



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

Curriculum

Module title	Hydrogen for internal combustion engines
Number of lessons	<p>Expected number of educational lessons necessary to achieve the learning outcomes assigned by education units</p> <p>Total number of lessons: 20 Number of theoretical lessons: 10 Number of vocational training lessons: 10</p>
Entry requirements	<p>For successful completion of the module, a student needs to have the following entry vocational competencies:</p> <ol style="list-style-type: none"> Be able to fully understand gasoline engine, also understand the diesel engine. Has knowledge of the combustion rate of gasoline and diesel fuel. Has knowledge of the environmental pollution risks of gasoline- and diesel exhausts. Has knowledge of the health risks for working with gasoline- and diesel exhausts.
Brief summary of module aim	<p>This module's main purpose is to create an interest for using hydrogen gas in internal combustion chamber engines such as ordinary Otto and Diesel engines.</p> <p>In addition, the goal of the module is to present the possibility of modifying ordinary Otto or diesel engines to run on hydrogen gas including supporting developing countries that are still in the development phase of vehicle marketing and manufacturing.</p> <p>The module is also intended to create an interest in the environmental effects had we started the use of hydrogen at an earlier stage.</p> <p>Furthermore, the module's purpose is also to enlighten the students about the history of the discovery of hydrogen as well as exploring the use of gasoline and diesel as opposed to hydrogen.</p> <p>Familiarise the students with the risks of using hydrogen and especially its use under such high pressure.</p> <p>Creating an awareness of the risks involved using a gas with such a wide combustion range.</p>
Expected learning outcomes (educational)	<p>The student has basic historical details about hydrogen including basic knowledge of the different ways of producing hydrogen.</p> <p>The student also has general knowledge of the need for installation of public gas stations for hydrogen and its need for the development of the public usage of hydrogen. Furthermore, the student understands what it means to use hydrogen in obtaining permanent sustainable development within this field.</p>
Module outline	<p>Module outline</p> <ol style="list-style-type: none"> Introduction - history The Hydrogen gas Refueling The four-stroke principle in an Otto engine and Diesel engine



	<ol style="list-style-type: none">5. How does hydrogen work in an internal combustion engine6. The research stage7. Pros and Cons with the different methods8. Conclusions
Recommended educational practices (methods)	Basic methods and forms of education are: <ul style="list-style-type: none">– Written material including explanatory lectures– Demonstrative visual methods – demonstrations and observations, as well as working with images and instructions.– Study visits for the students to experience authentic situations with running engines.– Activating methods - discussions and problem solving.
Mode of module completion	Practical exam with a test of vocational skills with the final assessment – “pass – fail”.
Assessment standards of educational outcomes	The student needs to show knowledge of operating vehicles with hydrogen gas. Be able to show their knowledge in the subject as well as following instructions throughout the course. Show their knowledge by expressing themselves verbally on the subjects throughout the course. In addition, the student needs to complete a self- evaluation test during the course which shows their individual development. The final examination will be completed both orally and in writing.