluid flow control.	• Geothermal well safety • Temperature monitoring •Flow control •Basic pump maintenance
Geothermal Systems Maintenance Technician	Maintenance in Geothermal Installations	Mining Mechanic, Underground Electrician	3–4	Routine inspection, fault detection, and maintenance of geothermal systems, including mechanical and fluid components.	•Mechanical components •Fault detection • System cleaning • Maintenance records
Geothermal Drilling and Systems Specialist	Geothermal Drilling and Maintenance Technician	Driller, Mechanic	4	Drilling operations, subsurface evaluation, and maintenance of geothermal wells, ensuring long-term performance.	•Types of probes •Drilling equipment •Mud control • Repair and lubrication
Applied Geothermal Geologist	Specialist in Applied Geology for Geothermal Systems	Mine Geologist	5	Geotechnical and geological analysis for geothermal project design, including seismic interpretation and geochemistry.	•Seismic interpretation •Geochemistry •Geological software •Applied geothermal systems

The detailed training architectures for the geothermal energy sector, including programmes such as Assistant in Operation of Geothermal Pumps and Circuits, Basic Operation of Geothermal Plants, Maintenance in Geothermal Installations, Geothermal Drilling and Maintenance Technician, and Specialist in Applied Geology for Geothermal Systems, are thoroughly outlined in Appendix C. Each curriculum prioritizes hands-on expertise, stringent safety standards, and sector-specific skills, fostering effective workforce integration while supporting continuous skill development and recognition of prior learning.

4.4 Green hydrogen

Green hydrogen represents a cutting-edge segment of the energy transition, involving high-tech processes such as electrolysis, hydrogen storage, and gas handling. While the industry is still emerging, its growth potential is substantial, and so is the need for skilled workers. Mining professionals, particularly those with backgrounds in chemistry, electrical safety, and process control, can be retrained to meet these demands.

The training plans for green hydrogen are positioned at EQF Levels 2 to 5, depending on the role (hydrogen plant operators, electrolyzer technicians, hydrogen maintenance technicians, logistics coordinators, and advanced hydrogen systems technicians). The microcredential-based design allows for the gradual acquisition of specialized skills such as handling high-pressure systems, controlling electrochemical processes, managing hydrogen logistics, or ensuring occupational safety in explosive environments.

Given the technical complexity and regulatory sensitivity of hydrogen operations, modular training ensures that each step in the learning pathway is clearly certified and externally validated. This approach builds workforce capacity while supporting ongoing professional development and specialisation.

Key thematic areas for these programmes include the safe operation of hydrogen production facilities, maintenance of hydrogen equipment, system diagnostics, process control, and energy efficiency. Target occupations range from hydrogen plant operators and electrolyzer technicians to maintenance specialists, logistics coordinators, and advanced systems technicians. Table 4.5 summarises the proposed training programmes, target mining profiles, EQF levels, and contents.

Table 4-5. Green Hydrogen Training Programmes

Key Occupation	Training Programme	Mining Profile	EQF Level	Training Description	Modules / Microcredentials
Hydrogen Plant Operator	Basic Operator in Hydrogen Plants	Process Plant Operator	2-3	Operational supervision of electrolysis and hydrogen systems.	•Operating procedures • Safety •Pressure and temperature control
Electrolyzer Technician	Auxiliary Technician in Green Hydrogen Production	Chemical Plant Operator, Technical Assistant	3	Training to support operation and monitoring of electrolysis systems.	•Electrolysis fundamentals • Cell monitoring • Hydrogen safety •Operational parameters control

Maintenance Technician	Maintenance in Hydrogen Facilities	Refrigeration Technician, Mining Mechanic	4	Diagnosis, preventive maintenance, and optimization of hydrogen systems. Autonomy in troubleshooting.	•Advanced lubrication techniques • Leak detection and pressure system diagnostics •Preventive maintenance planning • Safety protocols for high-risk interventions
Logistics Coordinator	Logistics and Hydrogen Storage Coordinator	Logistics Coordinator	5	Management of hydrogen transport, storage, and traceability.	•ADR regulation •Route planning •Specific risk management
Advanced Hydrogen Systems Technician	Advanced Operation and Efficiency of Hydrogen Production Systems	Process Engineer, Electrochemical Technician, Energy Consultant	5	High-level technical training for the configuration, optimisation, and process control of hydrogen production systems. Includes advanced use of automation, SCADA, and energy modelling tools to improve efficiency and safet.	•Applied chemistry for hydrogen systems • Automation and process control •SCADA monitoring and analysis •Energy models and efficiency simulation

The in-depth training blueprints for the green hydrogen energy sector, covering programmes such as Basic Operator in Hydrogen Plants, Auxiliary Technician in Green Hydrogen Production, Maintenance in Hydrogen Facilities, Logistics and Hydrogen Storage Coordinator, and Advanced Operation and Efficiency of Hydrogen Production Systems, are elaborately presented in Appendix D. Respectively training pathway emphasizes practical competencies, robust safety protocols, and specialized technical knowledge, ensuring smooth integration into the green hydrogen workforce while promoting progressive upskilling and the validation of prior learning.

4.5 Pumped hydro System (PHS)

Pumped hydro is one of the most mature and large-scale energy storage technologies, often integrated into mountainous or water-rich regions, many of which overlap with areas of traditional mining activity. The operation and maintenance of PHS systems involve mechanical systems, fluid dynamics, electrical regulation, and large-scale infrastructure

management, which align closely with mining occupations such as equipment operators, hydraulic system technicians, and environmental engineers.

Training plans for this sector are aligned with EQF Levels 3 to 5 and adopt a modular structure that facilitates gradual skill acquisition through microcredentials. Modules may cover hydro-mechanical components, turbine and pump operation, dam safety protocols, and real-time system monitoring. Given the high safety and environmental standards required in PHS facilities, specific training on compliance, control systems, and emergency preparedness is also included. This sector offers a direct and realistic transition pathway for workers from mines located near existing or planned hydro facilities.

The core thematic areas addressed by these training plans include the operation of hydraulic pumping systems, hydroelectric equipment assembly, industrial electrical installations, and structural assembly and supervision of hydro sites. Target occupations range from pump operators and electricians to site supervisors, supporting a staged approach to upskilling. Table 4.6 below details the proposed training programmes, their target occupations, expected EQF levels, and technical contents.

Table 4-6. Pumped Hydro Training Programmes

Key Occupation	Training Programme	Mining Profile	EQF Level	Training Description	Modules / Microcredentials
Plant Operator	Basic Operator in Pumped Hydro Systems	Pump Technician	3	Basic control, monitoring, and safety in pumped hydro storage systems.	•Fluid mechanics basics •Sensor reading •Routine checks
Installation Technician	Assembly and Electrical Installation in Pumped Hydro Plants	Maintenance Assistant, Network Technician	3	Support in assembly of mechanical components and installation of cabling/control systems.	•Plant components •Installation protocols •Electrical safety
Maintenance Technician	Technician in Pumped Hydro Plant Assembly and Maintenance	Welder, Assembly Technician	4	Professional assembly, repair, and maintenance of pumped hydro systems.	•Hydraulic plans •Welding •Structural assembly
Site Supervisor	Supervisor for Pumped Hydro Construction and Operation	Mining Works Supervisor	5	Leadership and coordination of teams in construction and operation stages.	•Site management •Planning and budgeting •Occupational risk prevention

Advanced Pumped Hydro Systems Technician	Advanced Operation and Optimisation of Pumped Hydro Plants	Civil Works Technician, Mechanical Technician	5	Specialised technical training in the operation, optimisation, and monitoring of pumped hydro facilities, including hydraulic modelling, energy efficiency strategies, and SCADA integration for plant control	•Hydraulic modelling and analysis •Energy optimisation strategies •SCADA integration and monitoring •Predictive maintenance for hydraulic systemsHydraulic modelling

The detailed training frameworks for the pumped hydro energy sector, encompassing programmes such as Basic Operator in Pumped Hydro Systems, Assembly and Electrical Installation in Pumped Hydro Plants, Technician in Pumped Hydro Plant Assembly and Maintenance, Supervisor for Pumped Hydro Construction and Operation, and Advanced Operation and Optimisation of Pumped Hydro Plants, are comprehensively outlined in Appendix E. Each curriculum focuses on practical skills, stringent safety standards, and sector-specific expertise, enabling effective workforce integration while fostering continuous skill development and recognition of prior learning.

4.6 Battery Energy

Battery energy storage systems are becoming increasingly critical for grid flexibility and the broader integration of renewable energy sources. These systems require expertise in electrochemistry, electronics, cooling technologies, diagnostics, and digital control systems. For mining workers, especially those with backgrounds in electricity, equipment maintenance, and safety engineering, battery energy storage offers a promising career transition. Their existing technical skills provide a strong foundation, but they will need targeted upskilling in newer battery technologies to succeed in this field.

The training plans for this sector span EQF levels 2 to 5, designed with a high degree of modularity to adapt to the rapid pace of technological change (for example, lithium-ion, solid-state, or flow batteries). Through a system of microcredentials, learners can progressively build their skills in essential topics such as cell architecture, battery integration, charge/discharge management, safety procedures for high-voltage systems, and predictive maintenance. This approach supports rapid labour market entry through short, focused training blocks, while also providing clear routes for advanced certification over time.

The modular structure of these programmes further supports lifelong learning, ensuring workers can keep pace with new standards, evolving technologies, and environmental

sustainability requirements. Key thematic areas include battery production, assembly, quality control, system integration, safety, and circular economy processes for battery recycling. Target occupations range from assembly technicians to battery storage systems technicians, including specialized roles like circular economy technicians (Batteries) for recycling and material recovery. Table 4.7 summarises these pathways, including the recommended microcredential levels and their core components.

Table 4-7. Battery Energy Training Programmes

Key Occupation	Training Programme	Mining Profile	EQF Level	Training Description	Modules / Microcredentials
Assembly Technician, Production Operator	Auxiliary in Battery Assembly	Plant Operator	2	Manual and semi-automated assembly of battery cells and modules, focusing on safe handling and quality.	•Safe handling •Quality control •Industrial ergonomics
Process Operator, Battery Assembler	Operator in Battery Manufacturing Lines	Processing Plant Operator	3	Operation of assembly lines, packaging, and inspection of battery components.	•Tool usage • Visual quality control •Hazardous material safety
Maintenance Technician, Logistics Assistant	Technician in Battery Maintenance and Storage	Mechanical Maintenance Technician	4	Inspection, maintenance, and integration of battery systems in energy networks.	•Connection protocols •Charge / discharge testing •Electrical safety norms
Circular Economy Technician (Batteries)	Specialist in Battery Recycling and Circular Economy	Environmental Technician	5	Recovery, treatment, and reuse of used batteries according to environmental standards.	•Cell identification •Separation processes •Environmental compliance
Battery Systems Integrator, Energy Storage Technical Supervisor	Technician in Battery System Configuration	Electrical Systems Technician	5	Practical configuration, commissioning, and performance monitoring of medium-scale battery storage systems. Focus on operational safety and interoperability with energy networks.	•Battery pack interconnection •SCADA monitoring (data interpretation/alarms) •Performance validation testing (capacity/cycle tests) •Safety protocols

The comprehensive training structures for the battery energy storage sector, including programmes such as Auxiliary in Battery Assembly, Operator in Battery Manufacturing Lines, Technician in Battery Maintenance and Storage, Specialist in Battery Recycling and Circular Economy, and Technician in Battery System Configuration, are elaborately detailed in Appendix F. Every training pathway emphasizes hands-on technical proficiency, rigorous safety practices, and industry-specific competencies, ensuring seamless workforce integration while supporting ongoing skill enhancement and validation of prior learning.

4.7 Cross-sectoral training plan

The cross-sectoral training plan is designed to address the needs of a rapidly evolving energy landscape, where professionals must operate across multiple renewable technologies and adapt to systemic changes in production, distribution, and sustainability requirements. Unlike sector-specific training initiatives, these academic programmes provide a comprehensive, integrated approach, enabling graduates to work at the intersection of engineering, environmental management, and economic transformation. The plan brings together undergraduate and postgraduate degrees as well as specialised short courses; an overview of the cross-sectoral academic programmes is presented in Table 4.8, which summarises target occupations, EQF levels and the main modules.

Table 4-8. Overview of Cross-Sectoral Academic Programmes

Key Occupation	Training Programme	Target Profile	Energy Technology Scope	EQF Level	Training Description	Core Subjects / Modules
Renewable Energy Systems Engineer	Degree in renewable energy and sustainability engineering	Secondary school graduates, technical diploma holders	Multi-technology (solar, wind, hydro, hydrogen, storage, bioenergy)	6	Multidisciplinary university degree covering the design, management, and optimisation of renewable energy systems with integrated sustainability principles.	Mathematics, Physics, Engineering Fundamentals, Renewable Energy Technologies, Smart Grids, Energy Storage, Sustainability, Project Management
Industrial Transition Manager	Postgraduate Programme in mining transition and sustainable	University graduates in engineering, environmental sciences, economics, or related fields	Cross-sector (mining transition, renewable integration,	7	Specialised training to lead industrial and territorial transformation processes towards sustainable	Transition Policy & Governance, Sustainable Territorial Planning, Circular Economy,

	industrial reconversion		circular economy)		energy models, focusing on mining regions in transition.	Socioeconomic Impact Assessment, Stakeholder Engagement, Capstone Project

4.7.1 Degree in renewable energy and sustainability engineering

The Bachelor's Degree in Renewable Energy and Sustainability Engineering is a cross-cutting academic programme that addresses the growing demand for professionals capable of operating across multiple renewable energy technologies while integrating sustainability and innovation into energy systems. Designed as a multidisciplinary degree, it combines core engineering knowledge with specialised technical training and transversal competencies that are essential to lead the energy transition.

Unlike sector-specific training plans focused on individual technologies such as solar, wind, or hydrogen, this degree provides a holistic educational approach. It enables graduates to design, manage, and optimise complex energy systems that incorporate multiple sources and meet evolving environmental, economic, and technological challenges.

The programme has been carefully designed with the following key objectives:

- Provide solid foundational knowledge in core scientific and engineering disciplines: mathematics, physics, chemistry, computer science, and general engineering.
- Build technical competence in all major renewable energy technologies: solar (PV and thermal), wind (onshore/offshore), geothermal, hydro, hydrogen, bioenergy, and energy storage systems.
- Develop transversal and cross-disciplinary skills in: project management, sustainability, circular economy, digitalisation, and entrepreneurship.
- Prepare students to design and implement integrated energy solutions across diverse contexts, including industrial, urban, rural, and off-grid settings.
- Encourage innovation, adaptability, and critical thinking through a strong emphasis on R&D, system thinking, and hands-on experience.

The structure of the programme includes 240 ECTS credits over four academic years, organised into two main phases:

Years 1 and 2 – Basic and Core Engineering Education:

These initial years focus on building a strong scientific and technical base with courses such as:

- Mathematics, physics, chemistry, statistics
- Computer science, programming, and digital systems
- Mechanical, electrical, and fluid mechanics
- Electronics, automation, and industrial instrumentation
- Environmental science, geology, and business fundamentals

Years 3 and 4 – Specialised Training in Renewable Energy and Sustainability:

In the final two years, students deepen their expertise in energy and sustainability through:

- Renewable energy technologies: solar PV and thermal, wind, hydro and minihydro, geothermal and aerothermal, hydrogen, and bioenergy
- Cross-cutting energy systems: distributed generation, smart grids, energy efficiency, and storage
- Applied sustainability: green building, sustainable mobility, circular resource use, recycling of critical minerals
- Professional development: project management, entrepreneurship, innovation, and industry engagement

The programme also includes a final year thesis, typically connected to a real-world problem or developed in collaboration with industry partners or research centres, reinforcing the programme's practical orientation.

Key Features of the Programme

- Transversal Scope: Graduates are prepared to work across all renewable energy technologies and contribute to system integration and interconnection.
- Hands-on Training: Internships, laboratories, and applied projects ensure a direct connection with industry practices.
- Digital and Technological Readiness: Training in Industry 4.0 tools, robotics, automation, and cybersecurity prepares students for future energy systems.

- Sustainability Integration: Environmental, social, and economic sustainability principles are embedded throughout the curriculum, in line with the objectives of the EU Green Deal and the climate neutrality agenda.

Table 4.9 presents the full curriculum of the degree programme, outlining the subjects, credits, and learning outcomes across the four academic years.

Table 4-9. Degree in renewable energy and sustainability engineering

FIRST YEAR		
SUBJETCS		**AREA OF KNOWLEDGE**
FIRST SEMESTER	**ECTS**	
Math	6	Applied mathematics
Algebra lineal	6	Applied mathematics
Business	6	Business Organization
Computer Science Fundamentals	6	Computer Science and Artificial Intelligence
Mechanics and Thermodynamics	6	Applied Physics
SUBTOTAL FIRST YEAR FIRST SEMESTER	30	
SECOND SEMESTER		
Graphic expression	6	Graphic Expression in Engineering
Chemistry	6	Inorganic chemistry
Statistics	6	Statistics and Operations Research
Geographic Information System Applied to Energy Engineering	4.5	Cartographic, Geodesic and Photogrammetry Engineering
Geological and Hydrogeological Techniques Applied to Energy	4.5	Prospecting and Mining Research
Energy Policies and Sustainable Development	3	Business Organization
SUBTOTAL FIRST YEAR SECOND SEMESTER	30	
SUBTOTAL FIRST YEAR	60	
SECOND YEAR		
FIRST SEMESTER		
Calculation Extension	6	Applied mathematics
Structural mechanics	6	Continuum Mechanics and Structure Theory
Materials Science	6	Materials Science and Metallurgical Engineering
Electrical engineering. Electric machines	6	Ingeniería Eléctrica
Electronics	6	Tecnología Electrónica
SUBTOTAL SECOND YEAR FIRST SEMESTER	30	
SECOND SEMESTER		
Waves and Electromagnetism	6	Applied Physics

Thermoenergetic Processes.	6	Heat Engines & Machines
Fluid Mechanical Engineering	6	Fluid Mechanics
Automatic regulation and control	4.5	Systems Engineering and Automation
Electrical Installations and Smart Grids	4.5	Ingeniería Eléctrica
Management, Entrepreneurship and Innovation	3	Business Organization
SUBTOTAL SEGUNDO CURSO SEGUNDO SEMESTRE	30	
SUBTOTAL SECOND YEAR SECOND SEMESTER	60	
THIRD YEAR		
FIRST SEMESTER		
Energía eólica. Onshore y offshore	6	Fluid Mechanics/Construction Engineering
Generators and Heat Engines	6	Máquinas y Motores Térmicos
Numerical Methods	6	Applied mathematics
Hydraulic turbomachinery. Hydraulic and mini-hydraulic energy.	6	Mechanics of Fluids
Marine Energy	3	Hydraulic engineering
Critical Minerals and New Technologies. Reuse and Recycling	3	Mining
SUBTOTAL THIRD YEAR FIRST SEMESTER	30	
SECOND SEMESTER		
Energy Efficiency	6	Heat Engines & Machines
Self-consumption and Distributed Generation	3	Heat Engines & Machines
Digital Control of Electric Machines	4.5	Systems Engineering and Automation
Solar Thermal and Photovoltaic Energy. Solar Thermal Power Plants	7.5	Heat Engines & Machines
Geothermal, aerothermal and hydrothermal	4.5	Heat Engines & Machines/Mining Prospecting & Research
Bioenergía	4.5	Thermal Machines and Engines/Agroforestry Engineering
SUBTOTAL THIRD YEAR SECOND SEMESTER	30	
THIRD YEAR SUBTOTAL	60	
FOURTH YEAR		
FIRST SEMESTER		
Integrated project management	6	Engineering Projects
Energy Storage	7.5	Electrical Engineering/Thermal Machines & Engines/Mining Prospecting & Research
Business Organization and Security	4.5	Business Organization
Sustainable mobility	6	Electrical Engineering/Machines and Heat Engines

Sostenibilidad en la edificación e industria	6	Heat Engines & Machines
SUBTOTAL FOURTH YEAR FIRST SEMESTER	30	
SECOND SEMESTER		
Management Systems	3	Business Organization
Material Selection Criteria	4.5	Materials Science and Metallurgical Engineering
Terrain Engineering	4.5	Mining
Hydrogen as an energy vector	6	Heat Engines & Machines
ELECTIVES (CHOOSE ONE OR TWO)	6	
Final degree project	6	Research
SUBTOTAL FOURTH YEAR SECOND SEMESTER	30	
ELECTIVES (CHOOSE ONE)		
Mining and Circular Economy (Elective)	3	Mining
Ergonomics and Human Factors Engineering (Elective)	3	Business Organization
Market and Energy (Elective)	3	Business Organization
History of Engineering and Technology (Elective)	3	Construction Engineering
Internship in Company (optional)	6	Training
Robotics	6	Systems Engineering and Automation
Digitalization, Industry 4.0 and Cybersecurity	6	Computer Science and AI
Optional subtotals	30	
SUBTOTAL FOURTH YEAR SECOND SEMESTER	30	
FOURTH YEAR SUBTOTAL	60	
TOTAL GRADO	240	

4.7.2 Postgraduate programme in mining transition and sustainable industrial reconversion

The Postgraduate Programme in Mining Transition and Sustainable Industrial Reconversion (Table 4.10) represents a pioneering cross-sectoral initiative designed to empower engineers and industry leaders with the strategic and technical competencies needed to drive the transformation of mining-dependent regions. In an era where industrial decarbonisation and resource sustainability are paramount, this programme addresses critical gaps in repurposing mining infrastructure, optimising raw material flows, and integrating renewable energy systems into transitioning economies.

Unlike conventional sector-specific postgraduate studies, this programme adopts a holistic approach, bridging the gap between mining engineering, environmental science, and socio-economic policy. It emphasizes practical solutions for industrial reconversion, ensuring graduates can design projects that harmonize technical feasibility with economic viability and community needs. By focusing on Just Transition frameworks, the curriculum aligns with EU climate neutrality goals and regional development strategies, preparing leaders to navigate the political, environmental, and technological dimensions of mining transitions.

The programme is structured around five pillars of competency development:

1. Mining Transition Strategies: Advanced training in mine closure planning, land restoration, and environmental remediation techniques to mitigate the ecological legacy of mining operations.

2. Renewable Energy Integration: Expertise in deploying solar, wind, hydro, and hydrogen systems within post-mining infrastructures, transforming these sites into hubs for clean energy production.

3. Circular Economy Principles: Proficiency in critical raw material recovery, recycling technologies, and industrial symbiosis to build resilient, sustainable supply chains.

4. Transition Governance: Skills in stakeholder engagement, policy alignment, and project management to ensure inclusive and equitable transitions for affected communities.

5. Innovation and Entrepreneurship: Tools to develop scalable business models that drive economic diversification in post-mining regions.

6. Programme Structure and Pedagogy

The 60 ECTS curriculum, spanning one academic year, is organized into three thematic blocks:

1. Technical Transition Competencies: Focused on the practicalities of mining site repurposing, this block covers advanced mine closure techniques, environmental rehabilitation protocols, and the technical integration of renewable energy systems into industrial landscapes. Case studies highlight successful conversions of mining infrastructure into solar farms or pumped hydro storage facilities.

2. Sustainability and Circular Economy: Participants explore innovative approaches to resource management, including critical mineral recycling, waste valorization, and the design of closed-loop industrial systems. Emphasis is placed on aligning these strategies with EU directives on raw material autonomy and decarbonization.

3. Management, Policy, and Innovation: This block combines project management tools with policy analysis and stakeholder engagement methodologies. Participants learn to navigate regulatory frameworks, secure funding through the Just Transition Mechanism, and mediate conflicts between industry, governments, and local communities.

The programme culminates in an 18 ECTS Capstone project, where participants collaborate with industry partners or regional authorities to address a real-world transition challenge. Examples include designing repurposing plans for decommissioned coal mines or developing circular economy hubs for battery recycling.

Table 4.10 details the modular breakdown, ECTS allocation, and learning outcomes for each component of the programme.

Table 4-10. Postgraduate Programme in Mining Transition and Sustainable Industrial Reconversion

Module	ECTS	Description
Industrial Transition Policy and Governance	6	Frameworks and strategies for managing industrial and mining transitions at national and regional levels.
Sustainable Territorial Planning	6	Land-use planning tools, environmental assessment, and integration of renewable energy infrastructures.
Circular Economy and Industrial Symbiosis	6	Waste minimisation, materials recovery, and integration of local value chains.
Project Management in Transition Contexts	6	Planning, financing, and coordination of complex multi-stakeholder projects.
Socioeconomic Impact Assessment	6	Tools for evaluating economic diversification, job creation, and community resilience.
Digital Tools for Transition Monitoring	6	GIS, SCADA, and other digital platforms for monitoring progress and performance indicators.
Stakeholder Engagement and Communication	6	Participatory processes, conflict resolution, and public communication strategies.
Capstone Project	18	Applied project developed in collaboration with industry, government, or research centres, focusing on a real-world transition challenge.

5 IMPLEMENTATION STRATEGY AND RECOMMENDATIONS

This section outlines the strategic considerations for the effective implementation of the proposed training plans across different renewable energy sectors. While the training plans are designed to be adaptable, their success depends on coherent delivery strategies, recognition mechanisms, local alignment, and mechanisms for monitoring and improvement. The modular, microcredential-based approach adopted throughout ensures flexibility and scalability, but must be supported by institutional coordination, policy alignment, and ongoing evaluation to remain effective and relevant.

5.1 Suggested Delivery Modes and Institutions

Given the diversity of target learners, from young people entering the labour market to experienced mining professionals seeking to transition, the training programmes must accommodate a range of delivery modes and learning environments. These include:

- VET institutions, particularly for EQF Level 3–4 qualifications, where learners can gain hands-on experience in workshops and simulated environments. Many of these institutions already have infrastructure relevant to industrial or mechanical fields, which can be adapted for renewable energy training.
- Blended and online formats, especially for adult learners or those in rural areas. Digital platforms can deliver theoretical modules or microcredentials asynchronously, while practical components can be delivered during short, intensive in-person sessions at regional centres or through mobile training units.
- Industry-led programmes or apprenticeship models, in collaboration with renewable energy companies and public employment services. These models are particularly useful for EQF Level 4–5 learners who need workplace-based training and real-world exposure.
- Community organisations, NGOs, and local transition hubs can serve as delivery partners in areas affected by coal or mineral phase-out, especially when engaging vulnerable groups or those outside formal education systems.

Institutional partnerships between public, private, and civil society actors will be critical to ensure not only the deployment but also the sustainability of training offerings.

5.2 Certification and Accreditation Pathways

All proposed training plans are structured to align with the European Council's 2022 Recommendation on Microcredentials. Each training module, whether part of a longer programme or a standalone qualification, includes clear learning outcomes, assessment methods, and workload estimates. These can be issued as microcredentials that are:

- Transparent and standardised, including metadata such as EQF level, credit workload, issuing body, and acquisition date.
- Portable and stackable, enabling learners to accumulate and combine credentials over time toward a full qualification.
- Recognisable across borders, especially when integrated into Europass profiles and connected to National Qualification Frameworks (NQFs).

Accreditation pathways may involve national vocational education authorities, ministries of education, or specialised renewable energy certifying bodies. Where possible, partnerships with European Skills Agenda initiatives and European Centre for the Development of Vocational Training (CEDEFOP) databases can enhance the visibility and legitimacy of credentials.

For workers with existing experience in mining or related fields, Recognition of Prior Learning (RPL) mechanisms can shorten training time, reduce duplication, and increase motivation, especially for mid-career adults.

5.3 Adaptation at National or Regional Level

While the training plans are framed at the European level and grounded in EQF, their regional adaptation is essential for contextual relevance. Key considerations include:

- Technology prevalence: For instance, wind energy training will be more relevant in coastal or mountainous regions; geothermal training will focus on areas with tectonic or volcanic activity.
- Sociolinguistic and demographic factors: Training materials and delivery must be adapted for linguistic minorities, low-literacy learners, or underserved rural populations. Inclusion of gender-sensitive and intergenerational approaches is recommended.
- Alignment with territorial Just Transition Plans (JTPs): In regions undergoing coal or mining phase-outs, training programmes must be integrated into broader economic restructuring strategies, supported by local authorities, trade unions, and employers.

- Policy flexibility: National ministries and regional agencies should be able to adjust the training content or duration based on local labour market dynamics, while maintaining alignment with EQF levels and learning outcomes.

A clear example is found in Asturias (Spain), specifically in the Aller–Barredo–Figaredo complex. This region, historically dependent on coal mining, is now undergoing a transition toward geothermal, photovoltaic, and wind energy systems. The area presents favourable geological and hydrological conditions for geothermal applications, with extensive infrastructure in place due to its mining legacy. Training programmes in Asturias have been designed to:

- Reskill former mine workers into geothermal plant operators, pumped hydro technicians, or green hydrogen assistants.
- Be delivered in partnership with the University of Oviedo (UNIOVI), which has a local campus in Mieres, and nearby vocational training centres.
- Reflect local energy transition plans, which involve hydrogen production, electrolyser operation, and battery storage systems, all of which require new profiles not previously present in the local labour force.

Such programmes combine:

- On-site modules using decommissioned mines as training labs (e.g., Barredo mine, which still pumps over 1.2 million m^3 of water annually),
- Online modules for theoretical and safety content,
- And microcredential certification to allow stackable learning and recognition beyond the region.

This localised strategy shows how training plans can be fine-tuned to:

- Match regional energy assets (e.g., geothermal potential),
- Address specific labour transitions (e.g., former pump operators becoming geothermal circuit technicians),
- And integrate into territorial JTPs at national and European levels.

Similar place-based adaptations are expected in other countries where the project operates.

5.4 Monitoring, Evaluation, and Continuous Improvement

To ensure the long-term success and quality of training implementation, a robust system of monitoring and evaluation must be embedded. This involves:

- Key Performance Indicators (KPIs) such as:
    - Number of learners trained per year.
    - Transition rates from mining to renewable energy employment.
    - Completion and certification rates.
    - Gender balance and inclusion of disadvantaged groups.
    - Learner satisfaction and employment outcomes six months post-training.
- Stakeholder feedback mechanisms, involving learners, instructors, employers, and public authorities to assess relevance, quality, and impact of training content.
- Continuous improvement processes, including:
    - Regular updates of modules to reflect new technologies (e.g., storage, digitalisation).
    - Periodic review of learning outcomes and assessment methods.
    - Inclusion of soft skills and green transversal competences as industry needs evolve.
- Digital tracking systems may also be implemented to manage microcredentials, enabling learners and institutions to monitor progress and assemble learning pathways efficiently.

Figure 2 provides a concise summary of the implementation strategy and main recommendations.

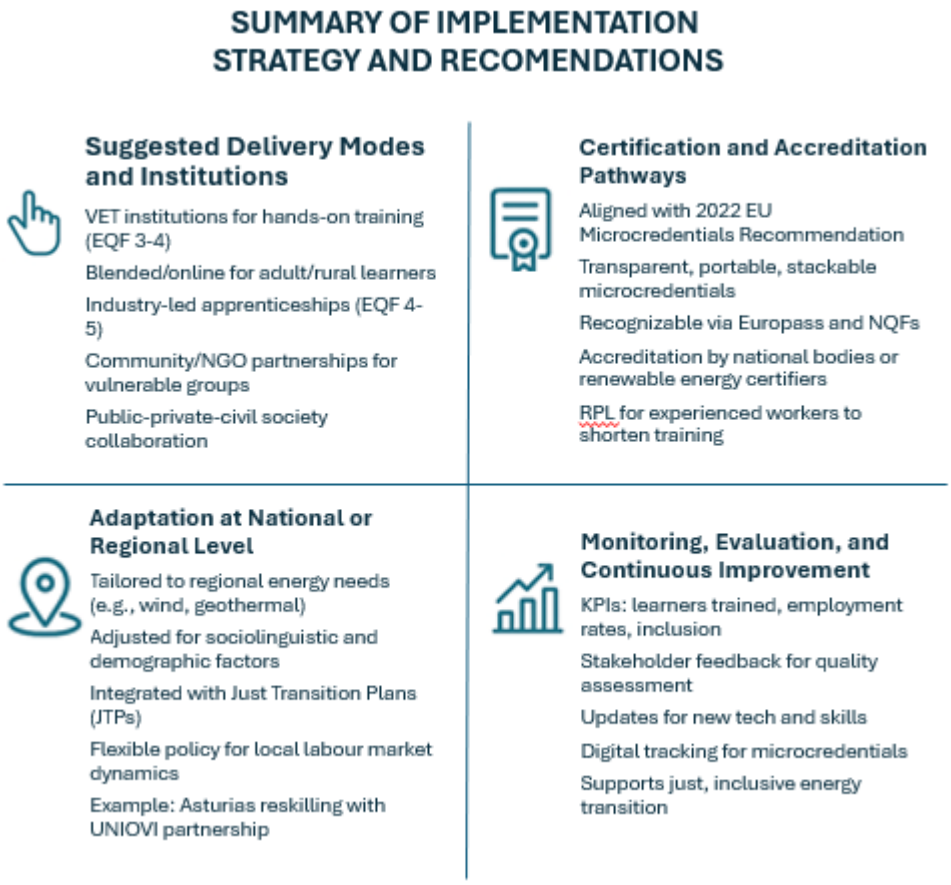

Figure 5-1. Summary of implementation strategy and recommendations

By incorporating these implementation elements, the training framework becomes not only a technical instrument for skills improvement, but a strategic tool to enable a more just, inclusive and prepared energy transition.

6 CONCLUSIONS & LESSONS LEARNED

This deliverable has demonstrated that the transition from coal mining to renewable energy requires not only the deployment of new technologies but also the design of robust educational pathways. Former coal workers possess a wide range of technical competences that, when properly mapped and connected with renewable energy requirements, can serve as the foundation for re-skilling strategies.

The analysis and programme design presented here show that transferable competences can significantly shorten the learning curve, reducing both training costs and barriers to labour reintegration. At the same time, modular and EQF-aligned structures ensure that programmes remain flexible, scalable, and compatible with lifelong learning approaches.

Furthermore, the inclusion of cross-sectoral academic programmes at university level extends the impact of this initiative beyond vocational training, fostering the development of multidisciplinary expertise capable of designing, managing, and optimising integrated renewable energy systems. In this sense, the deliverable not only provides training pathways for immediate reskilling needs but also contributes to building the future workforce of the sustainable energy economy.

Overall, the findings underline the importance of aligning training content with industry requirements, educational standards, and local socio-economic realities. By doing so, the proposed frameworks can serve as reference guidelines for policy-makers, educational institutions, and training providers seeking to implement effective re-skilling strategies across Europe.

The lessons relevant to the Project from this deliverable can be summarised as follows:

1. Transferability of competences: Coal mining workers hold technical skills in safety, maintenance, and process control that can be effectively adapted to renewable energy, offering a solid foundation for re-skilling.
2. Need for modular and flexible learning: Training programmes structured through micro-credentials and modular units allow progressive acquisition of competences, recognition at each stage, and adaptability to evolving industry needs.
3. Importance of alignment with EQF: Referencing the European Qualifications Framework ensures recognition, portability, and comparability of training outcomes across countries and sectors.
4. Multi-level educational approach: Addressing vocational, technical, and academic levels is essential to ensure inclusiveness, from plant operators and technicians to engineers and consultants.
5. Value of cross-sectoral programmes: University-level degrees and postgraduate courses provide a multidisciplinary dimension, preparing professionals for integrated system thinking and long-term industry innovation.

6. Policy and institutional relevance: The proposed training pathways can guide not only individual career transitions but also institutional curriculum development and policy design at regional, national, and EU levels.

7 GLOSSARY

ECTS - European Credit Transfer and Accumulation System

ESCO - European Skills, Competences, Qualifications and Occupations

EQAVET - European Quality Assurance Reference Framework for Vocational Education and Training

EQF – European Qualifications Framework

PPE - Personal Protective Equipment

PV Systems - Photovoltaics systems

RES – Renewable Energy Sources

RPL - Recognition of Prior Learning

SCADA - Supervisory Control and Data Acquisition

UNIOVI – Universidad de Oviedo

VET – Vocational Education and Training

8 REFERENCES

Cedefop. (2017). *Description of the eight EQF levels. Europass*. Retrieved from https://europass.europa.eu/en/description-eight-eqf-levels.

Cedefop. (2023). *Microcredentials for labour market education and training: microcredentials and evolving qualifications systems.* . Retrieved from http://data.europa.eu/doi/10.2801/566352.

Cedefop. (2024). *Microcredentials: striving to combine credibility and agility*. Retrieved from https://data.europa.eu/doi/10.2801/966682.

Coles, M. (2007). Qualifications frameworks in Europe; Platforms for qualifications, integration and reform: European Union, Education and Culture DG.

Commission, E. (2019). ESCO handbook European skills, competences, qualifications and occupations. *Publications Office of the EU*.

Commission, E. (2022). *European skills, competences, qualifications and occupations – Annual report 2021*. Publications Office of the European Union.

Commission, E. (n.d). European credit system for vocational education and training (ECVET). Retrieved August 1, 2025, from https://www.ec.europa.eu/social/main.jsp?catId=1141

Commission, E. (n.d.-a). EQAVET - European Quality Assurance in Vocational Education and Training. Directorate-General for Employment, Social Affairs and Inclusion Retrieved July 30, 2025, from https://employment-social-affairs.ec.europa.eu/policies-and-activities/skills-and-qualifications/working-together/eqavet-european-quality-assurance-vocational-education-and-training_en

Commission, E. (n.d.-b). What is ESCO? Retrieved July 20, 2025, from https://esco.ec.europa.eu/en/about-esco/what-esco

Méhaut, P., & Winch, C. (2012). The European Qualification Framework: skills, competences or knowledge? *European educational research journal, 11*(3), 369-381.

Pouliou, A. (2024). *Exploring the emergence of microcredentials in vocational education and training (VET)*: Publications Office of the European Union.

APPENDICES

Appendix A – Training Plans Wind Energy

A1. Wind Turbine Maintenance Technician

Programme Title	Wind Turbine Maintenance Technician			
Key Occupation	Maintenance Technician			
Target Mining Profile	Electrical or mechanical maintenance worker			
Renewable Energy Sector	Wind Energy			
EQF Level	4			
Total Duration	120 hours (4 weeks full-time / 8 weeks part-time)			
Delivery Mode	Hybrid (Online + In-Person Practical Training)			
Certification	3 Microcredentials (1 per module)			
Training Objectives	1. Enable safe, effective troubleshooting and maintenance of wind turbine systems.			
	2. Facilitate the transition of coal workers to the renewable sector.			
	3. Provide stackable training for progressive upskilling.			
Learning Outcomes	1. Troubleshoot and repair electrical systems in wind turbines.			
	2. Conduct mechanical diagnostics and repairs.			
	3. Implement preventive maintenance routines to ensure operational efficiency.			
Assessment Methods	1. Knowledge Test (30%)			
	2. Practical Demonstration (40%)			
	3. Team-Based Scenario (30%)			
Recognition of Prior Learning (RPL)	Available for relevant mining experience in electrical or mechanical maintenance procedures.			
Progression Pathway	Leads to higher-level training (e.g., Wind Project Supervisor – EQF 5)			
Module Title	Description	Duration	Key Competencies Acquired	Microcredential Awarded
Electrical systems basics	Covers fundamentals of electrical components in wind turbines, including wiring, circuits, fault detection, and basic repairs. Emphasises safety standards and integration with turbine operations.	40 hours	• Identify and troubleshoot electrical faults • Understand wiring and circuit principles	Certificate in Electrical Systems Basics
Mechanical diagnostics	Trains learners in identifying mechanical issues, using diagnostic tools, and performing repairs on turbine components like gears	40 hours	• Use diagnostic tools for mechanical faults • Perform repairs on key mechanical parts	Certificate in Mechanical Diagnostics

	and bearings. Includes hands-on practice in mining-similar environments.			
Preventive maintenance routines	Focuses on scheduled maintenance practices to prevent breakdowns, including inspections, lubrication, and record-keeping. Builds on mining maintenance experience for wind-specific applications.	40 hours	• Develop and follow maintenance schedules • Conduct routine inspections and lubrication • Maintain accurate maintenance documentation	Certificate in Preventive Maintenance Routines

A2. Blade Damage Inspection and Minor Repairs

Programme Title	**Blade Damage Inspection and Minor Repairs**			
Key Occupation	Rotor Blade Inspector			
Target Mining Profile	Surface technician, mechanical assistant			
Renewable Energy Sector	Wind Energy			
EQF Level	4			
Total Duration	120 hours (4 weeks full-time / 8 weeks part-time)			
Delivery Mode	Hybrid (Online + In-Person Practical Training)			
Certification	3 Microcredentials (1 per module)			
Training Objectives	1. Enable safe, effective inspection and repair of wind turbine blades.			
	2. Facilitate the transition of coal workers to the renewable sector.			
	3. Provide stackable training for progressive upskilling.			
Learning Outcomes	1. Perform visual and ultrasonic inspections of rotor blades.			
	2. Apply composite repair methods for minor damages.			
	3. Work safely at heights during inspections and repairs.			
Assessment Methods	1. Knowledge Test (30%)			
	2. Practical Demonstration (40%)			
	3. Team-Based Scenario (30%)			
Recognition of Prior Learning (RPL)	Available for relevant mining experience in surface inspection and mechanical assistance.			
Progression Pathway	Leads to higher-level training (e.g., Wind Project Supervisor – EQF 5)			
Module Title	**Description**	**Duration**	**Key Competencies Acquired**	**Microcredential Awarded**
Blade inspection techniques	Covers visual, ultrasonic, and other non-destructive testing methods for detecting blade damage. Includes hands-on practice with tools and interpretation of results.	40 hours	• Conduct visual and ultrasonic inspections • Identify common blade defects • Use inspection tools effectively	Certificate in Blade Inspection Techniques

Composite repair methods	Trains learners in repairing minor structural damages using composite materials, including sanding, patching, and curing processes. Emphasises quality control.	40 hours	• Apply composite patching and repair techniques • Ensure structural integrity post-repair • Follow material handling safety guidelines	Certificate in Composite Repair Methods
Working at height certification	Focuses on safe practices for working at elevations, including harness use, fall protection, and rescue procedures specific to wind turbine blades.	40 hours	• Use fall protection equipment correctly • Perform tasks safely at heights • Execute rescue and emergency protocols	Certificate in Working at Height

A3 Supervisor for Onshore Wind Farm Operations

Programme Title	**Supervisor for Onshore Wind Farm Operations**			
Key Occupation	Wind Project Supervisor			
Target Mining Profile	Foreman, crew coordinator			
Renewable Energy Sector	Wind Energy			
EQF Level	5			
Total Duration	120 hours (4 weeks full-time / 8 weeks part-time)			
Delivery Mode	Hybrid (Online + In-Person Practical Training)			
Certification	3 Microcredentials (1 per module)			
Training Objectives	1. Enable effective planning and supervision of wind farm operations.			
	2. Facilitate the transition of coal workers to the renewable sector.			
	3. Provide stackable training for progressive upskilling.			
Learning Outcomes	1. Coordinate projects and teams in wind farm settings.			
	2. Lead health and safety initiatives.			
	3. Manage technical documentation and reporting.			
Assessment Methods	1. Knowledge Test (30%)			
	2. Practical Demonstration (40%)			
	3. Team-Based Scenario (30%)			
Recognition of Prior Learning (RPL)	Available for relevant mining experience in foreman roles and crew coordination.			
Progression Pathway	Leads to advanced training (e.g., Advanced Wind Energy Technician – EQF 5)			
Module Title	Description	Duration	Key Competencies Acquired	Microcredential Awarded
Project coordination	Covers planning, scheduling, and overseeing wind farm installation and maintenance	40 hours	• Plan and schedule project tasks	Certificate in Project Coordination

	tasks, including resource allocation and team management.		• Allocate resources and manage teams • Monitor project progress effectively	
Health and safety leadership	Trains learners in leading safety protocols, risk assessments, and compliance with wind farm regulations. Includes emergency response planning.	40 hours	• Conduct risk assessments and safety audits • Lead emergency response teams • Ensure regulatory compliance	Certificate in Health and Safety Leadership
Technical documentation	Focuses on creating, managing, and interpreting technical reports, blueprints, and records for wind operations.	40 hours	• Prepare and manage technical reports • Interpret blueprints and data • Maintain accurate operational records	Certificate in Technical Documentation

A4. Advanced Design and Integration of Wind Energy Systems

Programme Title	**Advanced Design and Integration of Wind Energy Systems**
Key Occupation	Advanced Wind Energy Technician
Target Mining Profile	Requires prior engineering background
Renewable Energy Sector	Wind Energy
EQF Level	5
Total Duration	120 hours (4 weeks full-time / 8 weeks part-time)
Delivery Mode	Hybrid (Online + In-Person Practical Training)
Certification	3 Microcredentials (1 per module)
Training Objectives	1. Enable advanced optimisation and integration of wind energy systems.
	2. Facilitate the transition of coal workers to the renewable sector.
	3. Provide stackable training for progressive upskilling.
Learning Outcomes	1. Analyse SCADA systems and performance data.
	2. Ensure grid connection and compliance.
	3. Use tools for wind farm layout and optimisation.
Assessment Methods	1. Knowledge Test (30%)
	2. Practical Demonstration (40%)
	3. Team-Based Scenario (30%)
Recognition of Prior Learning (RPL)	Available for relevant mining experience in engineering or technical analysis.
Progression Pathway	Leads to specialised roles in wind energy design and management.

Module Title	Description	Duration	Key Competencies Acquired	Microcredential Awarded
SCADA systems and performance data analysis (Supervisory Control and Data Acquisition)	Covers monitoring and analysing wind turbine performance using SCADA tools, including data interpretation and system optimisation.	40 hours	• Monitor systems via SCADA interfaces • Analyse performance data for improvements • Optimise turbine operations based on data	Certificate in SCADA Systems and Data Analysis
Grid connection and compliance	Trains learners in integrating wind systems with electrical grids, ensuring regulatory compliance and efficient power transmission.	40 hours	• Design grid connections for wind farms • Ensure compliance with energy standards • Troubleshoot grid integration issues	Certificate in Grid Connection and Compliance
Wind farm layout and optimisation tools	Focuses on using software and tools for designing efficient wind farm layouts, including site analysis and energy yield predictions.	40 hours	• Use layout optimisation software • Analyse site data for farm design • Predict and maximise energy output	Certificate in Wind Farm Layout and Optimisation

Appendix B – Training Plans Photovoltaic Energy

B1. Auxiliary in Solar Panel Installation

Programme Title	Auxiliary in Solar Panel Installation			
Key Occupation	Auxiliary PV Installer			
Target Mining Profile	Mining Helper, Surface Operator			
Renewable Energy Sector	Photovoltaic Energy			
EQF Level	2–3			
Total Duration	120 hours (4 weeks full-time / 8 weeks part-time)			
Delivery Mode	Hybrid (Online + In-Person Practical Training)			
Certification	3 Microcredentials (1 per module)			
Training Objectives	1. Enable safe, effective support in solar panel installation operations.			
	2. Facilitate the transition of coal workers to the renewable sector.			
	3. Provide stackable training for progressive upskilling.			
Learning Outcomes	1. Use PPE and follow solar site safety protocols.			
	2. Assist in structural assembly and basic wiring.			
	3. Support senior installers with hand tools and on-site works.			
Assessment Methods	1. Knowledge Test (30%)			
	2. Practical Demonstration (40%)			
	3. Team-Based Scenario (30%)			
Recognition of Prior Learning (RPL)	Available for relevant mining experience in safety procedures and equipment handling.			
Progression Pathway	Leads to mid-level training (e.g. Residential Photovoltaic Panel Installation – EQF 3)			
Module Title	**Description**	**Duration**	**Key Competencies Acquired**	**Microcredential Awarded**
Structural Assembly	Covers basic assembly techniques for solar module structures, including mounting frames and supports, with emphasis on safety and precision in on-site works.	40 hours	• Assemble solar module structures accurately • Identify and use mounting tools effectively • Ensure structural integrity during installation	Certificate in Structural Assembly

Basic Wiring	Trains learners in preliminary wiring tasks for solar panels, including cable routing and basic connections, while adhering to electrical safety standards.	40 hours	• Perform basic wiring connections safely • Route cables and identify wiring components • Apply introductory electrical safety practices	Certificate in Basic Wiring
PPE and Use of Hand Tools	Focuses on the selection, inspection, and proper use of personal protective equipment (PPE) and hand tools specific to solar installation environments.	40 hours	• Select and inspect PPE correctly • Use hand tools efficiently in solar works • Follow safety protocols for tool handling	Certificate in PPE and Hand Tools

B2. Residential Photovoltaic Panel Installation

Programme Title	**Residential Photovoltaic Panel Installation**
Key Occupation	Residential PV Installation Technician
Target Mining Profile	Electrical Technician, Maintenance Assistant
Renewable Energy Sector	Photovoltaic Energy
EQF Level	3
Total Duration	120 hours (5 weeks full-time / 10 weeks part-time)
Delivery Mode	Hybrid (Online + In-Person Practical Training)
Certification	4 Microcredentials (1 per module)
Training Objectives	1. Enable effective installation of small-scale PV systems in residential settings.
	2. Facilitate the transition of coal workers to the renewable sector.
	3. Provide stackable training for progressive upskilling.
Learning Outcomes	1. Apply basic electricity principles in PV installations.
	2. Perform structural mounting and inverter cabling.
	3. Ensure compliance with electrical safety regulations.
Assessment Methods	1. Knowledge Test (30%)
	2. Practical Demonstration (40%)
	3. Team-Based Scenario (30%)

Recognition of Prior Learning (RPL)	Available for relevant mining experience in electrical work and maintenance.			
Progression Pathway	Leads to mid-level training (e.g. Maintenance in Photovoltaic Systems – EQF 3–4)			
Module Title	**Description**	**Duration**	**Key Competencies Acquired**	**Microcredential Awarded**
Basic Electricity	Covers fundamental principles of electricity relevant to PV systems, including circuits, voltage, and current in residential setups.	30 hours	• Understand basic electrical concepts • Apply electricity principles to PV components • Identify electrical hazards in installations	Certificate in Basic Electricity
Structural Mounting	Trains learners in mounting solar panels on residential structures, including roof and ground systems, with focus on stability and integration.	30 hours	• Install structural mounts securely • Assess mounting sites for suitability • Use tools for precise mounting alignment	Certificate in Structural Mounting
Inverter Cabling	Focuses on cabling techniques for inverters in PV systems, including connections and basic configuration for residential energy integration.	30 hours	• Perform inverter cabling accurately • Connect components in PV circuits • Test cabling for functionality	Certificate in Inverter Cabling
Electrical Safety Regulations	Emphasises compliance with electrical safety standards, including regulations for PV installations in residential and rural areas.	30 hours	• Apply safety regulations in PV work • Conduct safety inspections • Mitigate electrical risks effectively	Certificate in Electrical Safety Regulations

B3- Maintenance in Photovoltaic Systems

Programme Title	**Maintenance in Photovoltaic Systems**

Key Occupation	PV Maintenance Technician			
Target Mining Profile	Plant Technician, Electrical Operator			
Renewable Energy Sector	Photovoltaic Energy			
EQF Level	3–4			
Total Duration	120 hours (5 weeks full-time / 10 weeks part-time)			
Delivery Mode	Hybrid (Online + In-Person Practical Training)			
Certification	4 Microcredentials (1 per module)			
Training Objectives	1. Enable effective inspection and maintenance of PV systems.			
	2. Facilitate the transition of coal workers to the renewable sector.			
	3. Provide stackable training for progressive upskilling.			
Learning Outcomes	1. Perform panel cleaning and connection checks.			
	2. Conduct voltage verification and troubleshooting.			
	3. Apply preventive maintenance techniques.			
Assessment Methods	1. Knowledge Test (30%)			
	2. Practical Demonstration (40%)			
	3. Team-Based Scenario (30%)			
Recognition of Prior Learning (RPL)	Available for relevant mining experience in plant operations and electrical checks.			
Progression Pathway	Leads to advanced training (e.g. Installation and Maintenance of Solar Systems – EQF 4)			
Module Title	**Description**	**Duration**	**Key Competencies Acquired**	**Microcredential Awarded**
Panel Cleaning	Covers techniques for cleaning solar panels, including methods to remove dirt and debris while maintaining system efficiency.	40 hours	• Clean panels effectively without damage • Identify cleaning tools and materials • Assess panel condition post-cleaning	Certificate in Panel Cleaning
Connection Checks	Trains learners in inspecting and verifying electrical connections in PV systems, including troubleshooting basic issues.	40 hours	• Perform connection inspections accurately • Identify faulty connections • Apply basic repair techniques	Certificate in Connection Checks
Voltage Verification	Focuses on measuring and verifying voltage levels in PV systems, using	40 hours	• Measure voltage safely • Interpret voltage readings	Certificate in Voltage Verification

	tools for electrical checks and safety.		• Troubleshoot voltage-related issues	
Preventive Maintenance	Emphasises strategies for preventive maintenance, including scheduling and basic system optimisation.	40 hours	• Implement preventive maintenance plans • Conduct routine system checks • Optimise PV performance proactively	Certificate in Preventive Maintenance

B4. Installation and Maintenance of Solar Systems

Programme Title	**Installation and Maintenance of Solar Systems**			
Key Occupation	PV Systems Specialist			
Target Mining Profile	Electrician, Mechanic			
Renewable Energy Sector	Photovoltaic Energy			
EQF Level	4			
Total Duration	120 hours (5 weeks full-time / 10 weeks part-time)			
Delivery Mode	Hybrid (Online + In-Person Practical Training)			
Certification	4 Microcredentials (1 per module)			
Training Objectives	1. Enable advanced installation and optimisation of PV systems. 2. Facilitate the transition of coal workers to the renewable sector. 3. Provide stackable training for progressive upskilling.			
Learning Outcomes	1. Design and configure PV systems. 2. Handle inverters and grid connections. 3. Apply predictive maintenance techniques.			
Assessment Methods	1. Knowledge Test (30%) 2. Practical Demonstration (40%) 3. Team-Based Scenario (30%)			
Recognition of Prior Learning (RPL)	Available for relevant mining experience in electrical and mechanical work.			
Progression Pathway	Leads to supervisory training (e.g. Photovoltaic Plant Supervisor – EQF 5)			
Module Title	**Description**	**Duration**	**Key Competencies Acquired**	**Microcredential Awarded**
System Design	Covers principles of designing PV systems, including sizing, layout,	30 hours	• Design PV systems effectively • Calculate system requirements	Certificate in System Design

	and integration for optimal performance.		• Optimise layouts for efficiency	
Inverters	Trains learners in selecting, installing, and configuring inverters for PV systems, with focus on functionality.	30 hours	• Install and configure inverters • Troubleshoot inverter issues • Integrate inverters with PV components	Certificate in Inverters
Grid Connection	Focuses on connecting PV systems to the grid, including compliance with standards and safe integration.	30 hours	• Perform grid connections safely • Ensure regulatory compliance • Test grid-integrated systems	Certificate in Grid Connection
Predictive Maintenance	Emphasises advanced techniques for predicting and preventing system failures through monitoring and analysis.	30 hours	• Apply predictive maintenance strategies • Use monitoring tools • Analyse data for system health	Certificate in Predictive Maintenance

B5. Photovoltaic Plant Supervisor

Programme Title	**Photovoltaic Plant Supervisor**
Key Occupation	Photovoltaic Plant Supervisor
Target Mining Profile	Plant Foreman
Renewable Energy Sector	Photovoltaic Energy
EQF Level	5
Total Duration	120 hours (5 weeks full-time / 10 weeks part-time)
Delivery Mode	Hybrid (Online + In-Person Practical Training)
Certification	4 Microcredentials (1 per module)
Training Objectives	1. Enable effective management of PV plant operations.
	2. Facilitate the transition of coal workers to the renewable sector.
	3. Provide stackable training for progressive upskilling.
Learning Outcomes	1. Lead teams and coordinate staff.
	2. Monitor SCADA systems and ensure compliance.
	3. Apply management skills in PV operations.

Assessment Methods	1. Knowledge Test (30%) 2. Practical Demonstration (40%) 3. Team-Based Scenario (30%)			
Recognition of Prior Learning (RPL)	Available for relevant mining experience in plant supervision and operations.			
Progression Pathway	Leads to higher-level roles in renewable energy management.			
Module Title	**Description**	**Duration**	**Key Competencies Acquired**	**Microcredential Awarded**
Team Leadership	Covers skills for leading teams in PV plant operations, including coordination, motivation, and conflict resolution.	30 hours	• Lead teams effectively • Coordinate staff activities • Resolve operational issues	Certificate in Team Leadership
Electrical Regulations	Trains learners in understanding and applying electrical regulations specific to PV plants, ensuring compliance.	30 hours	• Apply electrical regulations • Conduct compliance audits • Mitigate regulatory risks	Certificate in Electrical Regulations
SCADA Systems	Focuses on using SCADA systems for monitoring and controlling PV plant operations, including data analysis.	30 hours	• Operate SCADA systems • Analyse operational data • Optimise plant performance	Certificate in SCADA Systems
Management Skills	Emphasises general management skills for PV plants, including planning, budgeting, and strategic oversight.	30 hours	• Apply management principles • Plan and budget operations • Oversee plant compliance	Certificate in Management Skills

Appendix C – Training Plans Geothermal Energy

C1. Assistant in Operation of Geothermal Pumps and Circuits

Programme Title	**Assistant in Operation of Geothermal Pumps and Circuits**			
Key Occupation	Geothermal Operations Assistant			
Target Mining Profile	Pump Technician, Plant Operator			
Renewable Energy Sector	Geothermal Energy			
EQF Level	2–3			
Total Duration	120 hours (5 weeks full-time / 10 weeks part-time)			
Delivery Mode	Hybrid (Online + In-Person Practical Training)			
Certification	4 Microcredentials (1 per module)			
Training Objectives	1. Enable safe, effective support in geothermal pump and circuit operations.			
	2. Facilitate the transition of coal workers to the renewable sector.			
	3. Provide stackable training for progressive upskilling.			
Learning Outcomes	1. Operate closed circuits and follow basic safety protocols.			
	2. Perform preventive maintenance tasks.			
	3. Conduct meter reading and basic monitoring.			
Assessment Methods	1. Knowledge Test (30%)			
	2. Practical Demonstration (40%)			
	3. Team-Based Scenario (30%)			
Recognition of Prior Learning (RPL)	Available for relevant mining experience in safety procedures and plant operations.			
Progression Pathway	Leads to mid-level training (e.g. Basic Operation of Geothermal Plants – EQF 3)			
Module Title	Description	Duration	Key Competencies Acquired	Microcredential Awarded
Closed Circuits	Covers the operation and monitoring of closed circuit systems in geothermal plants, including fluid circulation and basic controls.	30 hours	• Operate closed circuits efficiently • Monitor fluid flow in geothermal systems • Identify circuit components accurately	Certificate in Closed Circuits
Basic Safety	Trains learners in geothermal plant safety protocols, including hazard identification, emergency procedures, and personal protective equipment (PPE).	30 hours	• Identify and mitigate geothermal safety risks • Use PPE correctly in plant environments	Certificate in Basic Safety

			• Execute emergency protocols safely	
Preventive Maintenance	Focuses on routine preventive maintenance for geothermal pumps and circuits, including inspections and basic upkeep to ensure system reliability.	30 hours	• Perform preventive maintenance checks • Inspect pumps and circuits for issues • Apply maintenance techniques effectively	Certificate in Preventive Maintenance
Meter Reading	Emphasises accurate meter reading and data recording for geothermal operations, including interpretation of readings for system performance.	30 hours	• Read and interpret meters precisely • Record operational data accurately • Support monitoring of system efficiency	Certificate in Meter Reading

C2. Basic Operation of Geothermal Plants

Programme Title	**Basic Operation of Geothermal Plants**
Key Occupation	Low-Enthalpy Plant Operator
Target Mining Profile	Machinery Operator, Drilling Technician
Renewable Energy Sector	Geothermal Energy
EQF Level	3
Total Duration	120 hours (5 weeks full-time / 10 weeks part-time)
Delivery Mode	Hybrid (Online + In-Person Practical Training)
Certification	4 Microcredentials (1 per module)
Training Objectives	1. Enable effective operation of low-enthalpy geothermal systems.
	2. Facilitate the transition of coal workers to the renewable sector.
	3. Provide stackable training for progressive upskilling.
Learning Outcomes	1. Apply geothermal well safety procedures.
	2. Monitor temperature and control fluid flow.
	3. Perform basic pump maintenance.
Assessment Methods	1. Knowledge Test (30%)
	2. Practical Demonstration (40%)

	3. Team-Based Scenario (30%)			
Recognition of Prior Learning (RPL)	Available for relevant mining experience in machinery operation and drilling.			
Progression Pathway	Leads to mid-level training (e.g. Maintenance in Geothermal Installations – EQF 3–4)			
Module Title	Description	Duration	Key Competencies Acquired	Microcredential Awarded
Geothermal Well Safety	Covers safety procedures specific to geothermal wells, including risk assessment, protective measures, and compliance with operational standards.	30 hours	• Implement well safety protocols • Assess risks in geothermal operations • Ensure compliance with safety regulations	Certificate in Geothermal Well Safety
Temperature Monitoring	Trains learners in monitoring temperature in low-enthalpy systems, using tools for accurate readings and adjustments.	30 hours	• Monitor temperature levels effectively • Use monitoring equipment precisely • Interpret temperature data for operations	Certificate in Temperature Monitoring
Flow Control	Focuses on controlling fluid flow in geothermal plants, including valve operations and system balancing for optimal performance.	30 hours	• Control fluid flow accurately • Balance systems for efficiency • Troubleshoot flow-related issues	Certificate in Flow Control
Basic Pump Maintenance	Emphasises basic maintenance for geothermal pumps, including cleaning, lubrication, and minor repairs to maintain functionality.	30 hours	• Perform pump maintenance tasks • Clean and lubricate pump components • Conduct minor repairs safely	Certificate in Basic Pump Maintenance

C3. Maintenance in Geothermal Installations

Programme Title	**Maintenance in Geothermal Installations**
Key Occupation	Geothermal Systems Maintenance Technician
Target Mining Profile	Mining Mechanic, Underground Electrician
Renewable Energy Sector	Geothermal Energy
EQF Level	3–4

Total Duration	120 hours (5 weeks full-time / 10 weeks part-time)			
Delivery Mode	Hybrid (Online + In-Person Practical Training)			
Certification	4 Microcredentials (1 per module)			
Training Objectives	1. Enable effective inspection and maintenance of geothermal systems.			
	2. Facilitate the transition of coal workers to the renewable sector.			
	3. Provide stackable training for progressive upskilling.			
Learning Outcomes	1. Maintain mechanical components and detect faults.			
	2. Perform system cleaning and keep maintenance records.			
	3. Handle fluid components in geothermal installations.			
Assessment Methods	1. Knowledge Test (30%)			
	2. Practical Demonstration (40%)			
	3. Team-Based Scenario (30%)			
Recognition of Prior Learning (RPL)	Available for relevant mining experience in mechanical and electrical maintenance.			
Progression Pathway	Leads to advanced training (e.g. Geothermal Drilling and Maintenance Technician – EQF 4)			
Module Title	Description	Duration	Key Competencies Acquired	Microcredential Awarded
Mechanical Components	Covers inspection and maintenance of mechanical parts in geothermal systems, including repairs and replacements.	30 hours	• Maintain mechanical components effectively • Identify wear and tear in parts • Perform repairs on mechanical systems	Certificate in Mechanical Components
Fault Detection	Trains learners in detecting faults in geothermal installations, using diagnostic tools and troubleshooting methods.	30 hours	• Detect system faults accurately • Use diagnostic equipment • Resolve common installation issues	Certificate in Fault Detection
System Cleaning	Focuses on cleaning techniques for geothermal systems, including fluid lines and components to prevent blockages.	30 hours	• Clean systems thoroughly • Prevent contamination and blockages • Apply cleaning protocols safely	Certificate in System Cleaning
Maintenance Records	Emphasises keeping accurate records of maintenance	30 hours	• Maintain detailed records	

	activities, including documentation and reporting for compliance.		• Document maintenance activities • Generate reports for system oversight	Certificate in Maintenance Records

C4. Geothermal Drilling and Maintenance Technician

Programme Title	**Geothermal Drilling and Maintenance Technician**			
Key Occupation	Geothermal Drilling and Systems Specialist			
Target Mining Profile	Driller, Mechanic			
Renewable Energy Sector	Geothermal Energy			
EQF Level	4			
Total Duration	120 hours (5 weeks full-time / 10 weeks part-time)			
Delivery Mode	Hybrid (Online + In-Person Practical Training)			
Certification	4 Microcredentials (1 per module)			
Training Objectives	1. Enable advanced drilling and maintenance of geothermal wells.			
	2. Facilitate the transition of coal workers to the renewable sector.			
	3. Provide stackable training for progressive upskilling.			
Learning Outcomes	1. Handle types of probes and drilling equipment.			
	2. Control mud and perform repairs.			
	3. Ensure lubrication and long-term well performance.			
Assessment Methods	1. Knowledge Test (30%)			
	2. Practical Demonstration (40%)			
	3. Team-Based Scenario (30%)			
Recognition of Prior Learning (RPL)	Available for relevant mining experience in drilling and mechanical work.			
Progression Pathway	Leads to supervisory training (e.g. Specialist in Applied Geology for Geothermal Systems – EQF 5)			
Module Title	Description	Duration	Key Competencies Acquired	Microcredential Awarded
Types of Probes	Covers identification and application of various probes in geothermal drilling, including selection for subsurface conditions.	30 hours	• Identify probe types accurately • Select probes for drilling tasks • Apply probes in geothermal evaluations	Certificate in Types of Probes
Drilling Equipment	Trains learners in operating and maintaining drilling	30 hours	• Operate drilling equipment safely	Certificate in Drilling Equipment

	equipment for geothermal wells, with focus on safety and efficiency.		• Maintain equipment for performance • Troubleshoot equipment issues	
Mud Control	Focuses on mud management in drilling operations, including mixing, circulation, and control to support well stability.	30 hours	• Control mud effectively during drilling • Mix and circulate mud properly • Ensure well stability through mud use	Certificate in Mud Control
Repair and Lubrication	Emphasises repair techniques and lubrication practices for geothermal drilling systems to ensure durability and functionality.	30 hours	• Perform repairs on drilling components • Apply lubrication techniques • Extend system lifespan through maintenance	Certificate in Repair and Lubrication

C5. Specialist in Applied Geology for Geothermal Systems

Programme Title	**Specialist in Applied Geology for Geothermal Systems**
Key Occupation	Applied Geothermal Geologist
Target Mining Profile	Mine Geologist
Renewable Energy Sector	Geothermal Energy
EQF Level	5
Total Duration	120 hours (5 weeks full-time / 10 weeks part-time)
Delivery Mode	Hybrid (Online + In-Person Practical Training)
Certification	4 Microcredentials (1 per module)
Training Objectives	1. Enable effective geological analysis for geothermal projects.
	2. Facilitate the transition of coal workers to the renewable sector.
	3. Provide stackable training for progressive upskilling.
Learning Outcomes	1. Interpret seismic data and apply geochemistry.
	2. Use geological software for analysis.
	3. Design applied geothermal systems.
Assessment Methods	1. Knowledge Test (30%)
	2. Practical Demonstration (40%)
	3. Team-Based Scenario (30%)
Recognition of Prior Learning (RPL)	Available for relevant mining experience in geological analysis.

Progression Pathway	Leads to higher-level roles in renewable energy management.			
Module Title	Description	Duration	Key Competencies Acquired	Microcredential Awarded
Seismic Interpretation	Covers techniques for interpreting seismic data in geothermal contexts, including analysis for project planning.	30 hours	• Interpret seismic data accurately • Analyse subsurface structures • Apply interpretations to geothermal designs	Certificate in Seismic Interpretation
Geochemistry	Trains learners in geochemical analysis for geothermal systems, including fluid composition and resource evaluation.	30 hours	• Conduct geochemical assessments • Evaluate geothermal resources • Interpret chemical data effectively	Certificate in Geochemistry
Geological Software	Focuses on using specialised software for geological modelling in geothermal projects, including data input and visualisation.	30 hours	• Operate geological software proficiently • Model geothermal systems • Visualise and analyse data	Certificate in Geological Software
Applied Geothermal Systems	Emphasises the application of geological knowledge to design and optimise geothermal systems, integrating analysis for performance.	30 hours	• Design applied geothermal systems • Integrate geological data • Optimise system performance	Certificate in Applied Geothermal Systems

Appendix D – Training Plans Green Hydrogen

D1. Basic Operator in Hydrogen Plants

Programme Title	Basic Operator in Hydrogen Plants			
Key Occupation	Hydrogen Plant Operator			
Target Mining Profile	Process Plant Operator			
Renewable Energy Sector	Green Hydrogen			
EQF Level	3–4			
Total Duration	120 hours (4 weeks full-time / 8 weeks part-time)			
Delivery Mode	Hybrid (Online + In-Person Practical Training)			
Certification	4 Microcredentials (1 per module)			
Training Objectives	1. Enable safe and effective operation of hydrogen plant systems.			
	2. Facilitate the transition of coal workers to the renewable sector.			
	3. Provide stackable training for progressive upskilling.			
Learning Outcomes	1. Follow operating procedures for hydrogen systems.			
	2. Apply safety protocols in hydrogen operations.			
	3. Monitor and control pressure and temperature parameters.			
Assessment Methods	1. Knowledge Test (30%)			
	2. Practical Demonstration (40%)			
	3. Team-Based Scenario (30%)			
Recognition of Prior Learning (RPL)	Available for relevant mining experience in process plant operations.			
Progression Pathway	Leads to advanced training (e.g. Maintenance in Hydrogen Facilities – EQF 4)			
Module Title	Description	Duration	Key Competencies Acquired	Microcredential Awarded
Operating Procedures	Covers standard operating procedures for hydrogen plant systems, including startup, shutdown, and routine operations of electrolysis units.	30 hours	• Execute hydrogen plant operating procedures • Perform startup and shutdown tasks • Monitor routine system operations	Certificate in Operating Procedures
Safety	Trains learners in safety protocols specific to hydrogen plants, including hazard identification, emergency procedures, and use of PPE.	30 hours	• Identify and mitigate hydrogen-related risks • Apply PPE and emergency protocols	Certificate in Hydrogen Safety

			• Ensure safe operational practices	
Pressure Control	Focuses on monitoring and controlling pressure parameters in hydrogen systems, including valve operations and system balancing.	30 hours	• Monitor and control pressure levels • Operate pressure-related equipment • Troubleshoot pressure issues	Certificate in Pressure Control
Temperature Control	Emphasizes monitoring and controlling temperature in hydrogen production systems, using tools for accurate readings and adjustments.	30 hours	• Monitor and control temperature levels • Use temperature monitoring equipment • Interpret temperature data for operations	Certificate in Temperature Control

D2. Auxiliary Technician in Green Hydrogen Production

Programme Title	**Auxiliary Technician in Green Hydrogen Production**
Key Occupation	Electrolyzer Technician
Target Mining Profile	Chemical Plant Operator, Technical Assistant
Renewable Energy Sector	Green Hydrogen
EQF Level	3
Total Duration	120 hours (4 weeks full-time / 8 weeks part-time)
Delivery Mode	Hybrid (Online + In-Person Practical Training)
Certification	4 Microcredentials (1 per module)
Training Objectives	1. Enable support in operation and monitoring of electrolysis systems.
	2. Facilitate the transition of coal workers to the renewable sector.
	3. Provide stackable training for progressive upskilling.
Learning Outcomes	1. Understand electrolysis fundamentals and monitor cells.
	2. Apply hydrogen safety protocols.
	3. Control operational parameters in hydrogen systems.
Assessment Methods	1. Knowledge Test (30%)
	2. Practical Demonstration (40%)
	3. Team-Based Scenario (30%)

Recognition of Prior Learning (RPL)	Available for relevant mining experience in chemical plant operations or technical support.			
Progression Pathway	Leads to advanced training (e.g. Maintenance in Hydrogen Facilities – EQF 4)			
Module Title	Description	Duration	Key Competencies Acquired	Microcredential Awarded
Electrolysis Fundamentals	Covers the principles of electrolysis for green hydrogen production, including system components and basic operation.	30 hours	• Understand electrolysis principles • Identify system components • Support basic electrolysis operations	Certificate in Electrolysis Fundamentals
Cell Monitoring	Trains learners in monitoring electrolyzer cells, including performance checks and basic troubleshooting.	30 hours	• Monitor electrolyzer cell performance • Identify cell operational issues • Perform basic cell diagnostics	Certificate in Cell Monitoring
Hydrogen Safety	Focuses on safety protocols for handling hydrogen, including risk assessment, PPE use, and emergency procedures.	30 hours	• Apply hydrogen safety protocols • Identify and mitigate hydrogen risks • Use PPE effectively in hydrogen environments	Certificate in Hydrogen Safety
Operational Parameters Control	Emphasizes monitoring and controlling operational parameters (e.g., pressure, flow) in electrolysis systems for optimal performance.	30 hours	• Control operational parameters accurately • Use monitoring tools effectively • Ensure system stability and efficiency	Certificate in Operational Parameters Control

D3. Maintenance in Hydrogen Facilities

Programme Title	**Maintenance in Hydrogen Facilities**

Key Occupation	Maintenance Technician			
Target Mining Profile	Refrigeration Technician, Mining Mechanic			
Renewable Energy Sector	Green Hydrogen			
EQF Level	4			
Total Duration	120 hours (4 weeks full-time / 8 weeks part-time)			
Delivery Mode	Hybrid (Online + In-Person Practical Training)			
Certification	4 Microcredentials (1 per module)			
Training Objectives	1. Enable diagnosis, maintenance, and optimization of hydrogen systems.			
	2. Facilitate the transition of coal workers to the renewable sector.			
	3. Provide stackable training for progressive upskilling.			
Learning Outcomes	1. Perform advanced lubrication and leak detection.			
	2. Diagnose and plan preventive maintenance for hydrogen systems.			
	3. Apply safety protocols for high-risk interventions.			
Assessment Methods	1. Knowledge Test (30%)			
	2. Practical Demonstration (40%)			
	3. Team-Based Scenario (30%)			
Recognition of Prior Learning (RPL)	Available for relevant mining experience in refrigeration or mechanical maintenance.			
Progression Pathway	Leads to advanced training (e.g. Advanced Operation and Efficiency of Hydrogen Production Systems – EQF 5)			
Module Title	Description	Duration	Key Competencies Acquired	Microcredential Awarded
Advanced Lubrication Techniques	Covers advanced lubrication methods for hydrogen system components, ensuring durability and efficiency.	30 hours	• Apply advanced lubrication techniques • Maintain system components effectively • Optimize component longevity	Certificate in Advanced Lubrication Techniques
Leak Detection and Pressure System Diagnostics	Trains learners in detecting leaks and diagnosing pressure system issues in hydrogen facilities using specialized tools.	30 hours	• Detect leaks accurately • Diagnose pressure system issues • Use diagnostic tools effectively	Certificate in Leak Detection and Pressure Diagnostics

Preventive Maintenance Planning	Focuses on planning and executing preventive maintenance schedules for hydrogen systems to ensure operational reliability.	30 hours	• Plan preventive maintenance schedules • Conduct maintenance inspections • Optimize system performance	Certificate in Preventive Maintenance Planning
Safety Protocols for High-Risk Interventions	Emphasizes safety protocols for high-risk maintenance tasks in hydrogen facilities, including emergency response and risk mitigation.	30 hours	• Apply high-risk safety protocols • Mitigate risks during maintenance • Execute emergency procedures safely	Certificate in Safety Protocols for High-Risk Interventions

D4. Logistics and Hydrogen Storage Coordinator

Programme Title	**Logistics and Hydrogen Storage Coordinator**
Key Occupation	Logistics Coordinator
Target Mining Profile	Mining Logistics Coordinator
Renewable Energy Sector	Green Hydrogen
EQF Level	5
Total Duration	120 hours (4 weeks full-time / 8 weeks part-time)
Delivery Mode	Hybrid (Online + In-Person Practical Training)
Certification	3 Microcredentials (1 per module)
Training Objectives	1. Enable effective management of hydrogen transport and storage.
	2. Facilitate the transition of coal workers to the renewable sector.
	3. Provide stackable training for progressive upskilling.
Learning Outcomes	1. Apply ADR regulations for hydrogen transport.
	2. Plan routes and manage specific risks for hydrogen logistics.
	3. Ensure traceability in hydrogen storage systems.
Assessment Methods	1. Knowledge Test (30%)
	2. Practical Demonstration (40%)
	3. Team-Based Scenario (30%)
Recognition of Prior Learning (RPL)	Available for relevant mining experience in logistics coordination.
Progression Pathway	Leads to higher-level roles in renewable energy logistics management.

Module Title	Description	Duration	Key Competencies Acquired	Microcredential Awarded
ADR Regulation	Covers regulations for the transport of dangerous goods (ADR) specific to hydrogen, including compliance and documentation.	40 hours	• Apply ADR regulations for hydrogen transport • Ensure compliance with transport standards • Manage transport documentation	Certificate in ADR Regulation
Route Planning	Trains learners in planning efficient and safe routes for hydrogen transport, considering logistics and regulatory constraints.	40 hours	• Plan efficient transport routes • Optimize logistics for hydrogen delivery • Assess route-specific risks	Certificate in Route Planning
Specific Risk Management	Focuses on managing risks specific to hydrogen storage and transport, including hazard mitigation and emergency response.	40 hours	• Identify and mitigate hydrogen-specific risks • Develop risk management plans • Execute emergency response protocols	Certificate in Specific Risk Management

D5. Advanced Operation and Efficiency of Hydrogen Production Systems

Programme Title	**Advanced Operation and Efficiency of Hydrogen Production Systems**
Key Occupation	Advanced Hydrogen Systems Technician
Target Mining Profile	Process Engineer, Electrochemical Technician, Energy Consultant
Renewable Energy Sector	Green Hydrogen
EQF Level	5
Total Duration	120 hours (4 weeks full-time / 8 weeks part-time)
Delivery Mode	Hybrid (Online + In-Person Practical Training)
Certification	4 Microcredentials (1 per module)
Training Objectives	1. Enable advanced configuration and optimization of hydrogen production systems.
	2. Facilitate the transition of coal workers to the renewable sector.
	3. Provide stackable training for progressive upskilling.
Learning Outcomes	1. Apply chemistry principles to hydrogen systems.
	2. Use automation, SCADA, and energy modeling tools for process control.

	3. Optimize system efficiency and safety.			
Assessment Methods	1. Knowledge Test (30%)			
	2. Practical Demonstration (40%)			
	3. Team-Based Scenario (30%)			
Recognition of Prior Learning (RPL)	Available for relevant mining experience in process engineering or electrochemical systems.			
Progression Pathway	Leads to higher-level roles in renewable energy management.			
Module Title	Description	Duration	Key Competencies Acquired	Microcredential Awarded
Applied Chemistry for Hydrogen Systems	Covers chemical principles for green hydrogen production, including electrolysis reactions and material compatibility.	30 hours	• Apply chemical principles to hydrogen systems • Understand electrolysis reactions • Ensure material compatibility	Certificate in Applied Chemistry for Hydrogen Systems
Automation and Process Control	Trains learners in using automation systems for hydrogen production, including control algorithms and system integration.	30 hours	• Implement automation for hydrogen systems • Use control algorithms effectively • Integrate systems for optimal performance	Certificate in Automation and Process Control
SCADA Monitoring and Analysis	Focuses on using SCADA systems for monitoring and analyzing hydrogen production processes, including data interpretation.	30 hours	• Operate SCADA systems proficiently • Analyze production data • Optimize system performance using SCADA	Certificate in SCADA Monitoring and Analysis
Energy Models and Efficiency Simulation	Emphasizes energy modeling and simulation tools to improve the efficiency and safety of hydrogen production systems.	30 hours	• Develop energy models for hydrogen systems • Simulate system efficiency • Optimize production processes	Certificate in Energy Models and Efficiency Simulation

Appendix E – Training Plans Pumped Hydro System

E1. Basic Operator in Pumped Hydro Systems

Programme Title	Basic Operator in Pumped Hydro Systems			
Key Occupation	Plant Operator			
Target Mining Profile	Pump Technician			
Renewable Energy Sector	Pumped Hydro Energy			
EQF Level	3			
Total Duration	120 hours (4 weeks full-time / 8 weeks part-time)			
Delivery Mode	Hybrid (Online + In-Person Practical Training)			
Certification	3 Microcredentials (1 per module)			
Training Objectives	1. Enable safe and effective operation of pumped hydro storage systems.			
	2. Facilitate the transition of coal workers to the renewable sector.			
	3. Provide stackable training for progressive upskilling.			
Learning Outcomes	1. Understand fluid mechanics and perform sensor reading.			
	2. Conduct routine checks for system reliability.			
	3. Apply safety protocols in pumped hydro operations.			
Assessment Methods	1. Knowledge Test (30%)			
	2. Practical Demonstration (40%)			
	3. Team-Based Scenario (30%)			
Recognition of Prior Learning (RPL)	Available for relevant mining experience in pump operations or fluid systems.			
Progression Pathway	Leads to mid-level training (e.g. Assembly and Electrical Installation in Pumped Hydro Plants – EQF 3)			
Module Title	Description	Duration	Key Competencies Acquired	Microcredential Awarded
Fluid Mechanics Basics	Covers fundamental principles of fluid mechanics relevant to pumped hydro systems, including flow dynamics and system components.	40 hours	• Understand fluid mechanics principles • Identify pumped hydro system components • Apply fluid dynamics knowledge to operations	Certificate in Fluid Mechanics Basics

Sensor Reading	Trains Learners in reading and interpreting sensors for monitoring water flow, pressure, and other parameters in pumped hydro systems.	40 hours	• Read and interpret sensor data accurately • Monitor system performance using sensors • Identify anomalies in sensor readings	Certificate in Sensor Reading
Routine Checks and Safety	Focuses on performing routine checks to ensure system reliability and applying safety protocols specific to pumped hydro environments.	40 hours	• Conduct routine system checks • Apply safety protocols in hydro operations • Ensure operational reliability	Certificate in Routine Checks and Safety

E2. Assembly and Electrical Installation in Pumped Hydro Plants

Programme Title	**Assembly and Electrical Installation in Pumped Hydro Plants**
Key Occupation	Installation Technician
Target Mining Profile	Maintenance Assistant, Network Technician
Renewable Energy Sector	Pumped Hydro Energy
EQF Level	3
Total Duration	120 hours (4 weeks full-time / 8 weeks part-time)
Delivery Mode	Hybrid (Online + In-Person Practical Training)
Certification	3 Microcredentials (1 per module)
Training Objectives	1. Enable support in assembly and electrical installation of pumped hydro systems.
	2. Facilitate the transition of coal workers to the renewable sector.
	3. Provide stackable training for progressive upskilling.
Learning Outcomes	1. Assemble plant components and follow installation protocols.
	2. Apply electrical safety standards.
	3. Support cabling and control system installation.
Assessment Methods	1. Knowledge Test (30%)
	2. Practical Demonstration (40%)
	3. Team-Based Scenario (30%)
Recognition of Prior Learning (RPL)	Available for relevant mining experience in maintenance or electrical systems.

Progression Pathway	Leads to advanced training (e.g. Technician in Pumped Hydro Plant Assembly and Maintenance – EQF 4)			
Module Title	Description	Duration	Key Competencies Acquired	Microcredential Awarded
Plant Components	Covers the identification and assembly of mechanical components in pumped hydro plants, including turbines and pumps.	40 hours	• Identify and assemble plant components • Use tools for component assembly • Ensure component alignment and functionality	Certificate in Plant Components
Installation Protocols	Trains learners in following installation protocols for mechanical and electrical systems in pumped hydro plants.	40 hours	• Apply installation protocols accurately • Install mechanical and electrical systems • Verify installation quality	Certificate in Installation Protocols
Electrical Safety	Focuses on electrical safety standards for installing cabling and control systems in pumped hydro environments.	40 hours	• Apply electrical safety standards • Mitigate electrical risks during installation • Ensure safe cabling practices	Certificate in Electrical Safety

E2. Technician in Pumped Hydro Plant Assembly and Maintenance

Programme Title	**Technician in Pumped Hydro Plant Assembly and Maintenance**
Key Occupation	Maintenance Technician
Target Mining Profile	Welder, Assembly Technician
Renewable Energy Sector	Pumped Hydro Energy
EQF Level	4
Total Duration	120 hours (4 weeks full-time / 8 weeks part-time)
Delivery Mode	Hybrid (Online + In-Person Practical Training)
Certification	3 Microcredentials (1 per module)
Training Objectives	1. Enable professional assembly, repair, and maintenance of pumped hydro systems.

	2. Facilitate the transition of coal workers to the renewable sector.			
	3. Provide stackable training for progressive upskilling.			
Learning Outcomes	1. Interpret hydraulic plans and perform welding tasks.			
	2. Conduct structural assembly for pumped hydro systems.			
	3. Apply maintenance techniques for system reliability.			
Assessment Methods	1. Knowledge Test (30%)			
	2. Practical Demonstration (40%)			
	3. Team-Based Scenario (30%)			
Recognition of Prior Learning (RPL)	Available for relevant mining experience in welding or assembly.			
Progression Pathway	Leads to supervisory training (e.g. Supervisor for Pumped Hydro Construction and Operation – EQF 5)			
Module Title	Description	Duration	Key Competencies Acquired	Microcredential Awarded
Hydraulic Plans and Welding	Covers interpretation of hydraulic plans and welding techniques for assembling and repairing pumped hydro system components.	40 hours	• Interpret hydraulic plans accurately • Perform welding for system components • Ensure weld quality and integrity	Certificate in Hydraulic Plans and Welding
Structural Assembly	Trains learners in assembling structural components of pumped hydro plants, including alignment and stability checks.	40 hours	• Assemble structural components effectively • Verify structural alignment and stability • Use assembly tools proficiently	Certificate in Structural Assembly
Maintenance Techniques	Focuses on maintenance techniques for pumped hydro systems, including inspections, repairs, and system optimization.	40 hours	• Perform maintenance tasks efficiently • Conduct system inspections and repairs • Optimize system performance	Certificate in Maintenance Techniques

E3. Supervisor for Pumped Hydro Construction and Operation

Programme Title	**Supervisor for Pumped Hydro Construction and Operation**			
Key Occupation	Site Supervisor			
Target Mining Profile	Mining Works Supervisor			
Renewable Energy Sector	Pumped Hydro Energy			
EQF Level	5			
Total Duration	120 hours (4 weeks full-time / 8 weeks part-time)			
Delivery Mode	Hybrid (Online + In-Person Practical Training)			
Certification	3 Microcredentials (1 per module)			
Training Objectives	1. Enable leadership and coordination in pumped hydro construction and operation.			
	2. Facilitate the transition of coal workers to the renewable sector.			
	3. Provide stackable training for progressive upskilling.			
Learning Outcomes	1. Manage construction and operation sites effectively.			
	2. Plan and budget pumped hydro projects.			
	3. Implement occupational risk prevention measures.			
Assessment Methods	1. Knowledge Test (30%)			
	2. Practical Demonstration (40%)			
	3. Team-Based Scenario (30%)			
Recognition of Prior Learning (RPL)	Available for relevant mining experience in site supervision or management.			
Progression Pathway	Leads to higher-level roles in renewable energy management.			
Module Title	Description	Duration	Key Competencies Acquired	Microcredential Awarded
Site Management	Covers leadership and coordination skills for managing teams during construction and operation of pumped hydro plants.	40 hours	• Lead and coordinate site teams • Manage site operations efficiently • Resolve operational conflicts	Certificate in Site Management
Planning and Budgeting	Trains learners in planning and budgeting for pumped hydro projects, including resource allocation and cost management.	40 hours	• Develop project plans and budgets • Allocate resources effectively • Monitor project costs	Certificate in Planning and Budgeting

Occupational Risk Prevention	Focuses on implementing risk prevention measures specific to pumped hydro sites, including safety protocols and compliance.	40 hours	• Apply occupational risk prevention measures • Ensure site safety compliance • Mitigate risks effectively	Certificate in Occupational Risk Prevention

E4. Advanced Operation and Optimisation of Pumped Hydro Plants

Programme Title	**Advanced Operation and Optimisation of Pumped Hydro Plants**			
Key Occupation	Advanced Pumped Hydro Systems Technician			
Target Mining Profile	Civil Works Technician, Mechanical Technician			
Renewable Energy Sector	Pumped Hydro Energy			
EQF Level	5			
Total Duration	120 hours (4 weeks full-time / 8 weeks part-time)			
Delivery Mode	Hybrid (Online + In-Person Practical Training)			
Certification	4 Microcredentials (1 per module)			
Training Objectives	1. Enable advanced operation and optimization of pumped hydro facilities.			
	2. Facilitate the transition of coal workers to the renewable sector.			
	3. Provide stackable training for progressive upskilling.			
Learning Outcomes	1. Perform hydraulic modeling and energy optimization.			
	2. Integrate and monitor SCADA systems.			
	3. Apply predictive maintenance for hydraulic systems.			
Assessment Methods	1. Knowledge Test (30%)			
	2. Practical Demonstration (40%)			
	3. Team-Based Scenario (30%)			
Recognition of Prior Learning (RPL)	Available for relevant mining experience in civil works or mechanical systems.			
Progression Pathway	Leads to higher-level roles in renewable energy management.			
Module Title	Description	Duration	Key Competencies Acquired	Microcredential Awarded
Hydraulic Modelling and Analysis	Covers hydraulic modeling techniques for analyzing water flow and system performance in pumped hydro plants.	30 hours	• Develop hydraulic models • Analyze system performance • Optimize water flow dynamics	Certificate in Hydraulic Modelling and Analysis

Energy Optimisation Strategies	Trains learners in strategies to improve energy efficiency in pumped hydro systems, including load balancing and system tuning.	30 hours	• Implement energy optimization strategies • Balance system loads effectively • Tune systems for efficiency	Certificate in Energy Optimisation Strategies
SCADA Integration and Monitoring	Focuses on integrating and using SCADA systems for real-time monitoring and control of pumped hydro facilities.	30 hours	• Integrate SCADA systems • Monitor plant operations in real-time • Analyze SCADA data for performance	Certificate in SCADA Integration and Monitoring
Predictive Maintenance for Hydraulic Systems	Emphasizes predictive maintenance techniques for hydraulic systems, using data analysis to prevent failures and optimize performance.	30 hours	• Apply predictive maintenance techniques • Analyze data for system health • Prevent hydraulic system failures	Certificate in Predictive Maintenance for Hydraulic Systems

Appendix F – Training Plans Battery Energy

F1. Auxiliary in Battery Assembly

Programme Title	**Auxiliary in Battery Assembly**			
Key Occupation	Assembly Technician, Production Operator			
Target Mining Profile	Plant Operator			
Renewable Energy Sector	Battery Energy Storage			
EQF Level	2			
Total Duration	120 hours (4 weeks full-time / 8 weeks part-time)			
Delivery Mode	Hybrid (Online + In-Person Practical Training)			
Certification	3 Microcredentials (1 per module)			
Training Objectives	1. Enable safe and effective assembly of battery cells and modules.			
	2. Facilitate the transition of coal workers to the renewable sector.			
	3. Provide stackable training for progressive upskilling.			
Learning Outcomes	1. Handle battery components safely and perform quality control.			
	2. Apply industrial ergonomics for efficient assembly.			
	3. Ensure compliance with safety and quality standards.			
Assessment Methods	1. Knowledge Test (30%)			
	2. Practical Demonstration (40%)			
	3. Team-Based Scenario (30%)			
Recognition of Prior Learning (RPL)	Available for relevant mining experience in plant operations or manual assembly.			
Progression Pathway	Leads to mid-level training (e.g. Operator in Battery Manufacturing Lines – EQF 3)			
Module Title	Description	Duration	Key Competencies Acquired	Microcredential Awarded
Safe Handling	Covers safe handling techniques for battery cells and modules, including hazard identification and use of personal protective equipment (PPE).	40 hours	• Handle battery components safely • Identify battery-related hazards • Use PPE effectively in assembly environments	Certificate in Safe Handling
Quality Control	Trains learners in quality control processes for battery assembly, including inspection and defect identification.	40 hours	• Perform quality control inspections • Identify defects in battery components • Ensure assembly meets quality standards	Certificate in Quality Control
Industrial Ergonomics	Focuses on ergonomic practices for battery assembly tasks,	40 hours	• Apply ergonomic principles in assembly	Certificate in Industrial Ergonomics

	ensuring efficiency and reducing physical strain.		• Optimize work efficiency • Reduce physical strain during tasks	

F2. Operator in Battery Manufacturing Lines

Programme Title	**Operator in Battery Manufacturing Lines**			
Key Occupation	Process Operator, Battery Assembler			
Target Mining Profile	Processing Plant Operator			
Renewable Energy Sector	Battery Energy Storage			
EQF Level	3			
Total Duration	120 hours (4 weeks full-time / 8 weeks part-time)			
Delivery Mode	Hybrid (Online + In-Person Practical Training)			
Certification	3 Microcredentials (1 per module)			
Training Objectives	1. Enable operation of battery manufacturing lines and inspection processes.			
	2. Facilitate the transition of coal workers to the renewable sector.			
	3. Provide stackable training for progressive upskilling.			
Learning Outcomes	1. Operate tools and perform visual quality control.			
	2. Handle hazardous materials safely.			
	3. Support efficient battery manufacturing processes.			
Assessment Methods	1. Knowledge Test (30%)			
	2. Practical Demonstration (40%)			
	3. Team-Based Scenario (30%)			
Recognition of Prior Learning (RPL)	Available for relevant mining experience in processing plant operations.			
Progression Pathway	Leads to advanced training (e.g. Technician in Battery Maintenance and Storage – EQF 4)			
Module Title	Description	Duration	Key Competencies Acquired	Microcredential Awarded
Tool Usage	Covers the use of tools for operating battery manufacturing lines, including assembly and packaging equipment.	40 hours	• Operate manufacturing tools proficiently • Handle assembly and packaging equipment • Ensure tool safety and efficiency	Certificate in Tool Usage
Visual Quality Control	Trains learners in visual inspection techniques to ensure quality in battery components and final products.	40 hours	• Perform visual quality inspections • Identify defects in battery components • Maintain quality standards in production	Certificate in Visual Quality Control

Hazardous Material Safety	Focuses on safe handling and management of hazardous materials used in battery manufacturing, including compliance with safety protocols.	40 hours	• Handle hazardous aterials safely • Apply safety protocols in production • Mitigate risks from hazardous materials	Certificate in Hazardous Material Safety

F3. Technician in Battery Maintenance and Storage

Programme Title	**Technician in Battery Maintenance and Storage**			
Key Occupation	Maintenance Technician, Logistics Assistant			
Target Mining Profile	Mechanical Maintenance Technician			
Renewable Energy Sector	Battery Energy Storage			
EQF Level	4			
Total Duration	120 hours (4 weeks full-time / 8 weeks part-time)			
Delivery Mode	Hybrid (Online + In-Person Practical Training)			
Certification	3 Microcredentials (1 per module)			
Training Objectives	1. Enable inspection, maintenance, and integration of battery systems.			
	2. Facilitate the transition of coal workers to the renewable sector.			
	3. Provide stackable training for progressive upskilling.			
Learning Outcomes	1. Follow connection protocols and perform charge/discharge testing.			
	2. Apply electrical safety norms.			
	3. Ensure battery system integration and reliability.			
Assessment Methods	1. Knowledge Test (30%)			
	2. Practical Demonstration (40%)			
	3. Team-Based Scenario (30%)			
Recognition of Prior Learning (RPL)	Available for relevant mining experience in mechanical or electrical maintenance.			
Progression Pathway	Leads to advanced training (e.g. Technician in Battery System Configuration – EQF 5)			
Module Title	Description	Duration	Key Competencies Acquired	Microcredential Awarded
Connection Protocols	Covers protocols for connecting battery systems to energy networks, including wiring and integration procedures.	40 hours	• Follow battery connection protocols • Integrate battery systems into networks • Ensure secure connections	Certificate in Connection Protocols
Charge/Discharge Testing	Trains learners in performing charge and discharge tests to assess battery performance and health.	40 hours	• Conduct charge/discharge tests • Assess battery performance	Certificate in Charge/Discharge Testing

			• Identify battery health issues	
Electrical Safety Norms	Focuses on applying electrical safety standards during battery maintenance and storage operations.	40 hours	• Apply electrical safety norms • Mitigate electrical risks • Ensure safe maintenance practices	Certificate in Electrical Safety Norms

F4. Specialist in Battery Recycling and Circular Economy

Programme Title	**Specialist in Battery Recycling and Circular Economy**			
Key Occupation	Circular Economy Technician (Batteries)			
Target Mining Profile	Environmental Technician			
Renewable Energy Sector	Battery Energy Storage			
EQF Level	5			
Total Duration	120 hours (4 weeks full-time / 8 weeks part-time)			
Delivery Mode	Hybrid (Online + In-Person Practical Training)			
Certification	3 Microcredentials (1 per module)			
Training Objectives	1. Enable recovery, treatment, and reuse of used batteries.			
	2. Facilitate the transition of coal workers to the renewable sector.			
	3. Provide stackable training for progressive upskilling.			
Learning Outcomes	1. Identify battery cells and perform separation processes.			
	2. Ensure compliance with environmental standards.			
	3. Support circular economy practices in battery recycling.			
Assessment Methods	1. Knowledge Test (30%)			
	2. Practical Demonstration (40%)			
	3. Team-Based Scenario (30%)			
Recognition of Prior Learning (RPL)	Available for relevant mining experience in environmental management or material handling.			
Progression Pathway	Leads to higher-level roles in renewable energy management or circular economy.			
Module Title	Description	Duration	Key Competencies Acquired	Microcredential Awarded
Cell Identification	Covers identification of battery cells and materials for recycling, including classification and handling procedures.	40 hours	• Identify battery cells and materials • Classify cells for recycling • Handle materials safely	Certificate in Cell Identification
Separation Processes	Trains learners in processes for separating battery components, including mechanical and chemical methods.	40 hours	• Perform battery component separation • Use separation techniques effectively	Certificate in Separation Processes

			• Ensure material recovery efficiency	
Environmental Compliance	Focuses on compliance with environmental standards for battery recycling, including regulations and waste management.	40 hours	• Ensure environmental compliance • Apply waste management regulations • Mitigate environmental risks	Certificate in Environmental Compliance

F5. Technician in Battery System Configuration

Programme Title	**Technician in Battery System Configuration**			
Key Occupation	Battery Systems Integrator, Energy Storage Technical Supervisor			
Target Mining Profile	Electrical Systems Technician			
Renewable Energy Sector	Battery Energy Storage			
EQF Level	5			
Total Duration	120 hours (4 weeks full-time / 8 weeks part-time)			
Delivery Mode	Hybrid (Online + In-Person Practical Training)			
Certification	4 Microcredentials (1 per module)			
Training Objectives	1. Enable configuration, commissioning, and monitoring of battery storage systems. 2. Facilitate the transition of coal workers to the renewable sector. 3. Provide stackable training for progressive upskilling.			
Learning Outcomes	1. Configure battery pack interconnections and monitor SCADA systems. 2. Perform performance validation testing. 3. Apply safety protocols for battery system operations.			
Assessment Methods	1. Knowledge Test (30%) 2. Practical Demonstration (40%) 3. Team-Based Scenario (30%)			
Recognition of Prior Learning (RPL)	Available for relevant mining experience in electrical systems or energy management.			
Progression Pathway	Leads to higher-level roles in renewable energy management.			
Module Title	Description	Duration	Key Competencies Acquired	Microcredential Awarded
Battery Pack Interconnection	Covers configuration and interconnection of battery packs for medium-scale storage systems, ensuring compatibility with energy networks.	30 hours	• Configure battery pack interconnections • Ensure network compatibility • Verify connection integrity	Certificate in Battery Pack Interconnection
SCADA Monitoring	Trains learners in using SCADA systems for data interpretation and alarm	30 hours	• Operate SCADA systems for monitoring	Certificate in SCADA Monitoring

	management in battery storage systems.		• Interpret data and manage alarms • Optimize system performance	
Performance Validation Testing	Focuses on conducting capacity and cycle tests to validate battery system performance and reliability.	30 hours	• Perform capacity and cycle tests • Validate battery system performance • Identify performance issues	Certificate in Performance Validation Testing
Safety Protocols	Emphasizes safety protocols for configuring and operating battery storage systems, including risk mitigation and emergency procedures.	30 hours	• Apply safety protocols for battery systems • Mitigate operational risks • Execute emergency procedures safely	Certificate in Safety Protocols