



euRoepan bio-Economy
aLliancE in Farming

RELIEF'S BIOECONOMY TOOLKIT

FOR STUDENTS

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ACRONYMS

ECTS – European Credit Transfer and Accumulation System

EQF – European Qualifications Framework

EU – European Union

F2F – Face-to-Face training

HEI – Higher Education Institution

PBL – Project Based Learning

RES – Renewable Energy Solutions

SSH – Social sciences and humanities

STEM – Science, technology, engineering, and mathematics

TNA – Training Needs Analysis

VET – Vocational Education and Training

WBL – Work Based Learning

1. ABOUT RELIEF

The project **euROpean bio-Economy aLIancE in Farming** (RELIEF) aims to pioneer an innovative method for teaching bioeconomy principles in farming. Its primary objective is to create tailored online learning materials for Higher Education Institutions, Vocational Education and Training providers, students, and farming practitioners. These resources delve into crucial areas essential for adopting business models and strategies suitable for bioeconomy practices in farming.

Beyond just focusing on bioeconomy competencies, RELIEF endeavours to foster skills such as environmental awareness, entrepreneurship, interdisciplinary collaboration, and digital proficiency. These skills are deemed vital for successfully transitioning to a bioeconomy framework. Grounded in a learner-centric, problem-solving, and active learning approach, the educational tool aims to inspire substantial transformations in university curricula and course content.

The RELIEF project operates under the Erasmus+ Alliance for Innovation Programme, bringing together 12 partners representing diverse levels of market maturity, including more established markets like Italy and Sweden and emerging ones such as Greece, Portugal, and Cyprus.

1.1 Why bioeconomy in farming?

Farming in the EU is essential to livelihoods and local development. It also faces many challenges such as limited resources and growing environmental challenges.

Bioeconomy is a solution to this problem. It involves the use of renewable biological resources from land and sea, like crops, forests, animals, and micro-organisms to produce food, materials, and energy. In addition to these practices, it involves knowledge, science, technology, and innovation to provide sustainable solutions in the form of information, products, processes, and services. To be successful it needs to have sustainability and circularity at its heart. Stronger development of bioeconomy also accelerates progress towards an overall circular and low-carbon economy, and thus contributes to climate and environmental protection.

1.2 RELIEF's approach to bioeconomy

The future of bioeconomy heavily relies on how education and training within the sector are able to adjust to the complex relations between the multidisciplinary nature of the field, knowledge expansion and societal transformations related to bioeconomy. RELIEF approaches the potential of bioeconomy by targeting the limited availability of training in this realm, as well as the need for prompting knowledge creation around the impact and business models of the bioeconomy, raising awareness, and involving a wider range of actors.

2. STRUCTURE OF THE TOOLKIT

The RELIEF Toolkit for Bioeconomy introduces the learning tool developed during the RELIEF project. It presents the curriculum's structure as well as the learning approaches and methodologies that inform it. The toolkit is divided into different sections, where you can find the following information:

- [Findings of our research](#) presents a brief overview of developments, trends and needs within the field of education and training for bioeconomy within the European Union.
- In [What the curriculum has to offer](#), you can read about why the RELIEF learning resources are relevant to learners.
- [The RELIEF curriculum and its structure](#) introduces the structure of the modules and learning units included in the curriculum.
- [Methodologies for RELIEF](#) provides insights into the approaches, theories and methods that inform the contents of the learning tool as well as its assessment approach.
- A step-by-step guide on how to access and use the learning tool can be found in [How to use the RELIEF learning tools effectively](#).
- [Recommendations on how to use the RELIEF curriculum](#) includes tips and ideas on how to best use the RELIEF learning units. It also includes a detailed [overview](#) of each module, learning unit, duration, and learning outcomes.
- Finally, useful contacts and resources for further reading as well as links to the project's website and social media can be found in [Contacts and resources](#).



3. FINDINGS OF OUR RESEARCH

Our research has shown that the bioeconomy sector is becoming increasingly important across the European Union (EU). The green transition and an increasing interest in bioeconomy create hybrid and emerging knowledge subfields alongside a trend towards related education and training.

A second, noticeable trend is a move towards digitalisation. Education and training institutions often still rely on in-person teaching methods. Yet, learners – and particularly those with higher qualifications – show a preference for online or hybrid learning approaches.

Existing training and education offers are often part of traditional scientific disciplines (i.e., farming and forestry) that are under pressure to quickly adapt to new professional profiles.

While education and training in bioeconomy is becoming more relevant within the EU, developments of teaching approaches and offers are far from homogenous. Secondary education and VET programmes are only slowly adapting to the demand for professionals who are skilled in knowledge and practices relating to bioeconomy.

What is needed is the creation and dissemination of comprehensive curricula within the bioeconomy sector. These learning tools and materials need to include technical but also digital, entrepreneurial, soft, and transversal skills to efficiently address current professional requirements.

Read more here: <https://relief.uop.gr/wp-content/uploads/2023/08/relief-report-en.pdf>



4. WHAT THE CURRICULUM HAS TO OFFER

The RELIEF curriculum offers tools that allow you to better inform and advise clients on the challenges, benefits, and practical applications of bioeconomy in farming. These tools include learning resources, training techniques and access to the RELIEF Bioeconomy Hubs, which strategically foster visible and active networks of stakeholders. These national Hubs support the experimentation of RELIEF's curriculum and educational approach, granting priority access to workshops and events for network members. Moreover, each Hub provides information and connections related to bio-economy practices, along with offering consultations to farmers for the integration of these practices into their production cycles.

You will learn about...

- Principles and practices of circular economy and bioeconomy
- The use of renewable energies in agriculture
- Impacts of climate change, as well as mitigation and adaptation strategies
- Water management
- Agricultural reuse of organic residuals
- Biorefinery
- Bioenergy
- Precision technologies, remote sensing, automation technologies and smart farming solutions
- Controlled environmental agriculture and vertical farming
- Business and marketing strategies
- Relevant European regulations
- Soft, green, entrepreneurial, and digital skills

...through a blend of face-to-face, online, and work-based learning activities.

5. THE RELIEF CURRICULUM AND ITS STRUCTURE

The RELIEF curriculum is structured into five modules, each including a self-assessment quiz at their end. Each module includes four learning units, most of which consisting of 20 hours of studies and corresponding to EQF level 5 and one ECTS.

You can access the full curriculum here:

<https://relief.uop.gr/wp-content/uploads/2023/08/Relief-Curriculum-en.pdf>

To learn more about RELIEF's learning approaches and learning techniques see [Methodologies for RELIEF](#).



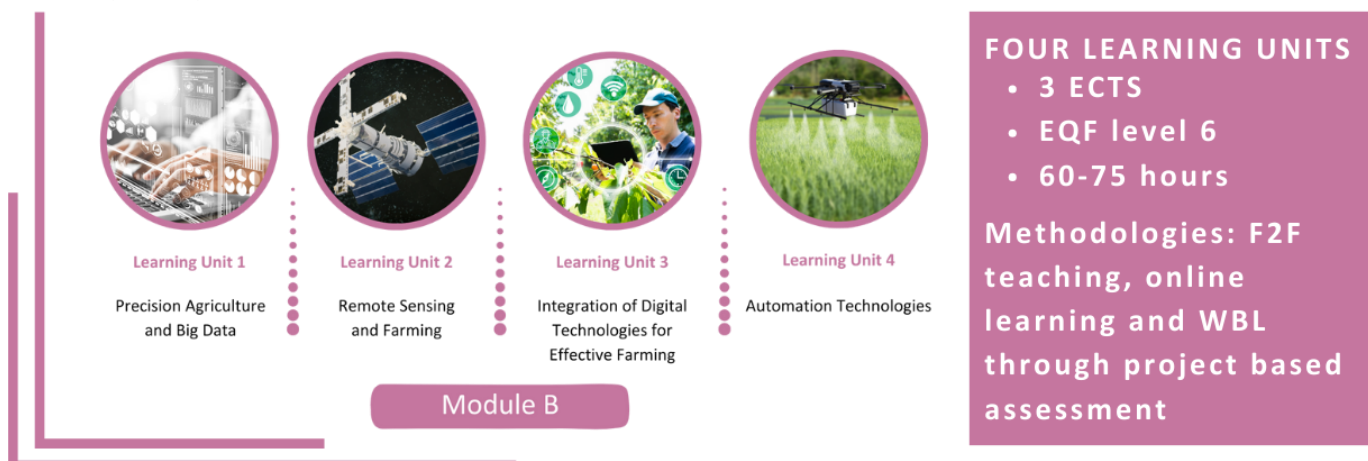
MODULE A – AGRICULTURAL SUSTAINABILITY, MANAGEMENT OF NATURAL RESOURCES AND CLIMATE ACTION

The first module is aimed at transferring knowledge on how to use resources such as water and energy sustainably and reuse of residual water and organic residuals in agriculture. It further aims to increase skills and knowledge on how to adapt to climate change through changes in agricultural practices.



MODULE B – DIGITAL TECHNOLOGIES AND ARTIFICIAL INTELLIGENCE

This module focuses on digital technologies that are used in agriculture. Students have the opportunity to increase their knowledge on technologies and practices such as remote sensing and automation technologies and acquire practical skills to be able to use them.



MODULE C – BIOECONOMY, CIRCULAR ECONOMY, AND BIO-BASED PRODUCTS

In this module, the learners expand their knowledge on the principles and practices of circular economy and bioeconomy. The module highlights the importance of collaboration and innovation and further covers the basics of biorefinery as well as bioenergy.



MODULE D – CONTROLLED ENVIRONMENT AGRICULTURE

This module aims to advance learners' knowledge of, and skills related to controlled environment agriculture including vertical farming, as well as business and marketing strategies.



MODULE E – HORIZONTAL SKILLS

This module is designed to equip learners with soft skills relevant to their field. It supports them in expanding and developing their knowledge and skills related to green practices, entrepreneurship, and digitalisation.



6. METHODOLOGIES FOR RELIEF

The RELIEF curriculum is based on several learning theories that place the learner at the centre of the learning process through **active engagement** as well as by fostering **critical thinking** and **personal growth**. Combined with a **problem-centred approach**, the result is that the learner actively works towards developing an understanding of the learning material through real-world applications and collaborations with others.

Furthermore, the inclusion of elements of **self-directed learning** allows the learners to take control of their learning process.

The RELIEF curriculum regards **experience as a resource**. The learners' experiences are considered and are actively used in the learning process by connecting existing knowledge with new information.

Since bioeconomy itself is an interdisciplinary concept, the approaches to teach and learn about it, too, aim at being interdisciplinary and combining STEM disciplines with SSH disciplines.



7. HOW TO USE THE RELIEF LEARNING PLATFORM EFFECTIVELY

The RELIEF learning contents are accessible through our online learning platform.



<https://elearning.relief.uop.gr/>

Follow the link below to watch a video on how to access the platform. You will also gain an overview of how to navigate the platform and use the modules and learning units most effectively.



<https://youtu.be/UI6bCPoXVil?si=0Wsh3LeNw5KPRdMy>

8. RECOMMENDATIONS ON HOW TO USE THE RELIEF CURRICULUM

Since the learning units cover a variety of sub-topics of bioeconomy, they can be used to address different training needs. Thus, the RELIEF learning tool can be used as a complete course, but it can also be flexibly adapted by choosing and combining relevant modules and/or learning units. They can be taken on their own or be used to complement the content of the courses or programs you are enrolled in to achieve your specific educational goals.

Our recommendations to best suit the RELIEF curriculum to your needs is the following:

1. Reflect upon the following questions:

What topics am I interested in? Asking yourself this question will help you selecting what which learning units most fit your educational goals. Remember that it is not necessary to take all learning units within one module. Check [section 3](#) for the available modules and their learning units.

What is my learning goal? When determining your study plan, it is important to keep in mind what you want to gain by the end of the learning trajectory. To help you determining this, have a look at the learning outcomes of each learning unit outlined on [section 3](#) below.

How many ECTS am I looking forward to achieving through the RELIEF content? If you have a goal for how many credits you want to achieve by taking the RELIEF content, keep in mind that each of RELIEF's learning units is equivalent to three ECTS.

What is the EQF level that fits my experience? Each of RELIEF's learning units are equivalent to EQF level 6 (equivalent to Bologna level 1), which is suitable for anyone with a Degree of Bachelor or Higher Education Diploma. Determining this is essential to ensure that you will be able to follow and complete the learning unit(s) you select.

How much time do I have available to complete the RELIEF content? Reflecting on your own time availability is highly important to effectively determine a study plan. This will enable you to make a schedule of how many and which learning units you will take.

2. Be SMART:

When thinking of the questions above, we recommend that you use the SMART framework to establish a learning goal that is:

- **S: Specific:** your goal is clear and well-defined.
- **M: Measurable:** you are aware of the assessment methodologies in the learning units you choose. They will ensure that your learning progress is evaluated and tracked.
- **A: Achievable:** your goal is realistic and is something that you can complete.
- **R: Relevant:** your goal is relevant to your personal and/or professional objectives.
- **T: Time-bound:** you have a clear idea of when you'll be able to achieve your goal.

This means that you should try to determine the following: a) which learning units you will complete; b) how relevant these are for you; c) whether they are something you can complete; and d) by when you will complete them.



3. Information that can help you answer the above questions:

Module	Learning Unit	Duration	Learning outcomes
A. Agricultural sustainability, management of natural resources and climate action	Renewable energy and its application as green agricultural energy source	60 hours	<ul style="list-style-type: none"> Describe the importance of renewable energies. Recognise and discuss relevant RES technologies available for agriculture and identify their basic mechanisms and processes. Assess and discuss off-grid RES in diverse climate conditions. Identify the best renewable applications; compare and propose RES.
	Climate Change	60 hours	<ul style="list-style-type: none"> Identify and discuss the fundamental concepts of the climate system, including climate change drivers and their impact on agriculture. Describe the role of climate models. Analyse and debate mitigation strategies in agriculture to reduce greenhouse gas emissions. Develop and propose adaptation strategies in agriculture. Formulate a plan of action to adapt agricultural practices to potential climate change impacts.
	Water, Energy, and Food (WEF) Nexus security, Drip Irrigation, and Desalination	60 hours	<ul style="list-style-type: none"> Identify different sources and uses of water. Ability to reuse water from different origins. Water control and monitoring. Better sensibility to water uses and waste. Better understanding of the notion of the value of water and its quality.
	Agricultural reuse of organic residuals	60 hours	<ul style="list-style-type: none"> Identify the types of organic residues that can be reused in agriculture. Compare the processes and treatments necessary to characterise organic residues and allow their proper use. Examine the costs and benefits of reusing organic residues in agriculture. Design a simple workflow aimed at the recovery and utilisation of organic residues in agriculture. Make decisions in this field aware of European regulations in terms of limitations and funding opportunities.

Module	Learning Unit	Duration	Learning outcomes
B. Digital technologies and artificial intelligence	Precision technology and Big Data	75 hours	<ul style="list-style-type: none"> Understand the basis of data science and its applications in industry and research. Understand the concept of remote sensing and the required technology. Understand how to install and connect IoT devices and extract data from the field. Understand how to install and use computer vision-based systems. Understand how to use historical data to create AI prediction models. Create, develop, and deploy a data pipeline. Develop Convolutional Neural Networks models. Develop AI regression models to identify trends.
	Remote Sensing and Farming	60 hours	<ul style="list-style-type: none"> Identify and understand remote sensing systems in farming. Identify applications of specific satellites in farming. Ability to use remote sensing systems in the fields of environment, agriculture, and forests. Understand image characteristics.
	Integration of digital technologies for effective farm management	60 hours	<ul style="list-style-type: none"> Identify and understand the concepts of digital technologies. Identify and analyse various monitoring systems and precision agriculture techniques for collecting and analysing essential information related to key agricultural factors. Identify real-world applications of smart farming, including the integration of digital technologies and their impact on farm management and sustainability. Analyse modern tools and techniques used in precision agriculture, such as remote sensing, drones, satellite imagery and data analytics for optimizing agricultural practices.
	Automation Technologies	60 hours	<ul style="list-style-type: none"> Accurately identify, state, and explain automation technologies and systems in agriculture as well as logical programming. Demonstrate how to run, and manage systems in different sectors. Demonstrate how robotics and unmanned field machinery work and perform relevant tasks with these systems. Combine knowledge and skills to design, develop and create automation systems in early stages. Assess and choose the most appropriate automation systems and technologies.

Module	Learning Unit	Duration	Learning outcomes
C. Bioeconomy, circular economy, and bio-based products	Circular economy	60 hours	<ul style="list-style-type: none"> Understand the basic principles and concepts, as well as policies and regulations related to the circular economy. Apply circular economy principles and practices in practical scenarios. Identify circular economy opportunities. Apply critical and system thinking in the context of circular economy challenges.
	The concept of biorefinery	60 hours	<ul style="list-style-type: none"> State the concept and principles of biorefineries. Identify various conversion processes and technologies used in biorefineries, as well as associated challenges. Identify different biorefinery concepts based on the characteristics of the feedstock. Identify and describe important factors when designing biorefinery systems.
	Bioenergy and energy crops	60 hours	<ul style="list-style-type: none"> Describe the bioenergy production sector, which raw materials can be used and the processes for processing them. Discuss which aspects make bioenergy sustainable. Identify the characteristics that biomass should have to be used for energy production. Distinguish the transformation processes that provide a qualitatively better product based on biomass characteristics. Develop a simple agricultural plan for bioenergy production crops. Make choices in this area aware of European regulations in terms of limitations and funding opportunities.
	Innovation, Economics and Strategic Management in the Bioeconomy	60 hours	<ul style="list-style-type: none"> Indicate the key concepts related to bioeconomy and distinguish them from conventional agribusinesses. Identify bio-based value chains as well as economic aspects and recognise potential convergences between industries and processes. Outline current and future trends for bioeconomy innovation. Compare open innovation practices of bio-based economy. Propose and develop service products in the bioeconomy. Adapt existing emerging technologies in the bio-based economy. Review open innovation practices and develop own strategic plans.

Module	Learning Unit	Duration	Learning outcomes
D. Controlled environment agriculture	Introduction to controlled environment agriculture: principles, techniques and innovations	60 hours	<ul style="list-style-type: none"> Name environmental factors which affect plants' growth and yield. Identify the basic elements for a controlled environment farm. Recognise the differences between greenhouses and plant factories. Name the available technologies and record the advantages and disadvantages of controlled environment agriculture. Record the advantages and disadvantages of controlled environment agriculture. Use suitable equipment to control greenhouse environment, manipulate environmental factors, and calculate energy need. Design and operate a controlled environment farm. Evaluate the cost of the environmental control in a greenhouse or in a plant factory.
	Advanced techniques in vertical farming: From LED lighting to plant nutrition	60 hours	<ul style="list-style-type: none"> Explain the role of and use LED lighting systems in promoting plant growth and development in vertical farming. Name and prepare the nutritional requirements of plants in a vertical farming setting. Predict the effectiveness of different vertical farming techniques. Estimate vertical farm efficiency. Defend the new technologies and advancements for vertical farming.
	Entrepreneurship in Vertical Farming: Business Models, Financial Planning and Marketing Strategies	60 hours	<ul style="list-style-type: none"> Describe what a business model is and how it applies to vertical farming. Discuss fundamentals of, apply, and compare marketing strategies in the context of vertical farming. Ability to make basic financial decisions based on financial planning principles. Be able to contribute to the marketing efforts of a vertical farming venture.
	Sustainable agriculture in controlled environments: Challenges, opportunities, and solutions	60 hours	<ul style="list-style-type: none"> Identify and analyse key challenges and opportunities of implementing agricultural practices in controlled environments. List sustainable agriculture techniques and technologies applicable to controlled environment, including hydroponics, vertical farming, resource management and pest and disease management control. Analyse case studies and real-world examples. Identify needs and conditions to select appropriate technologies in controlled environmental agriculture. Ability to design sustainable controlled environmental systems. Identify needs and conditions to select appropriate technologies in controlled environmental agriculture. Ability to design and operate sustainable controlled environmental systems

Module	Learning Unit	Duration	Learning outcomes
E. Horizontal Skills	Soft Skills	60 hours	<ul style="list-style-type: none"> Basics of interpersonal communication and the related principles; successful negotiation procedures; collaboration and team working; creative problem-solving procedures; decision-making process; ethical behaviour. Communicate with clarity and conviction; tailor communication strategy according to the specificities of each context. Create effective, flexible, and resilient teams. Gather information about a problem, identify and analyse problems and use techniques to come up with a decision.
	Green Skills	60 hours	<ul style="list-style-type: none"> Interpret the key concepts of European and International directives and frameworks related to sustainable development and the green transition. Recognise and measure the environmental impact of activities. Identify the elements of waste management, energy efficiency, water and food waste practices and mitigate resource waste. Recognise the importance of system thinking and life cycle thinking in the transition to a greener economy. Develop a responsible attitude towards the environment.
	Entrepreneurial Skills	40 hours	<ul style="list-style-type: none"> Understand the importance and complexity of modern entrepreneurship. Choose sustainable business models through critical and analytical thinking based on innovation. Prepare comprehensive business plans. Seek and obtain funding and recognise investment and development incentives. Cooperate, coordinate, and control the parties to design and implement innovative business ventures.
	Digital Skills	75 hours	<ul style="list-style-type: none"> Summarise principles of online trading and digital business strategies. List the main strategies for promoting products and services online and produce and modify digital content. Apply digital tools to facilitate effective communication and teamwork in collaborative scenarios. Interpret digital data and use data management tools to optimise farming operations. Implement and improve digital strategies. Evaluate the effectiveness of their digital communication and collaboration and create strategies for improvement. Analyse and interpret data to optimise farming operations and evaluate the effectiveness of data management strategies.

9. CONTACTS AND RESOURCES

RELIEF

- Project website: <https://relief.uop.gr/>
- Email: relief@uop.gr
- E-learning platform: <https://elearning.relief.uop.gr/>
- Facebook: <https://www.facebook.com/reliefprojecteu/>
- LinkedIn: www.linkedin.com/showcase/reliefprojecteu
- RELIEF Bioeconomy Hubs: <https://relief.uop.gr/hubs>

International Networks

- Rural Bioeconomy Alliance: <https://www.linkedin.com/company/rural-bioeconomy-alliance-rba/>
- European Bioeconomy Network (EuBioNet): <https://eubionet.eu/>
- World bioeconomy forum: <http://www.wcbef.com/>
- World bioeconomy forum (LinkedIn): <https://www.linkedin.com/company/world-bioeconomy-forum/>
- European Bioeconomy Library: <https://www.bioeconomy-library.eu>
- Bio-Based Industries Consortium: <https://www.bbi-europe.eu>
- Bioeconomy Science Centre: <https://www.biosc.de/eng>
- EU Knowledge Centre for Bioeconomy:
https://knowledge4policy.ec.europa.eu/bioeconomy_en

Read more about the learning approaches and methods used in RELIEF:

- PechaKucha: <https://www.pechakucha.com/about>
- Flipped Classroom: https://ec.europa.eu/programmes/erasmus-plus/project-result-content/17061004-3280-44bc-81ca-463b3f329b5d/Flipped_Classrom_in_Practice_EN.pdf
- Critical Thinking Mindset: <https://toolbox.hyperisland.com/critical-thinking-mindset>
- Systems Thinking – The Iceberg Model: <https://toolbox.hyperisland.com/a-systems-thinking-model-the-iceberg>
- Moving towards a Growth Mindset:

<https://www.personatalent.com/productivity/how-to-cultivate-a-growth-mindset>

- World Café: <https://theworldcafe.com/>



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