



euRoepan bio-Economy
aLliancE in Farming

RELIEF'S BIOECONOMY TOOLKIT

FOR HIGHER EDUCATION
INSTITUTIONS

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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 aLLiancE 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.

Bioeconomy 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.

For a successful bioeconomy strategy in farming, further support is needed for the workforce, as well as more knowledge about the impact and business models of bioeconomy and raising more awareness and involvement of a wider range of actors. Training in bioeconomy is still absent in many EU countries and there is a shortage of people with higher education in the farming sector. The transition to bioeconomy needs professionals with multidisciplinary, managerial, and cross-sectoral expertise. Higher education as well as vocational education and training can play a critical role in this transition by integrating dedicated curricula and training.

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.

Within the project, the partner organisations from Greece, Sweden, Italy, Cyprus, and Portugal have developed an innovative approach for teaching bioeconomy in farming using specific learning resources addressing Higher Education Institutions (HEIs), Vocational Education and Training (VET) providers, students, farmers, and agronomists.

1.3 The RELIEF Bioeconomy Hubs

A Bio-Economy Hub will be established in each partner country, supported by the respective country partners.

The aim of the hub will be to provide information about bio-economy practices to students, farmers, farmer consultants and consultation to farmers on how they can incorporate bio-economy practices in their production cycle.

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 (EU).
- In [What the curriculum has to offer](#), you can read about why the RELIEF learning resources are relevant to educators and 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 have access to learning materials on...

- 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

...which use a blend of face-to-face, online, and work-based learning approaches and which can be used flexibly, and even be integrated into existing courses and programmes.

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.

The theories that form the foundation of the RELIEF learning tools include:

Constructivist learning theory	Within this approach, trainers serve as facilitators and guides rather than authoritative sources of knowledge. They create an interactive learning environment that encourages curiosity, exploration, and critical thinking. It is based on the view that learners actively construct knowledge by engaging with their environment and others.
Experiential learning	This approach emphasises learning through direct experience and reflection. It involves active engagement through hands-on activities and real-world applications in which learners apply theoretical knowledge in practical contexts. This leads to deeper understanding and fosters critical thinking and problem-solving skills.
Active Learning	In this approach, learners are encouraged to participate actively in their learning process and develop their skills and knowledge through hands-on activities. Active learning encourages critical thinking, problem-solving and a deeper understanding of the subject.
Transformative learning	Transformative learning focuses on personal and intellectual growth through critical reflection and the questioning of assumptions. This approach aims to produce transformative change through shifts in individuals' understanding of themselves and the world. It can empower farmers and students to successfully manage the challenges and opportunities of sustainable agriculture.
Problem-based learning	PBL is centred on the collaboration of learners to solve real-world problems: Learners are presented with complex problems or scenarios that mirror real-world challenges and are encouraged to work together to find creative and innovative solutions. It emphasises active engagement, critical thinking and knowledge application.
Blended learning	Blended learning combines traditional F2F instructions with online learning. The use of both virtual and in-person learning environments creates a comprehensive yet flexible learning

	experience. Activities include interactive online modules, virtual discussions, as well as in-person interactions with instructors and other learners.
Collaborative group learning	This approach emphasises learning through active collaboration and interaction among learners who work in groups, engage in discussions, and participate in problem-solving activities and knowledge sharing. It encourages diverse perspectives and fosters critical thinking, communication and teamwork skills.
Design thinking	The complex challenges of the bioeconomy require innovative and sustainable solutions. Design thinking provides a structured approach to finding them. It is a human-centred approach to problem-solving and innovation. It emphasises empathy, collaboration and iterative processes to develop the ability to understand the needs and perspectives of end-users, to find creative solutions, and to prototype, test and refine ideas.

Based on these theories, the RELIEF curriculum combines the following methods:

Face-to-Face learning	F2F is the traditional approach to education: Learners and teachers meet in a shared physical space such as a classroom. It is characterised by direct interactions and communication between teachers and learners which enables direct feedback, active participation and real-time discussions. F2F can take place, for instance, as lectures, tutorials, practical activities for individuals or groups.
Work-based learning	WBL combines practical work experiences with classroom learning. Learners engage in real-world work environments, i.e., through internships, workshops or study visits, which allows them to apply theoretical knowledge in practical contexts.
Online learning	Online learning makes use of digital platforms and technologies to provide education flexibly and remotely. Learners have the opportunity to interact with teachers and fellow students online. They are able to study at their own pace.

A combination of theory and practical activities

Through the above-described approaches and methods, the RELIEF curriculum creates a learning experience that combines theoretical knowledge with practical activities to deepen the learners’ understanding of the covered subjects. These practical activities are incorporated into the course in the form of i.e., case studies, problem-based group work, and WBL in the form of study visits and workshops.

All learning units (see [The RELIEF Curriculum and its Structure](#)) make use of the PechaKucha approach, Flipped Classrooms, and the Critical Thinking Mindset approach.

PechaKucha

Learners present a story or an idea in a precisely timed format making use of visuals to support their communication.

Within the RELIEF curriculum, this approach is used as a part of F2F learning. The recommended number of participants is five to 20 with six minutes and 40 seconds per presentation.

Flipped Classroom

Flipped Classrooms reverse the traditional learning approach. Knowledge is transmitted through learners outside the classroom, i.e., through pre-recorded videos or online materials. The learners engage with these materials independently and at their own pace. Then, they attend an in-person session that includes interactive and practical activities, as well as discussions.

The Flipped Classroom approach combines F2F with online learning. The group of learners should include five to 20 participants. The time allocated to pre-recorded lectures is 15 minutes, while 45 minutes are planned for in-person discussions.

Critical Thinking Mindset

This approach emphasises analytical, rational, and reflective thinking in order to assess and interpret information objectively. It involves challenging assumptions, collecting and evaluating data, considering diverse perspectives, and drawing well-informed conclusions.

Activities that make use of the Critical Thinking Mindset take 30 to 60 minutes involving two to ten participants. The approach is part of F2F and online learning as well as WBL.

Systems Thinking: The Iceberg Model

The Iceberg Model is used to understand complex systems by visualising the underlying structures and behaviours that influence a particular situation or issue. It allows to gain a holistic perspective of a system, identifying both visible and underlying factors that contribute to behaviours and outcomes.

The approach is designed for two to 40 learners. Activities using this model have a duration of 30 to 120 minutes, taking place F2F or online.

Learning units A2 (*Understanding climate change*), A3 (*Water, Energy and Food [WEF] Nexus security, Drip irrigation and Desalination*) and C1 (*Circular Economy*) use the Iceberg Model as part of the Systems Thinking approach.

Moving Towards a Growth Mindset

This is a technique designed to help people move towards a growth mindset by noticing fixed mindset elements in themselves and actively adopting growth-oriented actions based on the premise that there are two mindsets. People with a fixed mindset assume that intelligence and abilities are fixed leading to an unwillingness to face challenges out of a fear of failure. People with a growth mindset assume that intelligence and abilities can be improved through effort, challenges and obstacles become part of the learning process rather than a barrier.

Activities that make use of this approach are designed for one to 20 participants in individual sessions as part of F2F learning and WBL. Learners spend 5 minutes per day engaging with Moving Towards a Growth Mindset activity.

Learning units of module A (*Agricultural sustainability, management of natural resources and climate action*), C1 (*Circular Economy*), C2 (*Discovering the potential of biorefineries*), C3 (*Bioenergy and bio crops*), and module E (*Horizontal Skills*) use the Moving Towards a Growth Mindset approach.

World Café

In a World Café, the learning environment is a relaxed, café-like setting with small, preferably round tables where participants engage throughout several rounds in conversations guided by specific questions. Insights and results are shared with the larger group.

This approach is part of F2F and online learning. It takes 20 minutes with four to five learners per table. Learning units of module E (*Horizontal skills*) include World Cafés.

Assessment Methodology

Assessment refers to both formative and summative assessment. Whereas formative assessment is part of the learning process to continuously provide feedback and adapt the learning process to the learners' needs and abilities, summative assessment



takes place after the learning process to evaluate if learners have achieved the intended learning outcomes.

Within RELIEF self-assessment plays a critical role. Self-assessment means that learners reflect on and evaluate their learning process and achievements. The RELIEF curriculum further includes written tests, case studies, practical activities (individually or in groups), decision-making scenarios, and problem-based group work activities as means of assessment for F2F learning.

In the online learning, self-assessment takes place through quizzes, multiple choice tests and true-or-false tests. It also includes reflection questions as a form of assessment. To make assessments of the learners' WBL, the RELIEF curriculum includes project-based assessment as well as monographs.

Read more here: <https://relief.uop.gr/wp-content/uploads/2023/11/relief-manual-en.pdf>

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 learning goals. The RELIEF learning tool can be used either as a complete course or flexibly adapted by choosing and combining relevant modules and/or learning units. They can be used on their own or be integrated into existing courses and programmes.

Our recommendations to select the resource among the RELIEF curriculum that best suits your needs is the following:

1. Reflect upon the following questions:

What is the topic I want to approach? Asking yourself this question will help you selecting which topics that are most relevant for your classes and students. Remember that the material can be combined in whichever way that best addresses your goal. It can also be adapted, meaning that you can use relevant content/activities as needed.

What is my teaching goal? When determining your teaching plan, it is important to keep in mind what you want your students to gain by the end of the learning trajectory. Please review the learning outcomes for each learning unit on the tables on [section 3](#).

What is my teaching goal in terms of ECTS? By answering this question, you will be able to assess which and how many learning units fit within your curriculum. Keep in mind that each of RELIEF's learning units is equivalent to three ECTS.

What is the EQF level that I can address? Just like determining the number of ECTS you can cover, assessing the EQF level that fits your curricula is crucial. This will enable you to select which learning units are suitable to the level of your students as well as that of the courses you teach.

How much time do I have available to implement the RELIEF content? After determining the topics that you want to approach, the teaching goals you want to achieve, and the ECTS and EQF level that fits your curricula, it is time to determine how much of the content you can cover in your course(s). This will be essential to enable you to make a schedule of how many and which learning units you will implement, as well as to draft an effective teaching plan for your students.

2. Be SMART:

When thinking of the questions above, we recommend that you use the SMART framework to establish a comprehensive and achievable learning objective for your course(s). In order to be SMART, your goal should be:

- **S: Specific:** The learning objective should be clear and well-defined. Educators should aim to specify what the learner will achieve (or be able to understand) upon successful completion of the course or lesson.
- **M: Measurable:** Criteria for measuring progress and outcome must be included to evaluate and track the learning process. Each of RELIEF's learning units include specific assessment methodologies that provide measurable criteria.
- **A: Achievable:** It is important that the content and learning objectives are attainable for students. They should therefore be selected in line with the background of your students to ensure that the learning journey will be realistic.
- **R: Relevant:** The selected content and objectives should align with the broader educational or professional goals of your students and curricula. This ensures that the RELIEF material will be meaningful to the students' overall development.
- **T: Time-bound:** A timeline with clear deadlines for the achievement of the learning goals should be defined. Each of RELIEF's learning units has a total duration that can be considered when setting this timeline.



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 in the field of 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 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

PechaKucha

- Astrid Klein and Mark Dytham (creators of PechaKucha): info@klein-dytham.com

Read more about Pecha Kucha here:

- <https://www.pechakucha.com/about>
- <https://www.masterclass.com/articles/pechakucha-explained>
- https://www.youtube.com/watch?v=4XTO8nk_L3c&ab_channel=PechaKucha20x20

Flipped Classroom

- Maureen J. Lage: lagenrj@niuohio.edu
- Read more about Flipped Classrooms here:
https://ec.europa.eu/programmes/erasmus-plus/project-result-content/17061004-3280-44bc-81ca-463b3f329b5d/Flipped_Classrom_in_Practice_EN.pdf

Critical Thinking Mindset

Read more about the Critical Thinking Mindset approach here:

- <https://toolbox.hyperisland.com/critical-thinking-mindset>
- <https://www.bioeconomy-library.eu/bio-challenge/>
- <https://www.fvaweb.eu/bes/>
- https://www.bioeconomy-library.eu/list-of-contents/?_sft_category=bioeconomy-education

Systems Thinking: The Iceberg Model

Read more about Systems Thinking and the Iceberg Model here:

- https://www.researchgate.net/figure/The-iceberg-model-four-levels-of-a-system-based-on-Meadows-2008-Maani-and-Cavana_fig2_350492311
- <https://toolbox.hyperisland.com/a-systems-thinking-model-the-iceberg>
- <https://ecochallenge.org/iceberg-model/>
- https://www.bioeconomy-library.eu/list-of-contents/?_sft_category=bioeconomy-education

Moving towards a Growth Mindset

- Positive Psychology (email): Info@positivepsychology.com
- Positive Psychology (website) : <https://positivepsychology.com/>

Read more about Moving towards a Growth Mindset:

- <https://www.personatalent.com/productivity/how-to-cultivate-a-growth-mindset>
- Moser, J. S., Schroder, H. S., Heeter, C., Moran, T. P., & Lee, Y.-H. (2011). Mind your errors: Evidence for a neural mechanism linking growth mind-set to adaptive posterror

adjustments. Psychological Science, 22, 1484–1489.

<https://doi.org/10.1177/0956797611419520>

World Café

- The World Café (website): <https://theworldcafe.com/>
- Juanita Brown (The World Café): juanita@theworldcafe.com



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