

EVTECH



**A4.2: Update of relevant ESCO occupational profiles and specifications for an EU-wide professional qualification.
TASK: Blueprint of an EU-wide qualification for EV.**

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1. EXECUTIVE SUMMARY

The Blueprint of an EU-wide qualification for EV is a document containing the following areas:

- INTRODUCTION OF THE BLUEPRINT - containing information on why a qualifications plan was created, for which target groups, how qualifications systems in the European Union can be reviewed and a description of the basic tools used in the process of acquiring VET qualifications.
- QUALIFICATION SUMMARY - containing definitions of qualifications and the general EVTECH qualification plan.
- QUALIFICATIONS SPECIFICATION - containing detailed information regarding the EVTECH qualification plan.
- QUALIFICATIONS STRUCTURE - containing a description of the structure of the EVTECH qualification plan, in particular descriptions of educational modules and hours of implementation.
- CERTIFICATION PROCESS - containing a description of the certification process and conditions for obtaining qualifications in the area of electric cars within the EVTECH program.
- REQUIREMENTS FOR TRAINING ENTITIES - containing conditions and requirements for entities training and delivering the EVTECH qualification plan.
- QUALITY ASSURANCE IN EDUCATION AND COMPETENCE ASSESSMENT - containing a description of internal and external quality assurance indicators and principles of competence assessment.
- MODULES SPECIFICATIONS - containing descriptions of each of the five educational modules.
- TRAINING DELIVERY PLANS - containing a description of how to implement the EVTECH qualification plan.
- CONCLUSION - containing a summary and tips for implementing the EVTECH qualification plan.

2. INTRODUCTION OF THE BLUEPRINT

As EV technology has become increasingly prevalent in a wide range of sectors, the goal of the consortium is to provide Modules (learning units) that will correspond to EQF 4, in order to support current and future EV professionals. This, will enable vehicle technicians to learn the skills needed to operate efficiently and safely on complex electric/electronic automobile systems, boosting their flexibility and employability in a (green) transitioning sector. Furthermore, the project will assist training providers in incorporating the materials into their web-based learning offerings, and finally, the project will improve collaboration between training providers and businesses in order to provide on-the-job training opportunities that will allow car technicians to upskill.

The main target groups are car technicians, who need to cope with contemporary work environment requirements via upskilling opportunities, to ensure long-term employability in the evolving automotive sector, to have access to formal & flexible training opportunities, and to become aware of workplace hazards & relevant safety measures; VET providers, who need to have access to flexible & easily deployable educational resources, and to improve the relevance of training programmes to correspond to new industry trends; automotive service companies, with the need to improve organisational learning and ensure upskilling opportunities & workplace safety, and (iv) sector representatives and associations, that need to establish occupational/educational standards for the sector, enhancing intra-EU labour mobility, and to support the greening of the mobility sector.

The VET qualifications system in the European Union is described by CEDEFOP¹, i.e. the European Centre for the Development of Vocational Training.

¹ “Key Indicators on Vet,” CEDEFOP, December 12, 2022, <https://www.cedefop.europa.eu/en/tools/key-indicators-on-vet>.

European tools to help you obtain VET qualifications:

- EQF tool

The EQF is an 8-level, learning outcomes-based framework for all types of qualifications that serves as a translation tool between different national qualifications frameworks². This framework helps improve transparency, comparability and portability of people’s qualifications and makes it possible to compare qualifications from different countries and institutions. The EQF covers all types and all levels of qualifications and the use of learning outcomes makes it clear what a person knows, understands and is able to do. The level increases according to the level of proficiency, level 1 is the lowest and 8 the highest level. Most importantly the EQF is closely linked to national qualifications frameworks, this way it can provide a comprehensive map of all types and levels of qualifications in Europe, which are increasingly accessible through qualification databases.

The EQF was set up in 2008 and later revised in 2017. Its revision has kept the core objectives of creating transparency and mutual trust in the landscape of qualifications in Europe. Member States committed themselves to further develop the EQF and make it more effective in facilitating the understanding of national, international and third-country qualifications by employers, workers and learners.

² “The European Qualifications Framework,” Europass, accessed November 20, 2024, <https://europass.europa.eu/en/europass-digital-tools/european-qualifications-framework>.

- ECVET tool

ECVET³ allows learners to accumulate, transfer and use their learning in units as these units are achieved. This enables building a qualification at learners' own pace from learning outcomes acquired in formal, non-formal and informal contexts, in their own country and abroad. The system is based on units of learning outcomes as part of qualifications that can be assessed and validated.

It offers a framework for making learners more mobile and qualifications more portable, laying down principles and technical specifications and making use of existing national legislation and regulations. It applies to VET (vocational education and training) qualifications at all levels of the European qualifications framework.

- EQAVET tool

The European Quality Assurance Reference Framework for Vocational Education and Training (EQAVET)⁴ emerged from the 2009 recommendation of the European Parliament and Council, as a European wide framework to support quality assurance in vocational education and training (VET) across Europe.

EQAVET is based on a quality assurance and improvement cycle (planning, implementation, evaluation/ assessment, and review/revision) and a selection of descriptors and indicators applicable to quality management at both VET system and VET provider levels.

EQAVET does not prescribe a particular quality assurance system or approach but provides a framework of common principles, indicative descriptors and indicators that may help in assessing and improving the quality of VET systems and VET provision. EQAVET can therefore be regarded as a 'toolbox,' from which the various users may choose those descriptors and indicators that they consider most relevant to the requirements of their quality assurance system.

³ "European Credit System for Vocational Education and Training (ECVET)," CEDEFOP, July 11, 2024, <https://www.cedefop.europa.eu/en/projects/european-credit-system-vocational-education-and-training-ecvet>.

⁴ "EQAVET - European Quality Assurance in Vocational Education and Training," EQAVET - European Quality Assurance in Vocational Education and Training - Employment, Social Affairs & Inclusion - European Commission, accessed November 20, 2024, <https://ec.europa.eu/social/main.jsp?langId=en&catId=1536>.

3. QUALIFICATION SUMMARY

Qualifications⁵ – the certificates and diplomas awarded following education, training and learning – are vital in modern societies. They affect our ability to get a job, practise a profession, pursue lifelong learning and move between countries. They also affect our general social standing and status. Qualifications are important:

- for employers, signaling what can be expected from a potential employee;
- for education and training, confirming that a candidate has successfully achieved a set of learning outcomes;
- for policy makers, as a focal point of education and training policies, providing among others a tangible output of learning processes.

While qualifications and degrees from initial education and training play an important role in Europe, new types of credentials (including digital badges, microcredentials, nano-credentials and others) are increasingly promoted as a complementary way of valuing learning, allowing individuals to collect and ‘stack’ learning experiences in a flexible way, at their own pace and throughout their life.

A broad range of qualifications are now included in national qualification frameworks linked to the European qualifications framework (EQF). These frameworks make understanding and comparing qualifications easier within and between countries, while they encourage countries to rethink and reform policy and practice on education, training and lifelong learning. Qualifications frameworks and related reforms have contributed to greater transparency of qualifications systems, and improved access to lifelong learning opportunities.

Electromobility, including electric cars, is one of the most developing areas that has a positive impact on the environment and climate. The implementation of the EVTECH project within the Erasmus+ KA2 program is in line with this trend, and its goal is to achieve the supply, quality and relevance of education and further training (VET) in the automotive industry.

⁵ "European Centre for the Development of Vocational Training", CEDEFOP, November 11, 2024, <https://www.cedefop.europa.eu/en/themes/qualifications-credentials>.

The project has also made transnational educational materials available in the form of OER to ensure wide adoption and support education and training professional opportunities in an attractive and flexible way. The EVTECH project developed a formal electric vehicle education and training program to meet current and emerging job needs, fundamentally improving the quality of sectoral formal and non-formal vocational training. The curriculum refers to EQF level 4 and is designed to last 2 semesters. It covers both theoretical and practical learning elements, using a modular structure to facilitate implementation in formal and informal VET environments. Each unit of learning is designed to aim at a unique set of learning outcomes, defined in terms of knowledge, skills and competencies, that can be assessed and validated in a consistent and coherent way. Each unit will also be assigned ECVET credit points, which will provide a benchmark for a future accredited qualification in the electromobility sector.

4. QUALIFICATIONS SPECIFICATION

Name	Electric Vehicles' maintenance and safety skills for car technicians
Type	VET
EQF level	4
Delivery method	VOOC/ in classroom
Awarding body	VET institution/ training entity
Type of certification to be obtained	Professional qualifications certificate in the area of electric cars. The certificate will confirm the acquisition of appropriate skills needed on the labor market, as well as part of the learning process in the direction of acquiring skills in the field of electric cars.
Prior knowledge	Electric car maintenance and safety
Entry requirements	Primary education completed
Duration	189 hours/ 2 semesters
Target group	Learners, E&T Providers, Automotive Service Companies, Sector Representatives and Associations
Assessment	<ul style="list-style-type: none"> • Theoretical: 60 % • Practical: 40 %
Passing thresholds	To receive a certificate, users must make materials in all modular units at least in 70%.
Delivery language	English, Greek, Polish, Spanish, Belgian, Danish

5. QUALIFICATIONS STRUCTURE

The EVTECH course consists of five modules, which are presented in the table below. The course modules in the EVTECH project are as follows:

- Module 1. EV Essentials
- Module 2. Vehicle Electrical & Electronic Principles
- Module 3. Vehicle Control System & Software
- Module 4. Battery Management System
- Module 5. EV Workplace Safety

Each module consists of learning units and each learning unit contains learning outcomes.

Modules	Learning outcomes	Duration
1 EV Essentials	1.1 EV technology overview 1.2 Currently available implementations 1.3 EV architecture (main building blocks) 1.4 Energy storage systems 1.5 Battery recharge 1.6 Operation of electric motors	Total: 22 hours
2 Vehicle Electrical & Electronic Principles	2.1 Direct Current motor vehicle electrical circuits: principles and properties of magnetism as applied to motor vehicle circuit devices 2.2 Interpretation of wiring diagrams 2.3 Circuit protection devices 2.4 Earthing principles and methods 2.5 Diagnosis, repair & maintenance of electric & electronic systems	Total: 41 hours
3 Vehicle Control System & Software	3.1 Troubleshoot and repair electronic systems 3.2 Advanced troubleshooting of electronic systems 3.3 Electrical system troubleshooting and safety on electric/hybrid vehicles	Total: 57 hours

	3.4 Troubleshooting and repair of electric/hybrid vehicles	
4 Battery Management System	4.1 Introduction to battery technology 4.2 The application of High Voltage batteries in Electric and Hybrid Electric vehicles 4.3 Diagnosis, repair & maintenance of Batteries including the BMS in Electric and Hybrid Electric vehicles	Total: 47 hours
5 EV Workplace Safety	5.1 Potential risks and challenges during EV repair, handling or maintenance 5.2 Electrical installation and functional system safety 5.3 Battery system safety 5.4 Tools and Equipment for Electric Vehicle Technicians	Total: 22 hours

6. CERTIFICATION PROCESS

The qualification will be awarded to participants who successfully complete the assessment threshold of 70%. The assessment and validation of learning outcomes given by the qualification is presented below:

EVTECH CERTIFICATION FRAMEWORK	
Examination duration	7 hours
Prerequisites for applicants	<p>First documentation</p> <ul style="list-style-type: none"> • Vocational training programme for Electric Vehicles' maintenance and safety skills Europass certificate supplement <p>Second documentation</p> <ul style="list-style-type: none"> • Curriculum vitae <p>Third documentation</p> <ul style="list-style-type: none"> • Completed application form
Prior Knowledge	The learner should have basic knowledge on a few of these disciplines: business management, economics, electrical engineering and electronics, computer science, system engineering, mathematics.
Assessment method	<ul style="list-style-type: none"> • Written: 60 % • Practical: 40 %
Assessment tools	<ul style="list-style-type: none"> • Examination • Oral/exercise • Project • Written exercise/test
Modules	<ul style="list-style-type: none"> • Module 1. EV Essentials

	<ul style="list-style-type: none"> • Module 2. Vehicle Electrical & Electronic Principles • Module 3. Vehicle Control System & Software • Module 4. Battery Management System • Module 5. EV Workplace Safety
Learning Outcomes	<ul style="list-style-type: none"> • EV technology overview • Currently available implementations • EV architecture (main building blocks) • Energy storage systems • Battery recharge • Operation of electric motors • Direct Current motor vehicle electrical circuits: principles and properties of magnetism as applied to motor vehicle circuit devices • Interpretation of wiring diagrams • Circuit protection devices • Earthing principles and methods • Diagnosis, repair & maintenance of electric & electronic systems • Troubleshoot and repair electronic systems • Advanced troubleshooting of electronic systems • Electrical system troubleshooting and safety on electric/hybrid vehicles • Troubleshooting and repair of electric/hybrid vehicles • Introduction to battery technology • The application of High Voltage batteries in Electric and Hybrid Electric vehicles • Diagnosis, repair & maintenance of Batteries including the BMS in Electric and Hybrid Electric vehicles • Potential risks and challenges during EV repair, handling or maintenance • Electrical installation and functional system safety • Battery system safety • Tools and Equipment for Electric Vehicle Technicians
Performance levels	Basic

	<p>Basic knowledge of EV operating principles, procedures and components</p> <p>Intermediate Memory and theoretical knowledge as well as cognitive and practical skills in specific contexts in the field of EV</p> <p>Advanced Extensive, specialized memory and theoretical knowledge, and a wide range of cognitive and practical skills needed in the operation and maintenance of EV</p>
Performance criteria	Description of the minimum level of performance - basic, intermediate or advanced a participant must demonstrate for each learning outcome successfully completed assessment.
Scoring/Passing thresholds	To pass a learning element (module), participants need to respond correctly to 70% of all element questions. In order to obtain the certificate, participants need to reach the passing threshold in all learning elements
Type of certification to be obtained	<p>Professional Certificate in Electric Vehicles' maintenance and safety skills</p> <p>This certificate will act as an official testimonial of relevant skills acquisition, to be used as evidence in the labour market but also as part of a learner's process towards the completion of a VET qualification on electric vehicle technician</p>

7. REQUIREMENTS FOR TRAINING ENTITIES

Accredited/authorized institutions and educational establishments may integrate curricula into an existing course or a new course that may be offered at secondary school level. These education providers are required to demonstrate the suitability of their course through a course description, goals and objectives, an outline of the training course content, and the linking of the course to the universal curriculum and related curricula.

Trainers must be able to demonstrate that they meet the following professional knowledge requirements:

- have professional competence or technical knowledge in the areas in which they provide training and/or experience in conducting training;
- have relevant experience in the specific area they will be assessing;
- have credible experience in conducting training.

Training providers must ensure that students have the potential and skills necessary to successfully complete the qualification and that employers wishing to use the EVTECH Electric Vehicle Maintenance and Safety Skills vocational training programme are fully committed to delivering the full programme to their employees.

8. QUALITY ASSURANCE IN EDUCATION AND COMPETENCE ASSESSMENT

Quality assurance in education and competence assessment must be oriented towards the development of systems that can generate confidence in the process.

The organization must implement procedures to ensure the functionality of the system. It can implement procedures regarding document control, record control, corrective action, preventive action, non-compliant process control and internal audit. Also, for the training process, the organization must have operational procedures that describe how this process is carried out.

From the certification point of view, the organization must have a documented structure which safeguards impartiality, including provisions to assure the impartiality of the operations of the certification body. This structure shall enable the participation of all parties significantly concerned in developing policies and principles on the content and functioning of the certification system, without any particular interest predominating. In the case that organizations decide to subcontract work related to certification (e.g. examination, testing) to an external body or person, a properly documented agreement is recommended; this should include confidentiality and prevention of a conflict of interest. Decision on certification shall not be subcontracted under any circumstances. In general, the assessment of conformity of an object of interest with specific mandatory or voluntary standards is subject to further activity called accreditation.

Organizations are expected to support their staff in ensuring that their knowledge and/or practice remains current. This includes currency within the occupational area and best practice in certification of competencies, delivery, mentoring, training, assessment and quality assurance. It should also take into account any national, international policy and legislative developments. All this is implemented in the context in which it is desired to develop an effective quality management system in education, professional training and certification of competences. Quality assurance includes, on the one hand, internal quality assurance, carried out by each organization, and external bodies are responsible for external quality assurance.

8.1 INTERNAL QUALITY ASSURANCE

Internal Quality Assurance (IQA) is the process of monitoring the teaching, learning, and assessment activities that a learner at a training provider will undertake. It refers to the Quality Assurance carried out in a training center, by an internal member of staff, called Quality manager.

Quality managers are the Supervisors or Managers within training centers. They are responsible for the staff, systems, and procedures. They are not trainers or assessors because this would cause a conflict of interest.

Internal quality assurance is key to ensuring that the training provider has an efficient training system and the competency certification process is independent of the training process.

A quality manager must have:

- experience in the technical field in which he carries out his activity;
- experience in professional training;
- experience in the assessment of professional skills;
- proof of the fact that he participated in a quality manager training program.

8.2 EXTERNAL QUALITY ASSURANCE

External Quality Assurance (EQA) is the process of ensuring that the organization carries out all activities in a consistent, safe and fair manner.

External Quality Assurance is carried out by an external body. The external body can be an authority, an accreditation body.

The External Quality Assurance process guarantees that the service offered by the organization (professional training and competency certification) is of quality and complies with all related standards. The external body will monitor the training center's processes/practices. The external body will also monitor the competence of the organization's staff (trainers, competence evaluators). In the event that it identifies non-conformities in the evaluation process, the external body will make recommendations and monitor the implementation of the respective recommendations.

The external evaluation body collaborates with evaluators who have experience in the field of professional training and competency certification. They also have the necessary training to make external evaluations.

9. MODULES SPECIFICATIONS

MODULE 1:

Module 1: EV Essentials	
Module description	This module covers a comprehensive understanding of various hybrid electric vehicle types and the configuration of front-wheel drive electric vehicles. It also explains the general architecture of electric vehicles, highlighting key components. Battery fundamentals, including capacity, voltage, and charge/discharge rates, are emphasized for their importance in EV performance. The charging process of Lithium-Ion cells is detailed, with a focus on safety and efficiency considerations. Finally, an explanation of different electric motor types used in EV traction systems is provided, offering insights into propulsion technologies.
Learning objectives	<ul style="list-style-type: none"> • Describe the characteristics of series, parallel, plug-in and non-plug-in hybrid electric vehicles. • Describe the configuration of a front-wheel drive electric vehicle with a motor located in the front. • Describe the general architecture of an electric vehicle and its main components • Describe the fundamental parameters of a battery and its relevance in electric vehicles • Explain the charging process of a Lithium-Ion cell and the relevant aspects to take into account during this process. • Explain the different types of electric motors used in the traction systems of electric vehicles.
Learning outcomes	1.1 EV technology overview 1.2 Currently available implementations 1.3 EV architecture (main building blocks) 1.4 Energy storage systems 1.5 Battery recharge 1.6 Operation of electric motors
EQF level	Level 4

Duration	Contact hours: 13 Traineeship hours: 2 Hours of study: 6 Evaluation hours: 1
Recommended background	EQF level 2 and 3
Prerequisites	Basic knowledge of these disciplines: automotive engineering, electrical and electronic engineering, computer science, mathematics and physics.
Learning materials	<ul style="list-style-type: none"> • 40 presentation slides • 10 pages of lecture notes • 15 Q&As • 2 case studies • 10 MCQs
Assessment materials	<ul style="list-style-type: none"> • Examination • Oral/exercise • Project • Written exercise/test

MODULE 2:

Module 2: Vehicle Electrical & Electronic Principles	
Module description	This module aims to provide a comprehensive understanding of electrical principles in the context of direct current vehicles. This encompasses gaining familiarity with fundamental concepts like voltage, current, and resistance. Moreover, the significance of protection devices in electrical circuits is emphasized, elucidating their vital role in averting overcurrents and short circuits. Grounding in electrical systems is highlighted for its critical role in ensuring safety and guarding against electric shock hazards. Additionally, the importance of diagnostic procedures for identifying faults in both electrical and electronic systems is underscored, recognizing their pivotal role in vehicle maintenance and repair efforts.

Learning objectives	<ul style="list-style-type: none"> • Understand the basic concepts of electricity and magnetism and their application in electrical circuits of direct current vehicles. • Become familiar with the basic concepts of electricity, including voltage, current and resistance. • Understand the importance of protection devices in electrical circuits and their role in preventing overcurrent and short circuits. • Understand the importance of grounding in electrical systems and its role in safety and protection against electric shock. • Understand the diagnostic procedures for faults in electrical and electronic systems, as well as their importance for the maintenance and repair of vehicles.
Learning outcomes	<p>2.1 Direct Current motor vehicle electrical circuits: principles and properties of magnetism as applied to motor vehicle circuit devices</p> <p>2.2 Interpretation of wiring diagrams</p> <p>2.3 Circuit protection devices</p> <p>2.4 Earthing principles and methods</p> <p>2.5 Diagnosis, repair & maintenance of electric & electronic systems</p>
EQF level	Level 4
Duration	Contact hours: 20 Traineeship hours: 5 Hours of study: 15 Evaluation hours: 1
Recommended background	EQF level 2 or 3
Prerequisites	Basic knowledge of these disciplines: automotive engineering, electrical and electronic engineering, computer science, mathematics and physics.

Learning materials	<ul style="list-style-type: none"> • 40 presentation slides • 10 pages of lecture notes • 15 Q&As • 2 case studies • 10 MCQs
Assessment materials	<ul style="list-style-type: none"> • Examination • Oral/exercise • Project • Written exercise/test

MODULE 3:

Module 3: Vehicle Control Systems and Software	
Module description	The purpose of this module is to give the learner the necessary knowledge, skill and competencies in regards to vehicle control systems and software to act as a car mechanic/technician in the era of electric and hybrid electric car technologies, and thereby giving the learner the ability to work in troubleshooting and repairing electronic systems on both a basic and an advanced level, and also on electric/hybrid vehicles.
Learning objectives	<ul style="list-style-type: none"> • Introduction to Control Theory (Basic Concepts) • Overview of Control System: The Electronic Control Unit • Control Area Network & Control Variables • Diagnosis, repair & maintenance of control system • Function of Control System in HEVs and EVs
Learning outcomes	<p>3.1 Troubleshoot and repair electronic systems</p> <p>3.2 Advanced troubleshooting of electronic systems</p> <p>3.3 Electrical system troubleshooting and safety on electric/hybrid vehicles</p> <p>3.4 Troubleshooting and repair of electric/hybrid vehicles</p>
EQF level	Level 4
Duration	<p>Contact hours: 30</p> <p>Traineeship hours: 5</p> <p>Hours of study: 20</p> <p>Evaluation hours: 2</p>

Recommended background	EQF level 2 or 3
Prerequisites	Basic knowledge of these disciplines: automotive engineering, electrical and electronic engineering, computer science, mathematics and physics and completion of the EVTECH modules: <ul style="list-style-type: none"> • No. 1 • No. 2
Learning materials	<ul style="list-style-type: none"> • 40 presentation slides • 10 pages of lecture notes • 15 Q&As • 2 case studies • 10 MCQs
Assessment materials	<ul style="list-style-type: none"> • Examination • Oral/exercise • Project • Written exercise/test

MODULE 4:

Module 4: Battery Management System	
Module description	The purpose of this module is to give the learner the necessary knowledge, skill and competencies in regard to high voltage batteries and Battery Management System (BMS) to act as a car mechanic/technician in the era of electric and hybrid electric car technologies, and thereby giving the learner the ability to work with diagnosis, repair & maintenance of batteries including the BMS in Electric and Hybrid Electric vehicles.
Learning objectives	<ul style="list-style-type: none"> • Function of batteries in Electric and Hybrid Electric vehicles • Primary functions of BMS • Design of batteries and interpretation cell diagrams • Diagnosis, repair & maintenance of Batteries including the BMS
Learning outcomes	4.1 Introduction to battery technology

	<p>4.2 The application of High Voltage batteries in Electric and Hybrid Electric vehicles</p> <p>4.3 Diagnosis, repair & maintenance of Batteries including the BMS in Electric and Hybrid Electric vehicles</p>
EQF level	Level 4
Duration	<p>Contact hours: 25</p> <p>Traineeship hours: 5</p> <p>Hours of study: 15</p> <p>Evaluation hours: 2</p>
Recommended background	EQF level 2 or 3
Prerequisites	Basic knowledge of these disciplines: automotive engineering, electrical and electronic engineering, computer science, mathematics and physics and completion of the EVTECH module No. 2.
Learning materials	<ul style="list-style-type: none"> • 40 presentation slides • 10 pages of lecture notes • 15 Q&As • 2 case studies • 10 MCQs
Assessment materials	<ul style="list-style-type: none"> • Examination • Oral/exercise • Project • Written exercise/test

MODULE 5:

Module 5: EV Workplace Safety	
Module description	The aim of this module is to provide the learner with the necessary knowledge, skills and competences in the safe operation, maintenance and repair of electric cars. The learner will be able to mark the car and workplace in a safe way. In addition to the risks arising from the maintenance and repair of

	electric and hybrid vehicles, the learner will be able to select appropriate personal protective equipment and tools needed to perform maintenance and repair of the vehicle. The learner will also know the effects of electric current on the human body.
Learning objectives	<ul style="list-style-type: none"> ▪ Potential risks and challenges during EV repair, handling or maintenance ▪ Electrical installation safety ▪ Functional system safety ▪ Battery system safety • Tools and Equipment for Electric Vehicle Technicians
Learning outcomes	<p>5.1 Potential risks and challenges during EV repair, handling or maintenance</p> <p>5.2 Electrical installation and functional system safety</p> <p>5.3 Battery system safety</p> <p>5.4 Tools and Equipment for Electric Vehicle Technicians</p>
EQF level	Level 4
Duration	<p>Contact hours: 13</p> <p>Traineeship hours: 2</p> <p>Hours of study: 6</p> <p>Evaluation hours: 1</p>
Recommended background	EQF level 2 or 3
Prerequisites	Basic knowledge of these disciplines: automotive engineering, electrical and electronic engineering, computer science, mathematics and physics.
Learning materials	<ul style="list-style-type: none"> • 40 presentation slides • 10 pages of lecture notes • 15 Q&As • 2 case studies • 10 MCQs
Assessment materials	<ul style="list-style-type: none"> • Examination • Oral/exercise • Project • Written exercise/test

10. TRAINING DELIVERY PLANS

10.1 Training tools

The training program was designed to horizontally cover various aspects (scientific, technical, ethical, communication) and topics in the field of electric cars.

Educational Resource Pool: trainer's manual, educational instructions and study materials (lecture notes, presentation slides, questions and answers, and case studies), support the implementation of the EVTECH curriculum in (formal) VET and non-formal learning settings for car technicians. All materials are offered OER for unrestricted use by third parties.

The project justifies the creation of this set of educational resources for several fundamental reasons.

Firstly, it ensures universal access to training by providing a comprehensive set of educational resources, including manuals, presentations, and learning materials. This facilitates access to electric vehicle training in both formal vocational education and non-formal learning contexts. This ensures a wide spectrum of professionals, from students to active technicians, can benefit from the training.

Secondly, it aligns with the demand of the job market. The electric vehicle industry is experiencing significant growth, with an increasing demand for specialized technicians in this field. By providing specific resources for electric vehicle training, professionals are prepared to meet the needs of the current and future job market.

Furthermore, the educational materials, including manuals and presentations, serve as valuable tools for trainers. They provide a structured framework and relevant content for teaching complex concepts in electric vehicles, supporting effective teaching. By offering a variety of resources such as case studies and multiple-choice questions, trainers are provided with options to adapt the training to different learning styles and individual participant needs, enhancing the flexibility of the training. By sharing these resources as Open Educational Resources (OERs), the project promotes collaboration and knowledge exchange in the field of electric vehicle training. This contributes to the creation of a broader community of practice and the continuous improvement of training.

A "Trainer's Handbook" for electric vehicle training is a manual specifically designed to support trainers or instructors delivering courses on this subject. It contains detailed information and resources that facilitate the effective teaching of concepts and skills related to electric vehicles.

This Handbook is divided in seven chapters:

- the first chapter is the executive summary;
- the second chapter provides an introductory note;
- the third chapter presents the structure of the document and details the items of the lesson plans;
- the fourth chapter describes the different EVTECH learning units with their learning objectives and the expected knowledge and skills to be achieved, and detailed lesson plans for classroom sessions and online use are proposed based on the multimedia content and exercises available, along with the prerequisites to attempt the session;
- the fifth chapter explains how the EVTECH MOOC is organised;
- the sixth chapter presents the EVTECH course, providing information on how to access and use the EVTECH MOOC, as well as how to facilitate the MOOC;
- the seventh and final chapter refers to the organisation of pilot training seminars based on the EVTECH MOOC.

The aim of the "Trainer's Handbook" is to provide the trainer with the tools and guidance necessary to deliver effective and high-quality electric vehicle training.

This learning format has additional benefits:

- A clear structure is one of the key benefits of utilizing a "Trainer's Handbook." It provides an organized and coherent framework for training sessions, making it easier to plan and deliver effective instruction.
- Moreover, the handbook offers comprehensive guidance and resources for trainers. This additional support can significantly boost their confidence and effectiveness in the classroom, ultimately enhancing the learning experience for participants.
- The time-saving aspect is another advantage. By providing pre-prepared materials, the manual allows trainers to allocate less time to preparation, enabling them to focus more on the actual training process.
- Consistency in training delivery is crucial, and a handbook helps ensure that all trainers follow a uniform approach. This is particularly valuable, as it maintains a standard regardless of a trainer's prior experience.
- Additionally, the handbook facilitates assessment procedures. It equips trainers with tools and methods to monitor participants' progress and assess their understanding, aiding in the overall effectiveness of the training.

In summary, a "Trainer's Handbook" is a valuable tool, but should be used with flexibility and complemented with the trainer's experience and judgment to ensure effective training tailored to the specific needs of the participants.

10.2 Training target audience

The target audience identified by the project members is the result of the questionnaire and brainstorming sessions conducted during project meetings.

1. **Mechanics and Automotive Technicians:** Professionals already working in vehicle repair workshops who want to acquire specific skills in the electric vehicle field.
2. **Students of Vocational Automotive Training:** Individuals studying to become mechanics or automotive technicians who wish to specialize in electric vehicles.
3. **Owners and Managers of Automotive Workshops:** Those who want to update their knowledge and skills to be able to offer repair and maintenance services for electric vehicles in their workshop.
4. **Professionals in the Automotive Industry:** Individuals working in the automotive industry in roles related to vehicle technology and maintenance.
5. **Entrepreneurs or Future Automotive Sector Business Owners:** Individuals interested in starting their own electric vehicle repair workshop and want to acquire the necessary skills.
6. **Instructors and Trainers in Vocational Training:** Professionals responsible for delivering training in the electric vehicle field who seek to update their knowledge and teaching methods.
7. **Enthusiasts or Amateurs in Electric Vehicle Technology:** Individuals with a personal interest in electric vehicles who want to gain deeper knowledge about their operation and maintenance.
8. **Energy and Sustainability Professionals:** Those interested in transitioning towards more sustainable forms of mobility and want to better understand electric vehicle technology.

It is important to tailor the content and presentation of the course to meet the needs and levels of experience of this diverse audience. Additionally, offering certification or accreditation options for successful course completion can enhance its appeal to participants.

11. CONCLUSION

The rules and activities described in this document can be analyzed and adapted through processes within an organization engaged in training and competency assessment activities. An institution that organizes training and at the same time certifies acquired skills may implement the requirements of two standards: ISO 9001:2015 "Quality management systems - Requirements" and ISO/IEC 17024:2012: Conformity assessment - General requirements for bodies conducting certification of persons. Both standards have a process approach and can be used by the training organization and the certification center unit. In accordance with both standards, the quality management system of training and competence assessment providers is based on the PDCA cycle, i.e. a dynamic approach that can be implemented in each of the organization's processes and in the entire organization. The PDCA cycle involves planning, implementation, control and continuous improvement of both the training and assessment processes. Continuous maintenance and improvement of process performance can be achieved by applying the PDCA concept at all levels of the organization.

Within a competence training and assessment organization, the process approach is structured as follows: PLAN-DO-CHECK-ACTION.

In the training process and in the certification of competences process the PDCA cycle has the following approach:

- PLAN - establishes the objectives and processes necessary to obtain results in accordance with the requirements of the beneficiaries of the training and competence assessment processes as well as with those of the organization;
- DO - implements the processes of training and evaluation of competences;
- CHECK - monitors and measures the training processes and objectives as well as competence evaluation, analyzing the results obtained;
- ACT - applies actions for the continuous improvement of the performance of both the training and competence evaluation processes.

Any process of training and evaluation of competences must be permanently improved in order to be efficient and updated.

12. REFERENCES

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