GREENES

Co-funded by the European Union

A.2.5. CREATING INNOVATIVE CONTENTS

Activity 2.5 Development of innovative content is a key activity necessary for the development and improvement of the situation within eight entities, in all three institutions: PC (Regulations, Energy Potential of Waste, Sensor Systems), P1 (Combustion and Ecology, Energy and Environment, Material and Energy Use of Waste), P2 (Modern Production Technologies and Modern Hydro Power Plants). The aim of this activity was to integrate data on all study programs, their objectives with content innovations in the field of green energy based on current directives and market requirements on the one hand, as well as existing capacities (infrastructure, facilities, labor, workforce, etc.) in the field in all three countries.

The virtual module, which includes the subjects of the EU Directive, Energy Potential of Waste, Sensor Systems, Energy and Ecology of Combustion, Production Technologies, and Energy of Small Hydropower Plants, is of exceptional importance in the context of the application of digital knowledge and skills in teaching content. This module contributes to the improvement of the field of environmental protection and energy through the integration of digital technologies at several levels. One of the key aspects of this module is the integration of digital tools, software, and platforms into teaching content. The use of digital simulations, virtual labs, or data analysis software tools allows students to better understand concepts in each field. Interactivity is also an essential element of this module, allowing students to engage dynamically through online discussions, interactive exercises, and virtual field trips.

In addition, the virtual module provides learning flexibility, allowing students to access content at any time and from anywhere. This makes it easier to learn remotely and adapt to the individual needs and pace of learning of students. Digitalization also makes it possible to adapt teaching content to different learning styles, combining visual, auditory, and kinesthetic elements for a more efficient transfer of knowledge. One of the most important aspects of this module is the monitoring of students' progress through automated tests, quizzes, or assignments. Teachers can use these digital tools to better track their understanding of the material and tailor teaching to the needs of students.

Overall, the virtual module with these subjects offers a unique opportunity to integrate digital technologies into the teaching process. This integration contributes to more effective learning, a better understanding of the concept, and the preparation of students for contemporary challenges in the field of environmental protection and energy.

Green knowledge, skills and competencies required by students and current employees are defined within the earlier activities in this work package, they are defined through cooperation with partners from the economy and are aligned with their needs and experiences. This should result in long-term agreements between P1-P3 partners and companies/stakeholders on the ground.
The seven courses are thus selected and mutually harmonized with their goals and outcomes to be one common module at the level of all three institutions and is the basis for further project activities within the K131 Call.

Module objectives

Inviting and Empowering Students to

- *Implementation of digital tools for monitoring and managing waste management processes to improve performance and efficiency.*
- *Development of digital platforms for the analysis of the energy potential of waste and proposing proper thermal processes for obtaining energy from waste, considering the specific characteristics of the area and technological possibilities.*
- *Integration of sensor systems into control processes to automatically collect data on process quality from the energy point, pollution level and other relevant parameters for faster response and decision-making.*
- *The use of digital algorithms and analytical tools to assess the economic and environmental aspects of different renewable energy technologies from various sources, in order to identify the most appropriate and sustainable options for energy production.*

Module outcomes

After completing the content of the courses, i.e., individual subjects, students will expand their knowledge and skills and will be trained to

- *Understand and apply digital tools in waste management processes to effectively check, analyze, and improve system performance.*
- *Empowered to implement digital platforms for the analysis of the energy potential of waste and the identification of best thermal processes for the conversion of waste into energy, considering the specific characteristics of local resources and market demands.*
- *Competent in integrating sensor systems into process control processes to automatically collect data from energy sources, pollution levels and other relevant parameters, as well as in analyzing this data to make informed decisions.*
- *Proficient in applying digital algorithms and tools to assess the economic and environmental viability of different renewable energy production technologies from various sources, with the aim of identifying the most optimal solutions that contribute to reducing environmental impact and improving energy efficiency.*

Subject	ECTS	Outcomes	Digital aspects
Directives and standards in the environment		monitors and implements existing EU directives in the field of environmental protection, especially in the field of waste management, monitors and implements the existing legislation of the Republic of Serbia in the field of environmental protection, especially in the field of waste management, monitors and implements existing standards in the field of waste management, The European Green Deal, the Green Agenda for the Western Balkans, the 2030 Climate and Energy Targets, Apply the standards for the implementation of the Green Press of a higher education institution. Green digitalization	Directive on digitalization in the energy sector
Energy potential of waste		Perform a techno-economic analysis of the possible application of the treatment of controlled incineration of municipal waste for a specific area. propose the type of thermal process for obtaining energy from waste, depending on the specific situation, analyses pollutants and proposes workable solutions to reduce the environmental impact of pollutants from the existing energy treatment of waste, propose measures for the improvement of processes and facilities to produce energy from waste, Monitor and apply the legislation in the field of energy recovery from waste.	Analytical Tools Sensor platform Programming environment Unmanned aerial vehicles. Block chain technology.

Sensor systems		Student's ability to apply sensor systems at various stages of the waste management process. Designing the structure of sensor systems Designs, supports, and manages sensor systems at various stages of the waste management process. Increases the level of energy efficiency of the system and saves energy resources by using sensor systems. Implement a digital management concept to save energy resources. .	Analytical Tools Sensor Platform Programming environment Unmanned aerial vehicles. Block chain technology.
Combustion and ecology		Types and characteristics of the combustion process of different fuels. To understand the energy assessment of the combustion process. To reverse the harmful effects of combustion on the environment.	Analytical Tools UAV Sensor Monitoring Systems Block chain
Energy & Environment		Predict the energy potential of the selected energy source, Recognize the sustainability of the chosen energy source, Choose the right technology for the conversion of energy that is beneficial for the environment, nature, and climate, Determination of techno-economic parameters of the selected energy conversion technology, Predict the environmental, natural and climate impact of the selected energy conversion technology. Elaborate analysis of the carbon footprint of a certain energy conversion technology.	Analytical Tools Sensor platform Programming environment Unmanned aerial vehicles. Blockchain technology.
Modern production technologies		Students will be able to prove an understanding of the principles and application of Computer Numerical Control (CNC) technology in the manufacturing process, as well as find and apply elements of digitalization in CNC processes.	Analytical Tools Sensor systems Block chain technology.

		The student will be able to apply the principle of algorithmic thinking in the programming of CNC machines to improve processes and improve product quality. The student will be able to find and solve problems in CNC processes using digital tools for diagnostics and analysis of machine performance	
Modern hydroelectric power plants		The student will be able to find the factors that affect the efficiency of hydropower plants and analyze their economic and environmental sustainability. The student will be able to apply the principles of digitalization in the monitoring and management of hydropower plants to perfect performance and reduce costs.	Analytical Tools Sensor Platform Programming environment Unmanned aerial vehicles. Block chain technology.

Across the EU, there is a similar initiative in the higher education system that promotes the development of innovative content in the field of green energy and sustainable development. This initiative is often part of larger R&D&I support programs, such as Horizon Europe, Erasmus+ or Structural Funds programs.

These programs support universities, research institutes and other educational institutions in the development of new study programs, research projects and innovative approaches in the field of green energy. The aim is to ensure that education and research in the EU are responsive to the current needs of the labor market and the challenges of sustainability and environmental protection.

These programs also foster international cooperation between educational institutions in the EU and around the world to exchange knowledge, experiences, and best practices in the field of green energy and sustainable development.

Examples of projects funded through these programs include the development of new courses, laboratory exercises, research projects and innovative technological solutions in the fields of renewable energy, energy efficiency, waste management and reduction of greenhouse gas emissions.

Through these initiatives, the EU looks to promote sustainable development, support the transition to a cleaner and more energy-efficient economy, and ensure that education is a key factor in achieving these goals.