



Project title	Education in Hydrogen Technologies Area
Project number	2021-1-CZ01-KA220-VET-000028073

Curriculum

Module title	Hydrogen storage and transport
Number of lessons	Estimated number of teaching hours required to achieve the learning outcomes set by the unit. Total number of hours: 20 Number of theoretical lessons: 10 Number of vocational training lessons: 10
Entry requirements	To successfully complete the module, the student must have already have the following professional competencies: <ul style="list-style-type: none"> a) Has knowledge of general aspects and regulations for storage of liquids and gases b) Has knowledge of general aspects and regulations for the transport of liquids and gases c) Can work with modern technical equipment (IT skills) d) Use technical documentation e) Pay attention to work safety and health protection at work
Brief summary of module aim	The goal of this module is to provide knowledge of aspects with regard to the design and capabilities of transport and storage infrastructure for hydrogen in various areas of industry. The information provided in the module will provide knowledge of the advantages and disadvantages of different options for hydrogen storage and transportation. The module also contains relevant information on developments in the field of storage and transport of hydrogen technologies for various industrial applications. Another goal is the knowledge of various materials and components that are used during the storage and transport of hydrogen. The safety aspects of all processes taking place during the storage and transport of hydrogen are a matter of course.
Expected learning outcomes (educational)	The student is familiar with the basic data on the possibilities of storage and transport of hydrogen. Knowledge of the issue determines the employment of students in positions in industrial companies specializing in hydrogen storage and transportation. Pupils will find other possible applications in the promising field of energy conversion and storage, with special regard to technologies that use hydrogen as an energy carriers. Students can establish themselves as employees of technical teams in industrial sphere. The student understands the importance of the need for sustainable development.
Module outline	Module outline: <ol style="list-style-type: none"> 1. Work safety during storage and transportation of hydrogen 2. Hydrogen transport <ol style="list-style-type: none"> 2.1 Transport of compressed hydrogen in containers by road or rail 2.2 Transport of liquid hydrogen in containers by road or rail 2.3 Hydrogen transport pipelines mixed with natural gas 2.4 Separation of hydrogen from the mixture with natural gas using membrane separation 2.5 Transport of pure hydrogen via an existing gas pipeline converted to pure hydrogen



	<p>2.6 Transport of pure hydrogen through a newly built gas pipeline 2.7 LOHC 3. Hydrogen storage 3.1 Storage of compressed hydrogen 3.2 Storage of liquid hydrogen 3.3 Storage of hydrogen in underground tanks mixed with methane or ammonia 3.4 Hydrogen storage in hydrides 3.5 Hydrogen storage in carbon-based containers 4. Components 4.1 Pressure vessels 4.2 Cryogenic tanks 4.3 High pressure storage</p>
Recommended educational practices (methods)	<p>The basic methods and forms of teaching are:</p> <ul style="list-style-type: none">- Work methods – explanation- Demonstration methods – demonstration and observation, working with images, instruction- Skill practical methods – imitation, manipulation, experimentation and laboratory work- Activating methods – discussion, problem solving- Group teaching – group and cooperative teaching, pair homogeneous and heterogeneous teaching, individualized teaching- E-learning course supported by presentations and illustrative photographs
Mode of module completion	<p>He passed the test with a test of professional knowledge with an overall evaluation of passed or failed</p>
Assessment standards of educational outcomes	<p>The basis for evaluation is the overall classification of the module. Emphasis is placed primarily on the depth of understanding of curriculum, logical thinking and the ability to apply knowledge in practice in solving application problems. The overall expression of the student, his teaching activity and ability to self-evaluate are also important. The knowledge of the subject matter is verified by a written or oral examination, in which emphasis is placed on the coherence, fluency and content accuracy of the speech.</p>