RES4CITY

renewable energies system for cities

Deliverable D2.4

Outline of RES4CITY Learning and Upskilling Programmes

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Acronym	Meaning
MC	Micro Credential
MP	Micro Programme
RES	Renewable Energy Sources

Executive Summary

The combination of rapid urbanization, escalating energy demands, and the urgent necessity to reduce carbon footprints has amplified the priority for cities to implement renewable energy solutions.

To build a sustainable and successful urban economy, it is crucial to develop learning and upskilling programmes for recently graduates and experienced professionals in order to provide the necessary skills to participate effectively in the renewable energy transition. By doing so, cities can rely on professionals prepared to address the challenges and opportunities presented by renewable energy adoption.

As the educational landscape evolves, learners increasingly seek knowledge that is personalized, flexible, and directly applicable to their needs. In response, Micro Programmes based on Micro Credentials have emerged as a powerful educational tool, capable of delivering specific knowledge efficiently. These bite-sized learning modules offer a unique and tailored approach to education, catering to the demands of modern learners and the dynamic requirements of diverse industries.

The rise of Micro-based learning represents a transformative shift in the educational and training sphere. Its ability to accommodate various learning styles and preferences, coupled with its alignment with rapidly changing industries and the ever-evolving job market, marks it as a game-changer in the field of education. Embracing Micro Programmes and Micro Credentials empowers learners to remain relevant and competitive in an ever-changing world.

Considering this, RES4CITY project introduce eight Micro Programmes targeting master students, recently graduates, and experienced professional with STEM (Science, Technology, Engineering and Mathematics) or SSH (Social Science and Humanity) background. The proposed MPs encompass a wide range of area of knowledge and discipline supporting the integration of RES in the urban environment.

The MPs have the following characteristics:

MP1. Decarbonizing Cities. Financial and Technological Perspective. The MP targets students and recent graduates with a STEM background.

MP2. Managing of Sustainability and Finance in Cities. The MP targets students and recent graduates with SSH background.

MP3. Advanced Energy Systems and Finance: From Data to Decision Making. The MP targets experienced professionals with STEM background.

MP4. Strategies for Sustainability and Finance in Urban Development. The MP targets experienced professionals with SSH background.

MP5. Sustainability by Design: Developing a Resilient Built Environment. The MP targets experienced students, recent graduates, and experienced professionals in the field of Engineering.

MP6. Sustainability and Innovation in Energy: Strategies and Analytics. The MP targets experienced students, recent graduates, and experienced professionals in the field of Management.

MP7. Sustainable Energy Solutions for Cities: Policy, Strategy, and Implementation. The MP targets experienced students, recent graduates, and experienced professionals in the field of Political Sciences.

MP8. Financing the Sustainable Transitions in Cities. The MP targets experienced students, recent graduates, and experienced professionals in the field of Finance.

1. Introduction

The impact of climate change is increasing its pressure at world level. Cities have emerged as both significant contributors to greenhouse gas emissions and key players for sustainable development. Rapid urbanization, increasing energy demands, and a pressing need to reduce carbon footprints have intensified the urgency for cities to adopt renewable energy solutions. Embracing renewable energy sources represents a pivotal shift towards achieving a sustainable and greener future, and learning programmes focused on integrating renewables in cities play a crucial role in shaping this transformation.

The needs for an urgent energy transition from fossil fuel to renewable energy is motivated by multiple factors. First and foremost, the necessity to fight climate change has become mandatory. The utilization of fossil fuels for energy generation or mobility determines relevant amounts of carbon dioxide, other greenhouse gases and pollutant emissions into the atmosphere, exacerbating the greenhouse effect, contributing to global warming and to the worsening of air quality. By integrating renewables, cities can significantly mitigate their carbon and pollutant emissions with a substantial reduction of the environmental impact and increase of the wellbeing of citizens.

Furthermore, integrating renewables in urban areas fosters job creation and economic growth. The renewable energy sector has experienced rapid advancements in recent years, leading to the development of new industries and job opportunities. Developing learning/upskilling programmes that equip students and professionals with the necessary skills to participate in the renewable energy workforce is essential for building a sustainable and prosperous urban economy.

Learning programmes are mainly intended for students. RES4CITY project targets master students in STEM (Science, Technology, Engineering and Math) and SSH disciplines (e.g., humanities, business, law, etc.). During the traditional Master Courses, usually, there is no time to be devoted to specific issues linked to energy transition, thus a knowledge gap is present in the fresh graduates. For example, it is very common that STEM graduates have deepened some technical aspects of the renewables, but little or no focus has been dedicated to regulatory, business, or financial aspects. The opposite happens for SSH graduates. Hence it is necessary to develop ad-hoc programmes that can quickly fill the gap. RES4CITY identified an approach based on Micro Credentials and Micro Programmes as the most suitable to reach this goal.

In addition to the knowledge gap in fresh master graduates, a professional gap can be highlighted in professionals who did not study at all the problem related to energy transition simply because at their time this aspect was out from the agenda of industries and policy makers. Moreover, there is also the problem of professionals working in the oil&gas industry who need to be upskilled in the field of sustainable energy. These are professionals that often have a deep knowledge of the whole energy sector, but limited skills in the field of sustainable energy because their focus was on fossil fuels. They can provide an expert contribution to the energy transition; thus, it is pivotal to offer them opportunities to quickly gain knowledge and skills in the field of sustainable energy.

Learning and upskilling programmes play a pivotal role in disseminating knowledge about renewable energy technologies, energy-efficient practices, and sustainable urban planning. By educating students and professionals on the latest developments in the field, learning and upskilling programmes can inspire a new generation of innovators and entrepreneurs to drive renewable energy research forward. Additionally, these programmes can encourage partnerships between academic institutions, businesses, and local governments, facilitating knowledge transfer and collaborative projects to address unique urban energy challenges.

2. RES4CITY Micro Programme based approach

In the fast-paced, technology-driven world of today, the traditional model of education is undergoing a profound transformation. As learners seek more personalized, flexible, and relevant knowledge, Micro Programmes based on Micro Credentials have emerged as a powerful tool to deliver specific knowledge effectively. These bite-sized learning modules offer a unique approach to education that addresses the demands of modern learners and the dynamic needs of various industries.

Micro-based learning can be seen as game-changer in the educational and training landscape due to its ability to cater to diverse learning styles and preferences to their alignment with rapidly changing industries and the job market. Ten main distinctive features can be highlighted to explain the high potential and impact that Micro Programmes have on the learning and upskilling process.

1- Targeted Learning: Focused and Relevant. Micro Programmes are designed to be short, focused, and specific. Unlike traditional courses that cover a broad range of topics, micro courses focus on a specific subject or skill. This targeted approach allows learners to access only the information they need, avoiding unnecessary content and saving time. Micro Programmes offer relevant knowledge that learners can immediately apply in their personal or professional lives.

2- Flexible and On-Demand Learning. One of the key advantages of micro programmes is their flexibility. Learners can access these courses anytime, anywhere, and on any device with an internet connection. This on-demand nature allows individuals to fit learning into their busy schedules, making it ideal for working professionals, students, and lifelong learners alike. As learners can complete a micro programme in a short period, they have the freedom to choose when and how they want to learn, promoting a seamless integration of education into their daily routines.

3- Personalized Learning Paths. Micro courses allow learners to tailor their learning experience according to their specific needs and interests. With a wide array of micro courses available on various topics, learners can create personalized learning paths that align with their career goals and aspirations. This adaptability enables learners to focus on areas they find challenging or that align with their career progression, ensuring a deeper understanding of the subject matter.

4- Continuous Learning and Skill Enhancement. In the rapidly evolving job market, acquiring new skills and staying *up to date* with industry trends is crucial for career advancement. Micro programmes enable learners to engage in continuous learning and skill enhancement. These short, focused *building blocks* of learning can be easily incorporated into a professional's daily routine, allowing them to stay relevant and competitive in their field without committing to long-term education programs.

5- Stackable Micro Credentials: Building Expertise Step by Step. Micro Programmes offer tangible proof of a learner's skills and expertise. These credentials can be stacked over time, allowing learners to build a comprehensive and validated portfolio of skills. As learners accumulate multiple micro credentials, they gain recognition for their mastery in specific areas, making them more appealing to employers and clients seeking specialized expertise.

6- Engaging and Interactive Learning Experience. Micro Programmes often leverage interactive learning technologies to engage learners actively. Through multimedia elements such as videos, quizzes, simulations, and gamified experiences, micro programmes create a dynamic and immersive learning environment. This interactivity enhances the learning experience, leading to better retention of knowledge and increased motivation to complete the course successfully.

7- Cost-Effective Education. Traditional higher education can be financially unfeasible for many learners. In contrast, micro programmes are generally more affordable and cost-effective. Learners can choose to pay only for the specific courses they need, making education accessible to a broader audience. Additionally, the shorter duration of micro courses means that learners can quickly see returns on their investments in the form of improved skills and employability.

8- Rapid Adaptation to Industry Needs. Micro programmes are uniquely suited to address the ever-changing demands of industries and the job market. As new technologies, methodologies, and practices emerge, micro programmes can be swiftly developed and deployed, ensuring that learners have access to the most current and relevant knowledge. This agility in content development allows educators to respond promptly to emerging trends and equip learners with skills that are in demand.

9- Boosting Learner Motivation and Confidence. The shorter duration of micro courses provides learners with a sense of accomplishment upon completion, boosting their motivation to continue learning. As learners earn micro credentials, they gain tangible evidence of their progress and expertise, enhancing their confidence in their abilities. This positive reinforcement cycle encourages learners to explore further topics and continue expanding their skill set.

10- Access to Global Knowledge and Expertise. The digital nature of micro courses transcends geographical boundaries, offering learners the opportunity to access knowledge and expertise from around the world. Learners can enrol in courses taught by leading industry professionals, renowned academics, and subject matter experts, regardless of their physical location. This exposure to diverse perspectives enriches the learning experience and broadens learners' understanding of various subjects.

The illustrated ten distinctive pillars of the Micro Programmes make them an attractive tool for deploying specialised education and training. RES4CITY project aims at exploiting this tool to support the development of specialized professionals in the field of renewable integration in cities. To this aim, eight Micro Programmes are developed targeting STEM and non-STEM students/professionals. Table *1* reports the title of the proposed courses and the corresponding target.

Title	Target
MP1. Decarbonizing Cities. Financial and Technological Perspective.	Educational - STEM
MP2. Managing of Sustainability and Finance in Cities	Educational – SSH
MP3. Advanced Energy Systems and Finance: From Data to Decision Making	Professional – STEM
MP4. Strategies for Sustainability and Finance in Urban Development	Professional – SSH
MP5. Sustainability by Design: Developing a Resilient Built Environment	Educational/Professional - Engineering
MP6. Sustainability and Innovation in Energy: Strategies and Analytics	Educational/Professional - Management
MP7. Sustainable Energy Solutions for Cities: Policy, Strategy, and Implementation	Educational/Professional - Political Sciences
MP8. Financing the Sustainable Transitions in Cities	Educational/Professional - Finance

Table 1. RES4CITY Micro Programmes (MP)

3. Micro Programme 1. *Decarbonizing Cities. Financial and Technological Perspective.*

3.1 Micro Programme Description

"Decarbonizing Cities: Financial and Technological Perspective" is a MP that explores the financial and technological solutions to decarbonize cities. The course will cover topics such as sustainable finance, renewable energy systems, data analytics, energy policy, efficient building techniques, and tools for cities decarbonization. The course will also explore the concept of positive energy districts and biogas systems as solutions for climate transition.

3.2 Micro Programme Learning Outcomes

On the successful completion of the MP, students will be able to

1- Recall key concepts and principles related to sustainable finance, renewable energy systems, and decarbonization of cities.

2- Understand the interdisciplinary nature of decarbonizing cities, including the economic, environmental, and social factors that influence the decarbonization process.

3- Apply their knowledge of decarbonizing cities to analyze and evaluate real-world case studies.

4- Analyze the strengths and weaknesses of different financial and technological solutions for decarbonizing cities and identify opportunities for improvement.

5- Evaluate the effectiveness of financial and technological solutions for decarbonizing cities and make recommendations for future actions.

6- Create their own financial and technological solutions for decarbonizing cities, considering the social, economic, and environmental context of the area.

This MP aims to equip students with the knowledge and skills to understand the financial and technological solutions to decarbonize cities, and to develop solutions to address the challenge of climate change at the local level.

3.3 Micro Programme Syllabus

Table 2 reports the syllabus of the micro programme. The MP is composed of ten MC, whose code refers to the MC basked as given in D2.3, of which six are mandatory, two are to be chosen within a group of four suggested MCs, one can be freely chosen within the MC basket, and the last one is a mandatory serious game. The serious game has the role of final exam since it focuses on the assessment of all the learning outcomes acquired during the MP.

MC Code	MC Title	STEM/ SSH	Mandatory/ Optional
MC22	*Fundamentals of energy system*	BOTH	M
MC23	*Introduction to renewable energies*	BOTH	M
MC02	*Introduction to sustainable finance*	BOTH	M
MC06	*Data analytics for the energy sector*	STEM	M
MC18	*Efficient building techniques*	STEM	M

MC21	*Tools for cities decarbonisation*	STEM	M
	Two MCs from the following basket:		
MC11	*Energy utilisation and storage*	STEM	O
MC08	*Case studies in energy management*	STEM	O
MC20	*Positive energy districts*	STEM	O
MC14	*Energy strategy and energy transition*	BOTH	O
MC36	*Energy Policy and flexible technologies*	BOTH	O
	ONE MC at student's choice from the MC basket		
MC10	SERIOUS GAME	BOTH	M

Table 2. Syllabus for MP1

4. Micro Programme 2. *Managing of Sustainability and Finance in Cities.*

4.1 Micro Programme Description

"Managing Sustainability and Finance in Cities" is a MP that aims to provide an in-depth understanding of the key concepts and practices related to sustainable energy systems, finance, and urban development. Through this program, participants will learn how to analyze and evaluate the potential of renewable energy sources, to propose circular economy solutions, develop sustainable business models, and create strategies for transitioning to a more sustainable energy future. Additionally, participants will gain an understanding of the social and economic factors that influence the acceptance of new technologies and explore the role of energy communities and sustainable development goals in creating just and equitable cities.

4.2 Micro Programme Learning Outcome

On the successful completion of the MP, students will be able to

Understand the principles of energy systems, sustainable finance, and urban development.

Analyse and evaluate the potential of renewable energy sources and sustainable business models.

Develop strategies for transitioning to a more sustainable energy future and apply them in real-world scenarios.

Evaluate the social and economic factors that influence the acceptance of new technologies and the role of energy communities in creating just and equitable cities.

Create a comprehensive plan for sustainable development in a specific city, taking into account the interrelatedness of energy, finance, and social and economic factors.

Assess the effectiveness of the plan in meeting the sustainability and finance goals of the city.

4.3 Micro Programme Syllabus

Table 3 reports the syllabus of the micro programme. The MP is composed of ten MC, whose code refers to the MC basked as given in D2.3, of which six are mandatory, two are to be chosen within a group of four suggested MCs, one can be freely chosen within the MC basket, and the last one is a mandatory serious game. The serious game has the role of final exam since it focuses on the assessment of all the learning outcomes acquired during the MP.

MC Code	MC Title	STEM/ SSH	Mandatory/ Optional
MC22	*Fundamentals of energy system*	BOTH	M
MC23	*Introduction to renewable energies*	BOTH	M
MC02	*Introduction to sustainable finance*	BOTH	M
MC44	*Sustainable business models*	SSH	M
MC14	*Energy strategy and energy transition*	BOTH	M
MC32	*Social acceptance of technologies*	SSH	M
	Two MCs from the following basket:		
MC19	*Energy communities*	BOTH	O

MC28	*Sustainable development goals for cities*	SSH	O
MC31	*Energy justice and poverty*	SSH	O
MC30	*Urban renewable energy: decision making methodologies*	SSH	O
MC40	*Circular economy for sustainable cities*	SSH	O
	ONE MC at student's choice from the MC basket		
MC10	SERIOUS GAME	BOTH	M

Table 3. Syllabus for MP2

5. Micro Programme 3. *Advanced Energy Systems and Finance: From Data to Decision Making*

5.1 Micro Programme Description

"Advanced Energy Systems and Finance: From Data to Decision Making" is a MP that provides a comprehensive understanding of the latest trends and techniques in the field of energy systems and sustainable finance. The program covers a wide range of topics, including the introduction to energy systems, sustainable finance, renewable energies, data analytics for the energy sector, circular economy, advanced modelling of buildings and energy systems, energy management, and smart communities. The program also includes case studies in energy management and analysis of energy consumption, which will help participants to understand the practical applications of the concepts learned in the program.

5.2 Micro Programme Learning Outcome

On the successful completion of the MP, students will be able to

Understand the principles of energy systems, sustainable finance, renewable energies and data analytics for energy sector.

Analyse and evaluate the potential of renewable energy sources, circular economy and advanced modelling of buildings and energy systems.

Develop strategies for energy management and smart communities and apply them in real-world scenarios.

Evaluate the energy consumption and case studies in energy management.

Create a comprehensive plan for sustainable energy and finance in real-world scenarios, considering the interrelatedness of energy systems, sustainable finance, data analytics, and circular economy.

Assess the effectiveness of the plan in meeting the sustainability and finance goals and make data-driven decisions in the energy sector.

5.3 Micro Programme Syllabus

Table 4 reports the syllabus of the micro programme. The MP is composed of ten MC, whose code refers to the MC basked as given in D2.3, of which six are mandatory, two are to be chosen within a group of four suggested MCs, one can be freely chosen within the MC basket, and the last one is a mandatory serious game. The serious game has the role of final exam since it focuses on the assessment of all the learning outcomes acquired during the MP.

MC Code	MC Title	STEM/ SSH	Mandatory/ Optional
MC02	*Introduction to sustainable finance*	BOTH	M
MC06	*Data analytics for the energy sector*	STEM	M
MC15	*Energy management and smart communities*	STEM	M
MC17	*Decarbonisation of thermal energy*	STEM	M
MC07	*Analysis of energy consumption*	BOTH	M
MC13	*Advanced modelling of buildings and energy systems*	STEM	M
	Two MCs from the following basket:		

MC38	*Economics and physics of energy storages*	BOTH	O
MC20	*Positive energy districts*	STEM	O
MC39	*Biogas systems for climate transition*	STEM	O
MC01	*Enacting a circular economy*	BOTH	O
MC42	*Small scale wind power*	STEM	O
	ONE MC at student's choice from the MC basket		
MC10	SERIOUS GAME	BOTH	M

Table 4. *Syllabus for MP3*

6. Micro Programme 4. *Strategies for Sustainability and Finance in Urban Development.*

6.1 Micro Programme Description

"Managerial Strategies for Sustainable Energy Systems and Finance in Urban Development" is a MP that provides a comprehensive understanding of the managerial strategies related to sustainable energy systems, sustainable finance, and urban development. The program covers a wide range of topics including the introduction to energy systems, sustainable finance, renewable energies, sustainable business models, energy strategy and energy transition, social acceptance of technologies, urban renewable energy decision making methodologies, circular economy for sustainable cities, and strategic behaviour in energy markets. The program is designed to provide participants with the knowledge, skills and tools to develop and implement effective strategies for achieving sustainable energy systems and sustainable finance in urban settings.

6.2 Micro Programme Learning Outcome

On the successful completion of the MP, students will be able to

1- Understand the principles of energy systems, sustainable finance, renewable energies, and urban development.

2- Analyse and evaluate the potential of renewable energy sources, sustainable business models, and energy strategy and energy transition.

3- Develop strategies for energy management and smart communities and apply them in real-world scenarios.

4- Evaluate the social and economic factors that influence the acceptance of new technologies, and the role of urban renewable energy decision making methodologies and circular economy in creating sustainable cities.

5- Create a comprehensive plan for sustainable energy and finance in urban settings, considering the interrelatedness of energy systems, sustainable finance, social and economic factors, and strategic behaviour in energy markets.

6- Assess the effectiveness of the plan in meeting the sustainability and finance goals and make data-driven decisions in the energy sector.

6.3 Micro Programme Syllabus

Table 5 reports the syllabus of the micro programme. The MP is composed of ten MC, whose code refers to the MC basked as given in D2.3, of which six are mandatory, two are to be chosen within a group of four suggested MCs, one can be freely chosen within the MC basket, and the last one is a mandatory serious game. The serious game has the role of final exam since it focuses on the assessment of all the learning outcomes acquired during the MP.

MC Code	MC Title	STEM/ SSH	Mandatory/ Optional
MC23	*Introduction to renewable energies*	BOTH	M
MC03	*Tools, Strategies and Trends in Sustainable Finance*	BOTH	M

MC40	*Circular economy for sustainable cities*	SSH	M
MC44	*Sustainable business models*	SSH	M
MC14	*Energy strategy and energy transition*	BOTH	M
MC30	*Urban renewable energy: decision making methodologies*	SSH	M
	Two MCs from the following basket:		
MC43	*Gender mainstreaming and intersectionality*	SSH	O
MC41	*Management of innovation projects*	SSH	O
MC35	*Strategic behaviour in energy markets: options and games*	BOTH	O
MC05	*Climate risk and climate investing*	BOTH	O
MC32	*Social acceptance of technologies*	SSH	O
	ONE MC at student's choice from the MC basket		
MC10	SERIOUS GAME	BOTH	M

Table 5. *Syllabus for MP4*

7. Micro Programme 5. *Sustainability by Design: Developing a Resilient Built Environment.*

7.1 Micro Programme Description

The MP *"Sustainability by Design: Developing a Resilient Built Environment"* will cover topics such as green infrastructure, energy efficiency, integration between transportation systems and buildings, and RES integration. The goal of the course would be to provide students with a comprehensive understanding of how to design buildings that are sustainable, resilient, and liveable. At the same time, approaches and strategies for supporting the energy and climate transition to reach EU 2050 targets are presented.

7.2 Micro Programme Learning Outcome

On the successful completion of the MP, students will be able to

1- Recall key concepts and principles related to sustainable buildings design.

2- Understand the interdisciplinary nature of sustainable buildings design, including the impacts of urbanization on the environment and society.

3- Apply their knowledge of sustainable buildings design to analyse and evaluate real-world buildings design projects.

4- Analyse the strengths and weaknesses of different sustainable buildings design strategies and identify opportunities for improvement.

5- Evaluate the effectiveness of sustainable buildings design policies and programs and make recommendations for future actions.

6- Create their own sustainable buildings design plans and proposals, considering the social, economic, and environmental context of the area.

7.3 Micro Programme Syllabus

Table 6 reports the syllabus of the micro programme. The MP is composed of ten MC, whose code refers to the MC basked as given in D2.3, of which six are mandatory, two are to be chosen within a group of four suggested MCs, one can be freely chosen within the MC basket, and the last one is a mandatory serious game. The serious game has the role of final exam since it focuses on the assessment of all the learning outcomes acquired during the MP.

MC Code	MC Title	STEM/ Non-STEM	Mandatory/ Optional
MC18	*Efficient building techniques*	STEM	M
MC12	*Thermal simulation of buildings*	STEM	M
MC26	*Understanding critical raw materials*	BOTH	M
MC24	*Urban metabolism strategies*	BOTH	M
MC37	*Renewable energy investments*	BOTH	M
MC21	*Tools for cities decarbonisation*	STEM	M
	Two MCs from the following basket:		

MC13	*Advanced modelling of buildings and energy systems*	STEM	O
MC33	*Hydrogen technologies for urban areas*	BOTH	O
MC30	*Urban renewable energy: decision making methodologies*	SSH	O
MC20	*Positive energy districts*	STEM	O
MC07	*Analysis of energy consumption*	BOTH	O
	ONE MC at student's choice from the MC basket		
MC10	SERIOUS GAME	BOTH	M

Table 6. *Syllabus for MP5*

8. Micro Programme 6. *Sustainability and Innovation in Energy: Strategies and Analytics.*

8.1 Micro Programme Description

"Sustainability and Innovation in Energy: Strategies and Analytics" is a micro program that focuses on providing a comprehensive understanding of the strategies, analytical tools, and best practices for promoting sustainability and innovation in the energy sector. The program covers a wide range of topics including data analytics for the energy sector, renewable energy investments, sustainable business models, decision-making for energy projects under uncertainty, management of innovation projects, social acceptance of technologies, energy strategy and energy transition, gender mainstreaming and intersectionality, and energy justice and poverty. The program is designed to provide participants with the knowledge, skills and tools to develop and implement effective strategies for promoting sustainable and innovative energy solutions.

8.2 Micro Programme Learning Outcome

On the successful completion of the MP, students will be able to

1- Understand the principles of data analytics, renewable energy investments, sustainable business models, and decision-making in the energy sector.

2- Analyse and evaluate the potential of renewable energy sources, sustainable business models, energy strategy and energy transition.

3- Develop and apply analytical tools to evaluate the performance of energy projects and understand the factors affecting the social acceptance of new technologies.

4- Evaluate the role of gender mainstreaming and intersectionality in promoting sustainable energy solutions and the impact of energy poverty on marginalized communities.

5- Create a comprehensive plan for promoting sustainable and innovative energy solutions, considering the interrelatedness of data analytics, renewable energy investments, sustainable business models, decision-making under uncertainty, and social acceptance of technologies.

6- Assess the effectiveness of the plan in meeting the sustainability and innovation goals and make data-driven decisions in the energy sector.

8.3 Micro Programme Syllabus

Table 7 reports the syllabus of the micro programme. The MP is composed of ten MC, whose code refers to the MC basked as given in D2.3, of which six are mandatory, two are to be chosen within a group of four suggested MCs, one can be freely chosen within the MC basket, and the last one is a mandatory serious game. The serious game has the role of final exam since it focuses on the assessment of all the learning outcomes acquired during the MP.

MC Code	MC Title	STEM/ Non-STEM	Mandatory/ Optional
MC22	*Introduction to renewable energies*	BOTH	M
MC34	*Decision-making for energy projects under uncertainty*	BOTH	M
MC41	*Management of innovation projects*	SSH	M

MC32	*Social acceptance of technologies*	SSH	M
MC37	*Renewable energy investments*	BOTH	M
MC44	*Sustainable business models*	SSH	M
	Two MCs from the following basket:		
MC31	*Energy justice and poverty*	SSH	O
MC43	*Gender mainstreaming and intersectionality*	SSH	O
MC14	*Energy strategy and energy transition*	BOTH	O
MC06	*Data analytics for the energy sector*	STEM	O
MC09	*Energy markets*	BOTH	O
	ONE MC at student's choice from the MC basket		
MC10	SERIOUS GAME	BOTH	M

Table 7. *Syllabus for MP6*

9. Micro Programme 7. *Sustainable Energy Solutions for Cities: Policy, Strategy and Implementation.*

9.1 Micro Programme Description

Sustainable Energy Solutions for Cities: Policy, Strategy and Implementation is a MP that focuses on providing a comprehensive understanding of the policies, strategies, and best practices for promoting sustainable energy solutions in cities. The program covers a wide range of topics including introduction to renewable energies, energy policy, energy strategy and energy transition, enacting a circular economy, sustainability assessment of cities, digital payments and smart city platforms, climate risk and climate investing, energy justice and poverty, and social acceptance of technologies. The program is designed to provide participants with the knowledge, skills, and tools to develop and implement effective energy solutions for cities.

9.2 Micro Programme Learning Outcome

On the successful completion of the MP, students will be able to

1- Understand the principles of renewable energy sources and energy policies.

2- Analyse and evaluate the potential of renewable energy sources, energy strategy and energy transition, and the circular economy for promoting sustainable energy solutions in cities.

3- Develop and apply sustainability assessment tools to evaluate the performance of cities and understand the factors affecting the social acceptance of new energy technologies.

4- Evaluate the role of digital payments and smart city platforms in promoting sustainable energy solutions, the impact of climate risks on energy investments, and the impact of energy poverty on marginalized communities.

5- Create a comprehensive plan for promoting sustainable energy solutions in cities, considering the interrelatedness of renewable energy sources, energy policies, circular economy, digital payments and smart city platforms, and social acceptance of technologies.

6- Assess the effectiveness of the plan in meeting the sustainability goals and make data-driven decisions in the energy sector.

9.3 Micro Programme Syllabus

Table 8 reports the syllabus of the micro programme. The MP is composed of ten MC, whose code refers to the MC basked as given in D2.3, of which six are mandatory, two are to be chosen within a group of four suggested MCs, one can be freely chosen within the MC basket, and the last one is a mandatory serious game. The serious game has the role of final exam since it focuses on the assessment of all the learning outcomes acquired during the MP.

MC Code	MC Title	STEM/ SSH	Mandatory/ Optional
MC23	*Introduction to renewable energies*	BOTH	M
MC16	*Energy policy*	BOTH	M
MC14	*Energy strategy and energy transition*	BOTH	M

MC27	*How sustainable is your city?*	SSH	M
MC31	*Energy justice and poverty*	SSH	M
MC32	*Social acceptance of technologies*	SSH	M
	Two MCs from the following basket:		
MC05	*Climate risk and climate investing*	BOTH	O
MC25	*Digital payments and smart city platform*	BOTH	O
MC01	*Enacting a circular economy*	BOTH	O
MC41	*Management of innovation projects*	SSH	O
MC44	*Sustainable business models*	SSH	O
	ONE MC at student's choice from the MC basket		
MC10	SERIOUS GAME	BOTH	M

Table 8. *Syllabus for MP7*

10. Micro Programme 8. *Financing the Sustainable Transitions in Cities.*

10.1 Micro Programme Description

Financing the Sustainable Transitions in Cities is a course that focuses on providing a comprehensive understanding of the tools, strategies and trends in sustainable finance, and how they can be used to finance sustainable transitions in cities. The course covers a wide range of topics including introduction to energy systems, tools, strategies and trends in sustainable finance, investing in sustainability, climate risk and climate investing, energy markets, energy policy, digital payments and smart city platforms, sustainability assessment of cities and network industries regulation and pricing. The course is designed to provide participants with the knowledge, skills and tools to understand the financial aspects of sustainable transitions in cities and to identify opportunities to invest in sustainable projects.

10.2 Micro Programme Learning Outcome

On the successful completion of the MP, students will be able to

1- Understand the principles of sustainable finance, energy systems and energy policy.

2- Analyse and evaluate the potential of sustainable finance tools, strategies and trends to finance sustainable transitions in cities.

3- Develop and apply the assessment tools to evaluate the sustainability performance of cities and the impact of network industries regulation and pricing on sustainable transition.

4- Evaluate the role of digital payments and smart city platforms in promoting sustainable finance and the impact of climate risks on sustainable finance investments.

5- Create a comprehensive strategy for financing sustainable transitions in cities, considering the interrelatedness of sustainable finance, energy markets, energy policy, digital payments and smart city platforms, and network industries regulation and pricing.

6- Assess the effectiveness of the strategy in meeting the sustainability goals and make data-driven decisions in the sustainable finance sector.

10.3 Micro Programme Syllabus

Table 9 reports the syllabus of the micro programme. The MP is composed of ten MC, whose code refers to the MC basked as given in D2.3, of which six are mandatory, two are to be chosen within a group of four suggested MCs, one can be freely chosen within the MC basket, and the last one is a mandatory serious game. The serious game has the role of final exam since it focuses on the assessment of all the learning outcomes acquired during the MP.

MC Code	MC Title	STEM/ SSH	Mandatory/ Optional
MC23	*Introduction to renewable energies*	BOTH	M
MC30	*Urban renewable energy: decision making methodologies*	SSH	M
MC03	*Tools, Strategies and Trends in Sustainable Finance*	BOTH	M
MC04	*Investing in sustainability*	BOTH	M
MC29	*Introduction to industrial organization*	SSH	M

MC09	*Energy markets*	BOTH	M
	Two MCs from the following basket:		
MC25	*Digital payments and smart city platform*	BOTH	O
MC27	*How sustainable is your city?*	SSH	O
MC05	*Climate risk and climate investing*	BOTH	O
MC32	*Social acceptance of technologies*	SSH	O
MC34	*Decision-making for energy projects under uncertainty*	BOTH	O
	ONE MC at student's choice from the MC basket		
MC10	SERIOUS GAME	BOTH	M

Table 9. *Syllabus for MP8*

Appendix – Micro Credentials Tables

MC01: Enacting a circular economy

MC title	Enacting a Circular Economy		
MC long title	Enacting a Circular Economy with Sustainable Energy Use		
ISCED codes	*Primary*: 072	*Complementary*: 052	**ECTS:** 2.5
Suitable for	☒ STEM ☒ NON-STEM		**EQF level:** 7-8
Background of the proposed micro-credential			
To enact a circular economy, and move towards sustainable energy usage, it is critical that we have an understanding of and can critically engage with environmental world views. Furthermore, the development of multi-stakeholder partnerships with regards to renewable energy materials and the development of new policy and legislation in this sphere is imperative. The Energy and the Circular Economy MC will support the development of knowledge and skills around the concept of the circular economy, specifically focusing on sustainable energy usage.			
Overview of the micro-credential			
This MC will introduce the skills and attributes required for critical reflection and action on creating a circular economy with sustainable energy use. Learners will be introduced to the concept of environmental world views, and the impact that these can have on collective action. Through thought experiments and case studies, learners will critically reflect on their own personal views. Students will learn about the current initiatives, opportunities and challenges associated with enacting a circular economy, and how best to plan for multi-stakeholder involvement in energy-related initiatives.			
Learning objectives			
On the completion of the micro-credential, participants will be able to: • Contextualise and reflect on environmental world views. • Comprehend and critically engage with the role of energy use in the circular economy. • Contextualise theory and relate this to varying societal groups' Ability, Motivation and Opportunity to enact a circular economy with sustainable energy use. • Carry out stakeholder mapping and circular economy project planning activities.			
Table of contents			
• Reflect on Environmental World Views and Ethics • Introduction to the Circular Economy and Sustainable Energy Use • Explore and Critically Evaluate Energy Innovation Case Studies • Investigate the Role of Societal Actors in Enacting a Circular Economy • Development of Interdisciplinary Partnerships for Circular Economy Action			
Teaching and learning methods			
The following teaching and learning methods will be used: • Teaching & Learning Methods: Video lectures (6 hours), case studies, academic papers, videos, audio clips & media articles.			
Prerequisites			
None			
Assessment methods			
Multiple choice questions			

MC02: Introduction to sustainable finance

MC title	Introduction to sustainable finance		
MC long title	-		
ISCED codes	*Primary*: 041	*Complementary*: 031	**ECTS:** 2.5
Suitable for	☒ STEM ☒ NON-STEM		**EQF level:** 6-7-8

Background of the proposed micro-credential

Sustainable finance is a broad and evolving field that aims to align financial decision-making with environmental, social, and governance (ESG) considerations. It involves integrating sustainability principles into investment decisions, lending practices, and overall financial strategies. The goal of sustainable finance is to support projects and businesses that contribute positively to the environment and society while mitigating risks associated with unsustainable practices. Key components of sustainable finance include impact investing, which focuses on generating measurable social and environmental benefits alongside financial returns. Environmental and social risk assessments help investors and financial institutions evaluate the sustainability performance of companies and projects. Additionally, sustainable finance encourages the integration of ESG factors into corporate reporting and decision-making processes, fostering greater transparency and accountability.

Overview of the micro-credential

The MC "Introduction to Sustainable Finance" offers the tools and insights needed to develop financial strategies that create value for society and invest in a sustainable future. Students will learn about the pressures, trends, and opportunities in the current financial system. They will investigate the strategic business implications of social and environmental challenges and discover how best to plan through sustainable initiatives like impact investing, the integration of Environmental, Social, and Governance (ESG) investing, and positive screening.

Learning objectives

On the completion of the micro-credential, participants will be able to:

- Understand the pressures, trends, and opportunities within the current financial system related to sustainable finance.
- Analyse the strategic business implications of social and environmental challenges in the context of sustainable finance.
- Develop financial strategies that create value for society and contribute to a sustainable future.
- Explore sustainable initiatives like impact investing, ESG integration, and positive screening for responsible and impactful investment decisions.

Table of contents

- Introduction to the current financial system.
- Capital flow in the financial system.
- Sustainable finance approaches.
- The role of the public sector in sustainable finance.

Teaching and learning methods

The following teaching and learning methods will be used:

- Video lectures on the introduction to sustainable finance with interactive features with H5P
- Presentations and data sheets
- Worked exercises (case studies)
- Teaching aids and research papers.

Prerequisites

Basic understanding of the global financial system and main definitions of macro-economic aggregation.

Assessment methods

Multiple choice questions

MC03: Tools, strategies and trends in sustainable finance

MC title	Tools, Strategies and Trends in sustainable finance		
MC long title	-		
ISCED codes	*Primary*: 041	*Complementary*: -	**ECTS:** 2.5
Suitable for	☒ STEM ☒ NON-STEM		**EQF level:** 6-7-8

Background of the proposed micro-credential

Sustainable finance is revolutionizing the financial landscape by incorporating environmental, social, and governance (ESG) considerations into decision-making. Investors leverage tools like impact investing, green bonds, and sustainable equity funds to align their portfolios with responsible principles. ESG integration assesses the sustainability performance of investments, while engagement empowers investors to drive positive change within companies. Continuously evolving trends, such as increased demand for sustainable products and climate-related disclosures, are reshaping financial markets. Sustainable finance's transformative power lies in its ability to foster a more resilient and responsible future, paving the way for a sustainable and equitable world.

Overview of the micro-credential

The MC "Tools and Strategies in Sustainable Finance" builds on the knowledge gained in the Introduction to Sustainable Finance (P03) and offers tools and insights needed to implement sustainable finance solutions in the student's own context, and better understand how these strategies can positively impact their organisation's long-term value gain. This module will also give them new perspectives on how businesses, banks, and insurers are shifting to more sustainable business models that offer positive returns for both their clients and society.

Learning objectives

On the completion of the micro-credential, participants will be able to:

- implement sustainable finance solutions in the student's own context, applying tools and insights gained from the course.
- Understand the positive impact of sustainable finance strategies on their organization's long-term value.
- Gain new perspectives on how businesses, banks, and insurers are adopting more sustainable business models for positive returns.
- Identify opportunities for creating positive societal impacts through sustainable finance practices.

Table of contents

- Relationship between risk and return, and the impact on sustainable finance.
- Key attributes for promoting sustainable finance.
- Megatrends and the innovations required to support a sustainable finance.
- Action plan development to promote sustainable finance.

Teaching and learning methods

The following teaching and learning methods will be used:

- Video lectures on the introduction to sustainable finance with interactive features with H5P
- Presentations and data sheets
- Worked exercises (case studies)
- Teaching aids and research papers.

Prerequisites

Micro-credential P03.

Assessment methods

Multiple choice questions

MC04: Investing in sustainability

MC title	Investing in sustainability		
MC long title	Investing in sustainability: ESG Scoring, Investing and the Risk Premium		
ISCED codes	*Primary*: 041	*Complementary*: -	**ECTS:** 2.5
Suitable for	☒ STEM ☒ NON-STEM		**EQF level:** 6-7-8

Background of the proposed micro-credential

Investors are increasingly seeking investment opportunities that align with environmental, social and governance (ESG) objectives to enhance fund performance. Today's business environment demands more than just acknowledging sustainability challenges; organizations are expected to take proactive leadership roles in addressing them. Leading through sustainability is crucial for remaining competitive and relevant. Embracing sustainability as a core principle not only contributes to a more sustainable future but also attracts conscious investors, fosters employee engagement, and builds customer loyalty. By seizing opportunities presented by sustainable investments, organizations can navigate the transformative investment landscape and become responsible agents of positive change.

Overview of the micro-credential

The MC "Investing in Sustainability" focuses on ESG Investing and examines the motivations behind ESG investing and the challenges involved in integrating this into existing investment processes. It is designed for practitioners or aspiring professionals across the financial services sector looking to improve their understanding of ESG issues. This course builds on an understanding of the fundamentals of investment management and offers the tools and insights needed to develop financial strategies that create value for society and invest in a sustainable future.

Learning objectives

On the completion of the micro-credential, participants will:

- Gain a comprehensive understanding of ESG Investing, including the motivations and drivers behind this approach.
- be able to analyse the challenges involved in integrating ESG considerations into existing investment processes.
- develop practical skills and tools to implement ESG strategies and enhance investment decision-making.
- have improved understanding of ESG issues and their impact on financial strategies and investment management in the pursuit of creating value for society and fostering a sustainable future.

Table of contents

- Climate urgency and action plan
- Climate risk measures
- Climate Investing: strategies for portfolio decarbonization
- Net Zero Carbon Metrics for portfolios

Teaching and learning methods

The following teaching and learning methods will be used:

- Video lectures on the introduction to sustainable finance with interactive features with H5P
- Presentations and data sheets
- Worked exercises (case studies)
- Teaching aids and research papers.

Prerequisites

Micro-credential P01.

Assessment methods

Multiple choice questions

MC05: Climate risk and climate investing

MC title	Climate Risk & Climate Investing		
MC long title	Climate Investing, Risk Measures & Portfolio Decarbonization		
ISCED codes	*Primary*: 041	*Complementary*: -	**ECTS:** 2.5
Suitable for	☒ STEM ☒ NON-STEM		**EQF level:** 7-8
Background of the proposed micro-credential			
Responsible Investors are increasingly paying more attention not only to the transition risk but also to physical risk, the financial losses that come from climate change (droughts, floods, storms, etc.), not from the adaptation of the economy to prevent these losses. These concerns go beyond looking for investment opportunities that meet environmental, social and governance (ESG) objectives, while enhancing the value of investing performance. In today's business environment, it is, therefore, no longer sufficient for organisations to simply acknowledge global sustainability challenges like climate change, resource depletion, and inequality – they're expected to lead the way through them.			
Overview of the micro-credential			
The MC "Climate Risk & Climate Investing" examines the motivations behind Climate investing, by examining climate risks transmission channels to financial stability, and the challenges involved in integrating climate risk into existing investment processes. It is designed for practitioners or aspiring professionals across the financial services sector looking to improve their understanding of ESG issues. This course builds on an understanding of the fundamentals of investment management and offers the tools and insights needed to develop financial strategies that create value for society and invest in a sustainable future.			
Learning objectives			
On the completion of the micro-credential, participants will: • Understand the motivations and drivers behind Climate investing, including the examination of climate risk transmission channels to financial stability. • be able to analyse the challenges involved in integrating climate risk considerations into existing investment processes. • develop practical skills and tools to implement climate risk strategies and enhance investment decision-making in the context of climate investing. • possess an improved understanding of climate-related issues and their impact on financial strategies and investment management.			
Table of contents			
• The environmental, social and governance (ESG) scoring • Performance of ESG Investing. • ESG Financing & the cost of debt. • ESG Risk Premium.			
Teaching and learning methods			
The following teaching and learning methods will be used: • Video lectures on the introduction to sustainable finance with interactive features with H5P • Presentations and data sheets • Worked exercises (case studies) • Teaching aids and research papers.			
Prerequisites			
Micro-credential P01.			
Assessment methods			
Multiple choice questions			

MC06: Data analytics for the energy sector

MC title	Data analytics for the energy sector		
MC long title	-		
ISCED codes	*Primary*: 061	*Complementary*: -	**ECTS:** 2.5
Suitable for	☒ STEM ☐ NON-STEM		**EQF level:** 7-8

Background of the proposed micro-credential

Data analytics in the energy sector involves the systematic extraction, organization, and analysis of vast amounts of data to derive valuable insights, optimize operations, and inform decision-making. As the energy industry becomes more complex and data-driven, leveraging data analytics has become imperative for driving efficiency, sustainability, and innovation. Through advanced data analytics techniques, such as machine learning and predictive modelling, energy companies can optimize energy production and distribution, identify energy consumption patterns, and forecast demand fluctuations. Moreover, data analytics aids in identifying potential areas for energy savings, improving asset performance, and enhancing customer experiences. By harnessing the power of data analytics, the energy sector can revolutionize its operations, increase renewable energy integration, and contribute to a more sustainable and resilient energy future.

Overview of the micro-credential

The MC "Data Analytics for the Energy Sector" provides a comprehensive overview of leveraging data analytics in the dynamic energy industry. Participants will learn advanced techniques such as machine learning and predictive modeling to analyze vast datasets, optimize energy production, and identify consumption patterns. The course focuses on improving operational efficiency, enhancing asset performance, and fostering sustainable practices. Through practical applications and real-world case studies, participants will gain the skills needed to drive innovation, make data-informed decisions, and contribute to a more resilient and sustainable energy future.

Learning objectives

On the completion of the micro-credential, participants will be able to:

- Understand the role of data analytics in the energy industry.
- Identify the different types of data sources and systems used in the energy sector.
- Use data visualization and dashboarding techniques.
- Apply statistical and predictive modelling methods to analyse energy data.
- Analyse real-world case studies from the energy industry and develop solutions to real-world problems using data analytics techniques.

Table of contents

- Introduction to data analytics in the energy sector
- Energy data sources and systems
- Energy data visualization and dashboarding
- Energy data analysis and modelling
- Case studies in energy data analytics

Teaching and learning methods

The following teaching and learning methods will be used:

- Lectures and presentations: The instructor could provide video lectures (3 hours) and presentations on key concepts and techniques in data analytics, using slides, videos, and other multimedia tools to support the material.

Prerequisites

Basic knowledge of data concepts and techniques, such as data types, data sources, data cleaning, and data visualization.
Familiarity with programming (e.g., python, R, etc.) and statistical analysis (Excel or SPSS).

Assessment methods

Multiple choice questions

MC07: Analysis of energy consumption

MC title	Analysis of energy consumption		
MC long title	Introduction to Fundamental Methodologies for energy consumption analysis		
ISCED codes	*Primary*: 071	*Complementary*: 031	**ECTS:** 2.5
Suitable for	☒ STEM ☒ NON-STEM		**EQF level:** 7-8
Background of the proposed micro-credential			
The present MC will support the development of knowledge and skills to analyse the rationale behind energy consumption of a given territorial energy system (e.g., at country level, regional level, city level, urban district level, etc.). The analysis of the consumption trend is relevant to assess the effectiveness of implemented energy policies as well as to understand how the energy consumption structure can evolve in the future. A mix of technical and socio-economic variables will be considered to develop adequate quantitative analyses to suggest informed decisions to policy makers or companies based on an analytical framework.			
Overview of the micro-credential			
The MC "Analysis of Energy Consumption" will provide an overview of analytical methods for analysing the trend of energy consumption from a system of any territorial extension (e.g., country level, regional level, city level, etc.). A mix of simple (e.g., intensity estimation, growth rates, etc.) and more complex (e.g., weather adjustment, decomposition analysis, etc.) analytical frameworks will be introduced. The aim is to interpret the time trend of energy consumption with reference to total consumption or to a specific source (e.g., electricity consumption, natural gas consumption, etc.). Technical and socio-economic variables will be employed for the definition of significant indexes and KPIs to explain the consumption trend.			
Learning objectives			
On the completion of the micro-credential, participants will be able to: • Identify the components influencing the energy consumption • Calculate relevant KPIs for the analysis of energy consumption • Compare the main features of energy consumption trend for different systems (e.g., countries, cities, etc.) • Recognize the effect of different energy policies on the consumption trend			
Table of contents			
• Introduction of the problem of energy consumption. • Analysis of the energy consumption mix, concept of energy intensity. • Compound Annual Growth Rate, elasticity of energy consumption, linear correlation index, weather adjustment procedure. • Introduction to the Decomposition Analysis Index, additive decomposition methodology, implementation of the Logarithmic Mean Divisia Index approach for the decomposing energy consumption.			
Teaching and learning methods			
The following teaching and learning methods will be used: • Video lectures, 3 hours, on the introduction of the problem of energy consumption, definition of simple KPI and energy consumption decomposition methodology • Presentations, data sheets, worked exercises, teaching aids, and research papers			
Prerequisites			
Knowledge of the main units of measures used in the energy field. Basic understanding of the main definitions of macro-economic aggregations (e.g., GDP, value added, etc.).			
Assessment methods			
Multiple choice questions			

MC08: Case studies in energy management

MC title	Case studies in energy management		
MC long title	-		
ISCED codes	*Primary*: 071	*Complementary*: 041	**ECTS:** 2.5
Suitable for	☒ STEM ☐ NON-STEM		**EQF level:** 7-8
Background of the proposed micro-credential			
The present MC will support the development of knowledge and skills to solve practical multidisciplinary problems in Energy Management. The application of quantitative technical and economic methodologies is paramount in the development of business cases supporting the investment process with specific reference to the energy field (e.g., energy efficiency, RES development, etc.). This MC provides practical insight to develop a quantitative decision-making framework supporting energy investments.			
Overview of the micro-credential			
The MC "Case Studies in Energy Management" will combine technical and financial techniques for developing quantitative models for the development of business cases. Five cases will be illustrated and commented during this MC. The aim is to provide a practical applicable framework to develop independent evaluations with specific focus on energy efficiency and RES investments. Spreadsheet based models will be introduced to develop the necessary calculations. The concepts of sensitivity and scenario analyses will be also introduced.			
Learning objectives			
On the completion of the micro-credential, participants will be able to: • Illustrate the logic for defining techno-economic models • Develop quantitative models for the development of energy-based business cases • Analyse different business cases based on technical and financial indicators • Propose quantitative conclusions			
Table of contents			
• Estimation of energy generation from RES and conventional power and heating plants. • Estimation of energy efficiency savings from energy efficiency interventions. • Concept of Levelized Cost of Energy (LCOE) and Levelized Cost of Heat (LCOH) • Drafting a flexible calculation spreadsheet, combination of technical and financial evaluation, calculation of financial indicators (i.e., Net Present Value, Internal Rate of Return, Pay Back Period, Profitability Index). • Development of 5 practical case studies.			
Teaching and learning methods			
The following teaching and learning methods will be used: • Video lectures (3 hours) on the analysis and solution of 5 practical case studies • Presentations, data sheets, worked exercises, teaching aids, and research papers			
Prerequisites			
Knowledge of the main units of measures used in the energy field. Fundamentals of energy concepts. Basics on financial analysis.			
Assessment methods			
Multiple choice questions and solution of case studies.			

MC09: Energy markets

MC title	Energy Markets		
MC long title	Understanding the Fundamentals of Energy Market		
ISCED codes	*Primary*: 071	*Complementary*: 031, 041	**ECTS:** 2.5
Suitable for	☒ STEM ☒ NON-STEM		**EQF level:** 7-8
Background of the proposed micro-credential			
The present MC will support the development of knowledge and skills to understand the dynamics of energy markets. Power, natural gas, and carbon markets will be analysed. The fundamental concepts and basic rules of these three markets, relevant in EU contexts, will be introduced and discussed. The knowledge presented in this MC is relevant since it is transversal to understand the dynamics of the energy sector.			
Overview of the micro-credential			
The MC "Energy Market" will provide an overview of power, natural gas, and carbon markets. The basic principles of each of these markets will be illustrated. The demand and supply balance will be discussed, as well as the concepts of merit order, marginal cost of production, and marginal abatement cost curve. An analytical approach to the description of the markets will be adopted. The connections among the three markets will be also analysed and the reciprocal influences discussed.			
Learning objectives			
On the completion of the micro-credential, participants will be able to: • Identify the interconnections among power, natural gas, and carbon markets • Understand the main drivers influencing energy markets • Estimate the system marginal price on a power market • Develop quantitative analyses for describing the market trends			
Table of contents			
• Introduction to the demand and supply balance. • Power market: day-ahead price, system marginal price, unit commitment problem, calculation of the variable cost of generation, concept of merit order. • Natural gas market: pricing formulas, gas hubs, take-or-pay clause. • Carbon market: marginal abatement cost curve, impact of carbon market on power generation.			
Teaching and learning methods			
The following teaching and learning methods will be used: • Video lectures, 3 hours, on the introduction of energy markets, definition of simple KPI for market analysis and concept of marginal abatement cost curves • Presentations, data sheets, worked exercises, teaching aids, and research papers			
Prerequisites			
• Knowledge of the main units of measures used in the energy field. • Basic understanding of the main definitions of macro-economic aggregations (e.g., GDP, value added, etc.).			
Assessment methods			
• Multiple choice questions • Development of a case study based on public data on the analysis of an energy market.			

MC10: Serious game

MC title	Serious game		
MC long title	Understanding the Fundamentals of Energy Market		
ISCED codes	*Primary*: -	*Complementary*: -	**ECTS:** 7.5
Suitable for	☒ STEM ☒ NON-STEM		**EQF level:** 6-7-8
Background of the proposed micro-credential			
Serious Games has emerged as a powerful tool for learning, training, and skill development. Serious Games are interactive digital experiences designed to educate and engage learners while addressing real-world challenges and scenarios. Serious Games represent a paradigm shift in education and training. They bridge the gap between traditional learning methods and the dynamic, technology-driven world we live in today. These games harness the principles of game design and interactivity to make learning not only informative but also enjoyable. Through Serious Games, learners are not passive recipients of information; they become active participants in their own learning journey. They tackle complex problems, make decisions, and experience the consequences of their actions in a safe and controlled environment. This immersive approach fosters deeper understanding, better retention of knowledge, and the development of critical thinking and problem-solving skills.			
Overview of the micro-credential			
This micro-credential is based on a serious game developed in RES4CITY to enhance the learning experience in sustainable renewable energy source and fuel technologies. It is based on a set of three games: (a) Warm-up games, where learners are trained on specific technical and non-technical topcis related to sustainability in cities; (b) Web-in basket game, a single-player tool where leanrers play a role to stimulate decision-making skills; (c) Business game, a single/multiplayer game where learners can play in a simulated environment.			
Learning objectives			
On the completion of the micro-credential, participants will: • Acquire transversal competences related to su sustainability in cities. • Gain skills in decision-making processes, communication and teamwork.			
Table of contents			
• Warm-up game • Web-in basket • Business game			
Teaching and learning methods			
The following teaching and learning methods will be used: • Serious game is delivered and played as an online game			
Prerequisites			
• None			
Assessment methods			
• Final score of the game			

MC11: Energy utilisation and storage

MC title	Energy Utilization and Storage		
MC long title	-		
ISCED codes	*Primary*: 071	*Complementary*: 041, 061	**ECTS:** 2.5
Suitable for	☒ STEM ☐ NON-STEM		**EQF level:** 6-7-8

Background of the proposed micro-credential

To achieve the emission reduction targets set by the European Union, it is necessary to phase out fossil fuels and accelerate the energy transition towards an energy system based on renewable energy sources. Energy storage and active management of local resources play a key role in this transition to a carbon-neutral economy as critical tools to facilitate the integration of variable renewable energy sources. Therefore, it is essential to empower professionals with skills in energy storage technologies and demand-side management that help enhance the integration of renewable energy sources.

Overview of the micro-credential

The aim of this MC is to increase the awareness of the participants on the relevance of local energy resources management and storage capabilities as tools to accommodate higher levels of local generation based on variable renewable sources and, at the same time, to facilitate the accommodation of higher levels of demand arising, for example, form the electrification of the transportation sector. The possible double role of storage equipment, static batteries or electric vehicles, is challenging and, at the same time, provides many opportunities in the energy transition process.

Learning objectives

On the completion of the micro-credential, participants will be able to:

- adequately characterize energy needs and availability, as well as optimization measures
- discuss the multiple alternatives to supply the local energy needs
- assess and evaluate alternative consumption patterns through demand-side management
- evaluate the role of storage in meeting energy needs
- characterize the alternative functions/roles of the storage facilities/equipment: energy and flexibility

Table of contents

- Energy consumption and energy supply alternatives and availability in urban environments.
- Local energy networks.
- Electrification strategies: the main challenges.
- Demand-side management.
- Energy management algorithms.
- Storage and EVs as flexibility, energy and ancillary services providers.
- Energy storage business models.

Teaching and learning methods

The following teaching and learning methods will be used:

- Video lectures, presentations and worked exercises.

Prerequisites

Basic notions of energy consumption and unit measures used in the energy field.

Assessment methods

Multiple choice questions.
Discussion of practical examples.

MC12: Thermal simulation of buildings

MC title	Thermal simulation of buildings		
MC long title	Introduction to thermal characterization and energy simulation of buildings		
ISCED codes	*Primary*: 071	*Complementary*: 061, 073	**ECTS:** 2.5
Suitable for	☒ STEM ☐ NON-STEM		**EQF level:** 6-7

Background of the proposed micro-credential

To achieve the established long-term climate neutrality targets, the Energy Performance of Buildings Directive was revised to set a more ambitious goal that from 2027 all new public buildings, 2030 all new buildings and from 2050 all buildings should be zero-emission buildings (ZEB). This goal of ZEB calls for buildings to have very high performance, with a very low amount of energy required being covered by energy from renewable sources and no on-site carbon emissions from fossil fuels. Given the need to improve the energy performance of the building stock, building energy simulation becomes an essential tool to help achieve these goals. Therefore, it is fundamental to train and empower professionals with skills in building energy simulation programs to be able to face the challenges currently posed.

Overview of the micro-credential

The aim of this MC is to introduce the students to the building energy simulation tools, showing their capabilities for the design of new and renovated buildings. This MC will provide the procedures to define the geometry of a building model, the parameterization of the thermal properties of the envelope and building utilization. The development of the exercises will permit to understand the capabilities to obtain detailed and integrated results about the different heat exchanges and thermal loads of a building system. The development of a case study will be used to practice and compare the influence of different solutions on the thermal performance of buildings. At the end, students will be prepared to use building simulation tools to contribute for the design of highly efficient buildings.

Learning objectives

On the completion of the micro-credential, participants will be able to:

- consolidate the main theoretical foundations and calculation methodology of building energy simulation.
- acquire the procedures and good practices for the adequate and effective use of building energy simulation tools.
- develop and consolidate skills to apply the general criteria for the definition and parameterization of building models and perform critical analysis of the results.
- evaluate the impact of building renovation measures.

Table of contents

- Introduction to thermal simulation of building.
- Introduction to the adopted simulation program: EnergyPlus.
- Geometry definition of a building model.
- Thermophysical parameterisation of materials and construction elements, definition of internal gains, air infiltration and ventilation, weather data and simulation parameters.
- Result analysis.

Teaching and learning methods

The following teaching and learning methods will be used:

- Video lectures to introduce the thermal simulation of buildings (2 hours)
- Presentations, worked exercises, and tutorial support for the development of case studies

Prerequisites

Basic knowledge of thermodynamics and heat transfer.

Assessment methods

Multiple choice questions.
Written case study report.

MC13: Advanced modelling of buildings and energy systems

MC title	Advanced modelling of buildings and energy systems		
MC long title	Advanced modelling of buildings and energy systems: the BIM approach		
ISCED codes	*Primary*: 071	*Complementary*: 061, 073	**ECTS:** 2.5
Suitable for	☒ STEM ☐ NON-STEM		**EQF level:** 7-8

Background of the proposed micro-credential

In the building sector, which encompasses architecture, engineering, construction and operation and maintenance, among other activities, digitization is established by Building Information Modelling (BIM). In the design phase, the BIM methodology allows the integrated three-dimensional visualization of the architectural project and the different technical disciplines, facilitating the communication, the identification of incompatibilities and the performance analysis of alternatives, namely thermal, energetic, and environmental, through the capabilities of the built-in calculation programs. Also, the BIM methodology allows the database of a building created in the design phase be used and kept updated in all the following phases of the building's lifecycle (construction, operation, maintenance, renovation or rehabilitation and end of life). Thus, it is important to push the training and use of the BIM methodology, which will offer great potential to support the achievement of the current objectives of decarbonizing the buildings sector.

Overview of the micro-credential

The aim of this MC is to introduce the use of the BIM methodology, focusing on the energy modelling of buildings, Heating, Ventilating and Air-Conditioning (HVAC) systems, and renewable energy systems integration. Based on a BIM environment platform the students will be trained to use different tools for 3D representation and calculation procedure (architectural building model, thermal loads calculations, HVAC and energy systems 3D representation and dimensioning). The learning process will be developed in groups of 2/3 students, who will be challenged to learn and use different technological tools to study and design highly efficient case studies buildings projects. Beyond the training of the BIM methodology and technological design tools, this MC intends to help the development of the critical thinking, creativity and collaboration work.

Learning objectives

On the completion of the micro-credential, participants will be able to:

- be familiar with the BIM methodology and its capabilities;
- be prepared to use HVAC and energy systems technological tools to design highly efficient buildings, and integration of renewable energy systems;
- develop critical thinking, creativity and acquire the procedures and good practices to develop projects in a collaboration context;

Table of contents

- Introduction to BIM methodology and software packages.
- Characterization and 3D geometric model of a case study building.
- Parameterization of the building model and thermal loads calculation.
- Design and sizing of HVAC systems and renewable energy systems.
- Performance evaluation and improvement studies.

Teaching and learning methods

The following teaching and learning methods will be used:

- Video lectures to introduce a BIM Platform and software package (2 hours)
- Software Packages tutorials and tutorial support for the development of case studies

Prerequisites

Basic knowledge of thermodynamics and heat transfer.
Fundamentals of thermal characterization and energy modelling of buildings and CAD tools

Assessment methods

Multiple choice questions.
Written case study report.

MC14: Energy strategy and energy transition

MC title	Energy strategy and energy transition		
MC long title	Advanced modelling of buildings and energy systems: the BIM approach		
ISCED codes	*Primary*: 041	*Complementary*: 052, 071	**ECTS:** 2.5
Suitable for	☒ STEM ☒ NON-STEM		**EQF level:** 6-7

Background of the proposed micro-credential

To achieve the ambitious goal of carbon neutrality by 2050 will require not only a focus on energy efficiency to reduce current energy needs, but also a strong commitment to renewable energy sources. These goals will require profound changes in all sectors of society (e.g., industry, buildings, transportation, and agriculture) and in the energy policies that govern countries, thus creating several challenges that will need to be addressed. Nevertheless, unique opportunities will also be created that will lead to new services and business models. This course provides information on the technical and societal challenges and opportunities for a sustainable energy transition.

Overview of the micro-credential

The aim of this module is to provide fundamentals on new possible local business models including RES through enabling technologies. To do so, it will address technical innovations and methods to decarbonize the power generation sector, while analysing the effects and main challenges of a high proportion of renewable energy in the power system, such as security of supply, reliability, and resilience. Furthermore, non-technical innovations, such as social, markets, political, and regulatory, will also be addressed.

Learning objectives

On the completion of the micro-credential, participants will be able to:

- Characterise the technical possibilities for decarbonizing the energy and end-user sectors.
- Recognize and assess innovations that go beyond technological solutions for a sustainable transition.
- Discuss the main challenges raised by the energy transition process, namely due to the massive dissemination of generation based on renewable sources and the increasing demand resulting from electrification of our societies.
- Discuss the different tools and approaches to deal with the energy transition process

Table of contents

- Technical innovations and methods to decarbonize the energy production sector.
- Integration of a high proportion of renewable energy into the power system.
- Energy usage, with a focus on how to decarbonize the end-use sectors.
- Non-technical innovations.
- Renewable power systems: main challenges, security of supply, reliability, and resilience

Teaching and learning methods

The following teaching and learning methods will be used:

- Video lectures, data sheets, presentations, and discussion of research papers

Prerequisites

None

Assessment methods

Multiple choice questions.
Written assignment with oral presentation.

MC15: Energy management and smart communities

MC title	Energy management and smart communities		
MC long title	-		
ISCED codes	*Primary*: 071	*Complementary*: 031	**ECTS:** 2.5
Suitable for	☒ STEM ☒ NON-STEM		**EQF level:** 7-8

Background of the proposed micro-credential

To facilitate the dissemination of local generation based on variable renewable energy sources and the electrification of our societies, two pillars of the energy transition, the active management of all available resources is critical. Community energy production should preferably be used locally, requiring local management and energy transactions. As resource management facilitates the dissemination of local generation, a deep understanding of existing dynamics between generation and consumption at local level and a thorough knowledge of its optimisation issues are required. Some aggregation at the resource management level enormously benefits the dissemination of variable renewable sources and the local utilization of the local generation. Concepts such as energy communities and microgrids are at stake, and tools such as demand-side management activities will play a critical role. Energy communities will reshape the traditional electricity system, and the active participation of citizens will accelerate the energy transition process.

Overview of the micro-credential

This module aims to increase the participant's awareness of the relevance of local/community energy generation and the usefulness of active management of energy resources. Different forms of aggregation and sharing local generation will be discussed. Participants must acquire in-depth knowledge of community energy production and sharing challenges. The legal framework will be at the debate, and the role of energy communities, nano/microgrids and virtual-power plants in the energy transition process will be discussed.

Learning objectives

On the completion of the micro-credential, participants will be able to:

- able to clearly understand the role of dispersed generation in the energy transition process and the need for active management of different resources (generating units, controllable demand, storage);
- able to understand the concepts and the roles of energy communities, microgrids and virtual power plants in the overall transition process;
- aware of the main objectives, constraints, technical requirements and consumer preferences that are at stake in energy management activities at different aggregation levels: individual consumers, buildings, communities, and cities/regions;
- aware of the main challenges, barriers and drivers for local transactions of energy.

Table of contents

- Introductory concepts about energy conversion: local generation, demand, storage, and flexibility.
- DSM: concept, evolution, barriers and cost-benefit analysis.
- Energy communities, microgrids, and virtual power plants: definition of concepts, legal framework, drivers and challenges.
- Resources management: individual level and aggregate level.
- Local transactions of energy.

Teaching and learning methods

The following teaching and learning methods will be used:

- Video lectures, presentations, and discussion of research papers
- Case studies

Prerequisites

Basics energy concepts

Assessment methods

Multiple choice questions.

MC16: Energy policy

MC title	Energy policy		
MC long title	-		
ISCED codes	*Primary*: 041	*Complementary*: 052, 071, 072	**ECTS:** 2.5
Suitable for	☒ STEM ☒ NON-STEM		**EQF level:** 6-7-8
Background of the proposed micro-credential			
Given the goal of achieving carbon neutrality by 2050 and the current energy crisis plaguing the European Union, defining appropriate energy policies to address current challenges and achieve the established targets is increasingly essential. These policies should address in a concerted manner all economic sectors and parts of society, including for example industry, buildings, and agriculture, as all will play an important role. The aim of this module is to provide an understanding of the development of EU energy policy, namely the climate and RES directives, and the current challenges to meeting the 2050 climate neutrality objective.			
Overview of the micro-credential			
Acquaint students with energy policy and economic concepts, both in analytical and modelling terms. Promote research skills in frontier areas as "economy-business-engineering". Promote awareness of policy and decision-making processes affecting energy management and development in both government and industry, including the economic, policy, regulatory, and institutional drivers that shape management decisions.			
Learning objectives			
On the completion of the micro-credential, participants will be able to: • Understand how energy and climate change policies are designed and implemented. • Understand the importance of regulation. • Understand climate change, ensuring economic development, fighting inequality, managing the rapid transition to renewable energy. • Develop policy analyses and guidelines in a wide range of energy-related areas.			
Table of contents			
• Energy policy and climate governance of the European Union (EU). • Energy value chain economics • structure of energy demand and supply. • Sectoral regulation policies • Electricity market reforms and competition in the electricity industry • Market power, an energy crisis, security of supply, market failures, and externalities • Renewable energy: policy incentives			
Teaching and learning methods			
The following teaching and learning methods will be used: • Video lectures, presentations, and discussion of research papers			
Prerequisites			
Basics of microeconomics			
Assessment methods			
Multiple choice questions.			

MC17: Decarbonisation of thermal energy

MC title	Decarbonisation of thermal energy		
MC long title	Decarbonisation of thermal energy in urban environment		
ISCED codes	*Primary*: 071	*Complementary*: 073	**ECTS:** 2.5
Suitable for	☒ STEM ☐ NON-STEM		**EQF level:** 7-8
Background of the proposed micro-credential			
Space heating, cooling and hot water are essential end-uses contributing to cities' global final energy consumption. This MC will focus on decarbonising these energy demands, mainly through electrification. Learners will understand the relevance of thermal demand for cities and the climate goals that the EU green deal established on this topic. First, we will assess the current state of the existing technology employed in the cities to face the issue. Then, we will explore the alternatives available to decarbonise the thermal demand in urban areas.			
Overview of the micro-credential			
The MC will focus on decarbonising thermal energy demands, mainly through electrification. First, it will provide an overview of the relevance of thermal energy in the cities' carbon footprint. Next, we will highlight this sector's EU Green Deal climate targets. The following topic will assess the existing thermal energy systems for heating, cooling and DHW in European cities. Ultimately, the MC will provide the skills for designing alternative technologies for achieving a carbon-neutral city. These alternatives involve solar collectors for DHW, heat pumps for heating and cooling, biomass boilers and hybrid systems, including storage.			
Learning objectives			
On the completion of the micro-credential, participants will be able to: • understand the relevance and challenges of decarbonising urban thermal demands • size solar DHW installations • size heat pumps installations for residential heating and cooling • size biomass boilers at a residential scale • design basic hybrid systems involving storage			
Table of contents			

• EU Green Deal climate targets for thermal urban decarbonisation
• Existing thermal energy systems for heating, cooling and DHW in cities
• Alternative technologies to decarbonise thermal energy systems in cities:
  ○ Design and sizing of solar DHW installations
  ○ Heat pumps systems for residential heating and cooling
  ○ Design and sizing of geothermal heat pumps
  ○ Biomass boiler for the residential scale
  ○ Hybrid systems, including storage or PV generation			

Teaching and learning methods			
The following teaching and learning methods will be used: • Video lectures, 4 hours, on the relevance of thermal energy needs, EU green deal climate targets and existing thermal energy systems. • Presentations, data sheets, worked exercises, teaching aids, and research papers			
Prerequisites			
Basics notions on mathematics and physics at EQF 5-6			
Assessment methods			
Multiple choice questions.			

MC18: Efficient building techniques

MC title	Efficient building techniques		
MC long title	Efficient building techniques evaluation and bioclimatic design		
ISCED codes	*Primary*: 073	*Complementary*: 071, 072	**ECTS:** 2.5
Suitable for	☒ STEM ☐ NON-STEM		**EQF level:** 6-7

Background of the proposed micro-credential

Buildings contribute to overall energy consumption is quantified at 30-40%, depending on their use and location. Due to its specific characteristics, it is one of the sectors in which the European Community recognises one of the most significant energy savings potentials. The MC tries to impact this issue by presenting the most representative and currently recognised technologies in achieving buildings with minimum energy consumption. It will start by assessing the current thermal performance of buildings and the principles of construction standards. Following, the MC will present the most used methods to evaluate the thermal performance of a building. Finally, we will work on innovative technologies and materials to improve buildings' efficiency.

Overview of the micro-credential

The MC presents the most recognised technologies in achieving buildings with minimum energy consumption. First, we will study the thermal performance of a building and discuss the basic principles of sustainable buildings from a thermal perspective. Following, we will present students with minimum energy consumption standards like Passivhaus. The next phase of the MC will involve ways to measure buildings' thermal performance. Infrared thermography is a powerful method to evaluate thermal isolation. The blower door testing evaluates construction infiltrations. Finally, building modelling and simulation improve technicians' understanding of building energy performance. To conclude the MC, learners will study innovative solutions in building construction. Geothermal energy is a heat pump-based system to heat and cool spaces with high efficiency, and bioclimatic design considers the environmental context to shape the construction.

Learning objectives

On the completion of the micro-credential, participants will be able to:

- understand the basic principles of sustainable buildings from an energy point of view.
- diagnose the thermal performance of a building.
- design buildings with minimum energy consumption.

Table of contents

- Introduction to the thermal performance of buildings
- Basic principles of sustainable building
- Minimum energy consumption standards. Example: Passivhaus
- Infrared thermography applied to building construction.
- Infiltrations and Blower door testing
- Building modelling and simulation
- Geothermal energy and bioclimatic design

Teaching and learning methods

The following teaching and learning methods will be used:

- Video lectures, 6 hours, on the study of the thermal performance of buildings, minimum energy consumption standards, diagnosis of building thermal performance and principles of bioclimatic design.
- Presentations, data sheets, worked exercises, teaching aids, and research papers

Prerequisites

Basics notions on mathematics and physics at EQF 5

Assessment methods

Multiple choice questions.

MC19: Energy communities

MC title	Energy communities		
MC long title	Energy communities: implementation in the urban environment		
ISCED codes	*Primary*: 071	*Complementary*: 031	**ECTS:** 2.5
Suitable for	☒ STEM ☒ NON-STEM		**EQF level:** 6-7

Background of the proposed micro-credential

Local energy communities (LEC) will be an essential cornerstone for the success of the Energy Transition, especially for urban areas where people live in apartment blocks with no access to privative roofs. The European Union (EU) acknowledges in the "Clean Energy for all Europeans" package the need for empowering prosumers to generate, consume, store, and sell electricity back to the grid. Thus, the EU introduces the notion of renewable energy communities (REC). Interest in LECs arises from the various benefits the concept of LEC presents from various perspectives, such as environmental, social, economic and technical. This MC will give learners an understanding of the concept and its regulative implications in the EU. The course will teach how to establish a new LEC and explore ways to upscale them for large-scale urban decarbonisation.

Overview of the micro-credential

This MC aims to give learners a good understanding of the local energy community (LEC) concept, its potential for a systematic change in the energy system and how to implement them. The MC will start by explaining the concept of LEC and its relevance in the urban context. Following this, we will set the European legal framework for LECs, explaining the similarities and differences between the Citizen Energy Communities and the Renewable Energy Communities. From here, we will explore the status of energy communities in the EU and some success stories to highlight the implications for the region and the energy system. Once they have performed this exercise, they will learn how to establish a LEC. Finally, we will discuss the possibilities of upscaling and interconnecting energy communities to decarbonise larger areas of the city.

Learning objectives

On the completion of the micro-credential, participants will be able to:

- understand the concept and implications of local energy communities.
- establish a new local energy community following basic guidelines.
- upscale and interconnect the communities

Table of contents

- Concept and relevance of energy communities
- European legislation: Citizen Energy Communities vs Renewable Energy Communities
- Current status and development of local energy communities (LEC)
- LECs' impact and benefits: technical, economic, environmental and social aspects.
- Main barriers and challenges
- LEC establishing process.
- Upscaling and interconnecting communities to decarbonise cities

Teaching and learning methods

The following teaching and learning methods will be used:

- Video lectures, 4 hours, on the concept and regulation of energy communities, the local energy communities impact, benefits and barriers and the establishing process guidelines.
- Presentations, data sheets, case studies, teaching aids, and research papers

Prerequisites

Basics knowledge of the energy systems.
Fundamental understanding of the energy market.

Assessment methods

Multiple choice questions.

MC20: Positive energy districts

MC title	Positive energy districts		
MC long title	The role of positive energy districts in a fair urban transition		
ISCED codes	*Primary*: 071	*Complementary*: 031, 073	**ECTS:** 2.5
Suitable for	☒ STEM ☐ NON-STEM		**EQF level:** 7-8

Background of the proposed micro-credential

Positive Energy Districts (PEDs) are a new paradigm for the energy transition, with an ambitious timetable for rapid upscaling to match the urgency of tackling climate change and adapting to it. PEDs can cut the urban energy transition into pieces according to the different realities that each area of the city experience. This approach allows decarbonisation to take a bottom-up approach to ensure it is fair and no one is left behind. The MC will explain the role of PEDs in a fair energy transition. Learners will get in contact with different indicators that can help measure the performance of the solutions put in place. Following, they will explore how to implement solutions for decarbonising mobility, efficiency and energy demand in urban districts to achieve a fair transition.

Overview of the micro-credential

Positive Energy Districts (PEDs) approach can cut the urban energy transition into pieces to take a bottom-up approach, ensuring it is fair and no one is left behind. The MC will start with an overview of current urban energy transition trends. Next, the MC will explore the design of fair urban energy transitions employing PEDs. Following, learners will explore the role of PEDs in a fair energy transition. To measure success, we need to use appropriate key performance indicators, and the MC will introduce students to the main proposals in the literature. Urban energy transition must confront the sectors with a greater carbon footprint to achieve a carbon-neutral city. This MC will deepen into the mobility problems in cities, building stock lack of efficiency and the thermal and electrical energy demands decarbonisation.

Learning objectives

On the completion of the micro-credential, participants will be able to:

- understanding the convenience of PEDs for urban energy transitions
- know the key performance indicators used to characterise PEDs
- design actions to tackle the primary sources of GHG emissions in an urban area

Table of contents

- Urban energy transitions: an overview
- Designing a fair urban energy transition
- Positive energy district (PED) as a fair approach
- Key performance indicators to characterise a PED
- Tackling mobility and enhancing efficiency
- Decarbonising energy demand
  - Renewable energy generation
  - District heating and cooling
- Energy communities

Teaching and learning methods

The following teaching and learning methods will be used:

- Video lectures, 4 hours, on the role of PEDs to decarbonise cities, key performance indicators and solutions to reduce carbon emissions.
- Presentations, data sheets, case studies, work exercises, teaching aids, and research papers

Prerequisites

Basics on mathematics and physics at EQF 5-6
Basic knowledge on energy systems

Assessment methods

Multiple choice questions.

MC21: Tools for city decarbonisation

MC title	Tools for cities' decarbonisation		
MC long title	Tools for cities' decarbonisation: from assessing to planning		
ISCED codes	*Primary*: 061	*Complementary*: 031, 052, 071, 073	**ECTS:** 2.5
Suitable for	☒ STEM ☐ NON-STEM		**EQF level:** 7-8

Background of the proposed micro-credential

Decarbonising cities is a complex process that needs broad perspectives and methods. This MC aims to give learners valuable tools to decarbonise any city from a more general scope to a specific result. The MC will teach how to use a multilevel perspective to assess an energy system. More on-the-ground approaches follow this assessment, such as solution concept mapping, stakeholders analysis, results reporting and mapping the results in GIS (such as ArcGIS or QGIS). Thus, we move on to prioritising the solutions using multicriteria decision methods. The solution will probably respond to multiple objectives, and multi-objective optimisation methods will help achieve carbon-neutral cities. Finally, the MC combines all these tools in developing decarbonisation roadmaps.

Overview of the micro-credential

This MC aims to provide students with useful tools to decarbonise any city from a broader perspective to a more focused outcome. We will consider a multilevel perspective to assess sustainable development. For that, we will use concept mapping and stakeholder analysis to evaluate the context of the city. In decarbonisation, it is essential using appropriate performance indicators and reporting to measure success. The MC will introduce students to city mapping software using ArcGIS. This software is helpful to visualise the evolution of indicators across the city. Once students get used to these tools, they will start to make decisions about the decarbonisation process. They will make multicriteria decisions based on AHP and ANP methodologies and optimise actions using multi-objective methodologies. Finally, all the tools converge into the development of decarbonisation roadmaps.

Learning objectives

On the completion of the micro-credential, participants will be able to:

- diagnose the urban energy systems to evaluate their sustainability
- employ tools like concept mapping, stakeholder analysis or city mapping to evaluate sustainable solutions
- select the best way of action through multicriteria decision-making and multi-objective optimisation.
- design a roadmap to decarbonise a city

Table of contents

- Sustainable development from a Multilevel perspective
- Concept and stakeholders mapping
- KPIs and reporting for sustainability
- City mapping software (GIS)
- Multicriteria decision making (AHP & ANP)
- Multi-objective methodology optimisation for sustainable projects
- Roadmap development for carbon-neutral cities

Teaching and learning methods

The following teaching and learning methods will be used:

- Video lectures, 8 hours, on the sustainability diagnosis tools and methodologies to select the best actions.
- Presentations, data sheets, case studies, work exercises, teaching aids, and research papers

Prerequisites

Basics on mathematics and physics at EQF 5
Principles on energy systems.

Assessment methods

Multiple choice questions.

MC22: Fundamentals of energy systems

MC title	Fundamentals of energy systems		
MC long title	Introduction to the energy system: concepts, characteristics and sustainability		
ISCED codes	*Primary*: 071	*Complementary*: 052	**ECTS:** 2.5
Suitable for	☒ STEM ☒ NON-STEM		**EQF level:** 6-7
Background of the proposed micro-credential			
Acquiring a general knowledge on energy resources and technologies is a paramount step towards the development of new skills and competences in the energy sector. This MC will introduce the learner to the main concepts related to energy, from its fundamental concepts to the main characteristics and features of the modern energy sector. We will explore the different energy resources and technologies, while their environmental impacts and sustainability will be discussed in light of recent developments and future perspectives. The MC is also suitable for learners with none or limited technical background, who want to start acquiring new skills in the energy sector.			
Overview of the micro-credential			
This micro-credential is aimed at providing a general understanding of the energy sector, by discussing its definition, boundaries, characteristics and environmental issues. The MC will introduce the learners to several technical concepts related to energy, such as: energy resource, primary and secondary energy, energy vector, energy conservation principle, process efficiency, energy consumption, environmental impact and resource renewability. Then, a general background on energy sources, with a special focus on renewable energies technologies, will be provided. Furthermore, the concept of sustainability, with reference to the UN Sustainable Development Goals (SDGs) and its meaning related to the energy sector, will be introduced.			
Learning objectives			
On the completion of the micro-credential, the learner: • has a clear understanding on the energy sector, its characteristics and features. • can navigate between the different energy source technologies. • understands the difference between non-renewable and renewable energy resources. • knows the concept of sustainability and environmental impact.			
Table of contents			
• Introduction to the concept of energy: definitions, units, conservation principle, efficiency concept. • Primary and secondary forms of energy, energy vectors, energy demand and consumption. • Energy sources and resources: definition, classification and environmental impact • Renewable vs non-renewable energy sources. • Sustainability aspects of the energy sector.			
Teaching and learning methods			
The following teaching and learning methods will be used: • Video lecturer, presentations, data sheets, case studies, work exercises, teaching aids, and research papers			
Prerequisites			
Basics of mathematics and physics at EQF 5.			
Assessment methods			
Multiple choice questions.			

MC23: Introduction to renewable energies

MC title	Introduction to renewable energies		
MC long title	Introduction to renewable energy systems: concepts and technologies		
ISCED codes	*Primary*: 071	*Complementary*: 052, 072	**ECTS:** 2.5
Suitable for	☒ STEM ☒ NON-STEM		**EQF level:** 6-7
Background of the proposed micro-credential			
Knowing the fundamentals of renewable energy sources (RES) is a paramount step towards understanding RES-based technologies and their potential applications. This MC will introduce the learners to the vast world of renewable energy systems, from the main concepts and definitions to the most recent technologies developed and their applications in different sectors. We will explore the different types of RES – from solar and wind energies to geothermal, hydroelectric and biomass technologies – from both theoretical and practical points of view. Specific case studies will be developed and discussed, with particular attention to the integration of RES technologies in urban areas.			
Overview of the micro-credential			
This micro-credential is aimed at providing a general understanding of renewable energy sources by discussing the different technologies and applications. The MC will start by introducing the learners to several basic definitions and concepts of the following RES: solar, wind, geothermal, hydroelectric and biomass. The technologies available, practical applications and design examples will be introduced and discussed for each RES. Special attention will be given to RES integration in urban context aimed at supporting the reduction of fossil-fuel consumptions and the sustainable transition of cities.			
Learning objectives			
On the completion of the micro-credential, the learner: • has a clear understanding of the definition and classification of renewable energy. • knows main features of solar, hydro, wind, geothermal and biomass sources. • can characterise the different RES technologies depending on the application			
Table of contents			
• Introduction to renewable energy sources: definition, classification, features and environmental impact. • Solar energy: characteristics of solar radiation, thermal solar technologies (thermal collectors, concentrated solar collectors), photovoltaic technology, applications. • Wind energy: characterisation of the wind source, wind turbines technology. • Geothermal energy: introduction, geothermal energy direct applications, power system generation, geothermal heat pumps. • Biomass: classification and properties, availability, biomass combustion, gasification, fermentation and anaerobic digestion. • Hydropower: characterisation of the hydro resource, classification, hydro turbines, small hydro.			
Teaching and learning methods			
The following teaching and learning methods will be used: • Video lecturer, presentations, data sheets, case studies, work exercises, teaching aids, and research papers			
Prerequisites			
Basics of mathematics and physics at EQF 5. Micro-credential P39			
Assessment methods			
Multiple choice questions.			

MC24: Urban metabolism strategies

MC title	Urban Metabolism strategies		
MC long title	Building a cleaner future throughout urban metabolism strategy		
ISCED codes	*Primary*: 073	*Complementary*: 052, 072	**ECTS:** 2.5
Suitable for	☒ STEM ☒ NON-STEM		**EQF level:** 6-7

Background of the proposed micro-credential

Urban metabolism and urban mine strategies are considered essential strategies to reduce environmental impact of human activities. This MC will lead the learners to the understanding of the complex meaning of waste and its many aspects, starting from the fundamental waste framework directive (2008/98/EC) and its new release. This is an essential starting point for understanding potential waste recovery strategies, particularly solid and construction and demolition waste at the urban level. We will explore the different approaches to valorise waste by reducing the consumption of raw materials, also by contributing to the reduction of the energy consumption (by considering that already embedded in pre-existing materials) required for their transformation. The MC is also suitable for learners with none or limited technical background, who want to start acquiring new skills in the energy sector

Overview of the micro-credential

The MC will introduce the concept of waste at the European level and the recently introduced changes in the definition of end-of-waste. The European classification of waste and the procedures for obtaining an end-of-waste classification are then presented. Methods for assessing the environmental impacts associated with the generation of construction and demolition waste are provided, followed by a description of the main material and waste streams at the urban scale. Also, a general framework on energy consumption and CO2 emission in production process of buildings materials will be provided. Recurrent urban metabolism and mining strategies are then provided. Students will then be introduced to the various methods of carrying out a pre-demolition audit of an existing building to maximise the value and reuse of existing materials.

Learning objectives

On the completion of the micro-credential, the learner:

- has a clear understanding of solid waste management, particularly construction and demolition waste;
- can choose between building materials and components with recycled content or virgin resources.
- Is able to map the urban settlement, considering buildings as urban mines and distinguishing between different residual materials to be valorised;
- knows the concept of sustainability and environmental impact in relation to the construction sector.

Table of contents

- Introduction to the urban metabolism concept.
- Waste in the construction sector and the process of waste generation at the urban level;
- End of waste valorisation strategies: metabolism and urban mining approaches.
- Environmental impacts of the construction sector: raw materials; energy and water consumption, embodied energy;
- Materials with recycled content and EPD (Environmental Product Declaration) certification
- Minimum environmental criterion in building sector at urban scale.

Teaching and learning methods

The following teaching and learning methods will be used:

- Video lecturer, presentations, data sheets, case studies, work exercises, teaching aids, and research papers

Prerequisites

Basics of mathematics and physics at EQF 5.

Assessment methods

Multiple choice questions.

MC25: Digital payments and smart city platform

MC title	Digital payments and smart city platform		
MC long title	The role of digital payments in a smart city		
ISCED codes	*Primary*: 061	*Complementary*: 041	**ECTS:** 2.5
Suitable for	☒ STEM ☒ NON-STEM		**EQF level:** 6

Background of the proposed micro-credential

The European Union is committed in supporting the development of Smart Cities, where the use of digital solutions makes traditional networks and services more efficient for the benefit of its inhabitants and businesses. Among all aspects involved in the development of smart cities, the transformation of existing payment framework into smart payment plays a pivotal role in establishing innovative financing models and schemes. The inclusion of various digital payment models into the payment ecosystem across a variety of transactions between citizens, businesses and public institutions can act as facilitator for financial inclusions, transparency and new business opportunities across different sectors – such as, energy and water utilities, urban mobility, education, social services, healthcare, communities of citizens, taxes and fees, etc.

Overview of the micro-credential

This micro-credential is aimed at providing a general understanding on digital payment frameworks and their role in smart cities and communities. It will introduce the learner to the most innovative smart payment schemes and services in relation to smart cities and the arising new business and market opportunities. Methods to evaluate the digital payment readiness of a city will be introduced and discussed, together with the most important internal and external challenges faced by smart cities in developing and implementing smart payments. Finally, practical case studies and worldwide best practices will be discussed and analysed. The MC is also suitable for learners with none or limited financial or banking background, who want to acquire new skills and competence on payment schemes and financial services.

Learning objectives

On the completion of the micro-credential, the learner:

- understands the role of smart payment schemes in smart cities
- can identify and select the different payment methods and models.
- knows new market and business opportunities related to smart payments

Table of contents

- Introduction to Smart Cities and Smart Payments
- Strategic vision: the role of digital payments in smart cities
- Digital payments classification and framework
- Worldwide best practices: an overview of experiences from different countries

Teaching and learning methods

The following teaching and learning methods will be used:

- Video lecturer, presentations, data sheets, case studies, work exercises, teaching aids, and research papers

Prerequisites

None

Assessment methods

Multiple choice questions.

MC26: Understanding critical raw materials

MC title	Introduction to life-cycle analysis of raw materials		
MC long title	-		
ISCED codes	*Primary*: 072	*Complementary*: 052	**ECTS:** 2.5
Suitable for	☒ STEM ☒ NON-STEM		**EQF level:** 6
Background of the proposed micro-credential			
Acquiring a general knowledge of the importance of Critical Raw Materials is of paramount importance in understanding what is the impact of material supply in the manufacture of high-tech products. This MC will introduce the importance of CRMs in Europe, the purpose of the CRMs list and what are the main challenges related to this topic. We will present the role of CRMs in the manufacturing processes and the strategies used by the EU to address the raw materials challenges. The MC is suitable for learners with none or limited technical background, who want to start acquiring new skills in the materials science and technology.			
Overview of the micro-credential			
This MC is an introductory guide to the Critical Raw Materials (CRMs) list created by the European Community. The list contains a group of raw materials, mostly minerals, that are strategic to the EU economy and are at risk of not being adequately supplied. The MC outlines the motivations of the EU's CRMs list and methodology used to set the list and it will introduce the learners to the main CRMs groups in the EU economy, with a general description of their chemo-physical properties. Then, a general background on the application of CRMs in industrial application, with a special focus on renewable energies technologies, will be provided. Finally some case studies about the importance of CRMs in the manufacture of high-tech products will be presented.			
Learning objectives			
On the completion of the micro-credential, the learner: • has a clear understanding on the definition and role of CRMs; • is able to browse EU documents about CRMs; • understands the challenge of CRMs in Europe; • knows the main applications of CRMs.			
Table of contents			
• Introduction to CRMs: definitions and role of CRMs in EU. • Purpose of the list of CRMs: main materials group and classifications. • Chemo-physical features of the main classes of CRMs. • Case studies of CRMs applications with a focus on energy-related applications.			
Teaching and learning methods			
The following teaching and learning methods will be used: • Video lecturer, presentations, data sheets, case studies, work exercises, teaching aids, and research papers			
Prerequisites			
Basics on mathematics, physics and general chemistry at EQF 5.			
Assessment methods			
Multiple choice questions.			

MC27: How sustainable is your city?

MC title	How sustainable is your city?		
MC long title	-		
ISCED codes	*Primary*: 052	*Complementary*: 031, 072, 073	**ECTS:** 2.5
Suitable for	☐ STEM ☒ NON-STEM		**EQF level:** 6
Background of the proposed micro-credential			
Setting decarbonization targets is a crucial step taken by many cities to combat climate change and transition towards a sustainable future. These targets, often politically driven, signify a city's commitment to achieving carbon neutrality, usually by a specific year like 2040. However, the successful realization of these ambitions depends on the technical aspects of implementation and progress monitoring. The transformation towards a carbon-neutral city requires practical solutions backed by scientific analysis. City authorities need to employ a range of analysis tools to assess their current carbon emissions, identify major sources, and formulate effective strategies for reduction. These might include transitioning to renewable energy sources, improving public transportation, promoting energy-efficient buildings, and adopting circular economy practices.			
Overview of the micro-credential			
This MC aims to teach how cities can assess their decarbonisation target using sustainability indicators. The students will be taught the background for using indicators and be given an indicators framework with which they can compare how energy sustainable “their” city is compared to a perfect city. In particular, students will first learn the definition of sustainability, sustainable development goals and use of indicators. First, the students will be introduced to different indicators frameworks and, then a pre-selected framework will be provided to compare progress of sustainability of a case study city compared to a perfect city. They will learn tools and methods to understand how indicators become measurable.			
Learning objectives			
On the completion of the micro-credential, the learner: • Understand sustainable development goals • Understand how to assess cities • Understand how to apply an indicator framework on a specific city case.			
Table of contents			
• Introduction to sustainable development goals • Introduction on the development of indicators and their use. • Apply specific indicators framework on a specific city case and compare with a perfect city.			
Teaching and learning methods			
The following teaching and learning methods will be used: • Video lecturer, presentations, data sheets, case studies, teaching aids, and reading materials			
Prerequisites			
Basics on mathematics of the concept of sustainable development			
Assessment methods			
Multiple choice questions. Assignments.			

MC28: Sustainable development goals for cities

MC title	Sustainable development goals for cities		
MC long title	-		
ISCED codes	*Primary*: 052	*Complementary*: 031, 072, 073	**ECTS:** 2.5
Suitable for	☐ STEM ☒ NON-STEM		**EQF level:** 6
Background of the proposed micro-credential			
The United Nations' 17 Sustainable Development Goals (SDGs) serve as a comprehensive roadmap for global development, aiming to address various social, economic, and environmental challenges by 2030. Climate change and decarbonization play a crucial role in several of these goals, highlighting their integrative significance in achieving a sustainable future. The interconnection between the SDGs underscores the importance of a holistic and collaborative approach to sustainability, where addressing climate change and promoting decarbonization are integral components in achieving a prosperous and resilient future for all.			
Overview of the micro-credential			
This MC aims to teach sustainability and in particular decarbonisation using SDGs. First, students will learn the definition of sustainability, the background of the SDGs and different ways of assessing for performance towards SDG targets. Tools and methods to make indicators measurable will be introduced and discussed, and practical case studies will be provided. Students will then have the opportunity to apply the acquired knowledge and competence on a specific case study.			
Learning objectives			
On the completion of the micro-credential, the learner: • Understand the multidisciplinary nature of the sustainable development goals. • Understand how to assess SDGs with measurable indicators. • Understand how to apply SDGs on a specific city case.			
Table of contents			
• Introduction to sustainable development goals • Development of indicators to assess targets. • Case study definition. • Apply specific SDGs on a specific city case.			
Teaching and learning methods			
The following teaching and learning methods will be used: • Video lecturer, presentations, data sheets, case studies, teaching aids, and reading materials			
Prerequisites			
Basics on mathematics of the concept of sustainable development			
Assessment methods			
Multiple choice questions. Assignments.			

MC29: Introduction to industrial organisation

MC title	Introduction to Industrial Organisation		
MC long title	-		
ISCED codes	*Primary*: 041	*Complementary*: -	**ECTS:** 2.5
Suitable for	☐ STEM ☒ NON-STEM		**EQF level:** 6
Background of the proposed micro-credential			
The interactions between energy technology, industry structure, and government regulations are reshaping the energy industry and significantly affecting the emission reduction effort. Understanding the changes in energy industries needs the tools from industrial organization, which provides the theoretical foundations for producers and consumers' behavior under different market structures, e.g., wholesale electricity markets as high-frequency auctions, vehicle markets as price competition in oligopoly markets, and energy distribution firms as regulated natural monopolies. Therefore, it is important to illustrate how ideas and tools from industrial organization can be used to create insights into the understanding of energy industries and regulatory policies.			
Overview of the micro-credential			
This MC presents the theoretical foundations of industrial organization, together with applications in energy industry. It focuses on how markets work, how firms compete, and how government regulates. Importantly, this MC helps students to analyze and interpret firms' strategies and government's regulations from a strategic point of view, based on game theory. It covers the topics such as market structure, market power, market conduct, price discrimination, price competition, and government regulations.			
Learning objectives			
On the completion of the micro-credential, the learner: • Understand the concepts in measuring market structure and market power • Understand the fundamental concepts related to monopoly • Explain firms' behaviours and strategies in oligopoly markets • Analyse how government regulations could affect the market outcomes			
Table of contents			
• Game theory basics • Market structure and market power • Price discrimination and monopoly • Oligopoly markets and firm competition			
Teaching and learning methods			
The following teaching and learning methods will be used: • Video lecturer, presentations, data sheets, case studies, teaching aids, and reading materials			
Prerequisites			
Basics knowledge on microeconomics Basic knowledge on energy markets			
Assessment methods			
Multiple choice questions. Assignments.			

MC30: Urban renewable energy: decision-making methodologies

MC title	Urban renewable energy: decision-making methodologies		
MC long title	-		
ISCED codes	*Primary*: 041	*Complementary*: 031, 071	**ECTS:** 2.5
Suitable for	☐ STEM ☒ NON-STEM		**EQF level:** 7-8

Background of the proposed micro-credential

As cities around the world continue to grow and become more populous, the need for sustainable and clean sources of energy is becoming increasingly important. One way that cities are addressing this need is by incorporating renewable energy technologies into their infrastructure. The adoption of renewable energy technologies in urban environments is not without challenges and requires effective decision-making processes to ensure that these technologies are integrated into urban infrastructure in a way that maximizes their benefits and minimizes their drawbacks.

Overview of the micro-credential

This MC aims to provide students with a comprehensive understanding of decision-making methodologies for the adoption of renewable energy technologies in urban contexts. The MC will cover a range of topics, including an overview of different decision-making technologies and methodologies, the identification of key decision variables and quantifiable factors, and an exploration of strategies for effectively integrating renewable energy technologies into urban infrastructure. Through a combination of lectures, discussions, case studies, and hands-on exercises, students will develop the skills and knowledge needed to make informed decisions about renewable energy technologies in urban environments. By the end of the MC, students will be able to analyse and evaluate the technical, social, environmental, and financial implications of using renewable energy technologies in cities, and to develop effective strategies for their implementation.

Learning objectives

On the completion of the micro-credential, the learner:

- Understand the principles and key concepts of decision-making methodologies for the adoption of renewable energy technologies in urban contexts.
- Identify the key decision variables and quantifiable factors involved in the adoption of renewable energy technologies in urban environments.
- Develop the skills and knowledge needed to analyse and evaluate the technical, social, environmental, and financial implications of using renewable energy technologies in cities.
- Understand strategies for effectively integrating renewable energy technologies into the infrastructure of urban areas, and for involving key stakeholders and decision makers in the process

Table of contents

- Analysis of different decision-making technologies and methodologies.
- Identification of key decision variables and quantifiable factors.
- Challenges and opportunities associated with implementing renewable energy technologies in cities.
- Exploration of strategies for integrating renewable energy technologies into urban infrastructure.
- Case studies of successful implementations of renewable energy technologies in urban environments

Teaching and learning methods

The following teaching and learning methods will be used:

- Video lecturer, presentations, data sheets, case studies, teaching aids, and reading materials

Prerequisites

Basics knowledge on energy production and consumption
Familiarity with renewable energy technologies
Basics on urban planning and development

Assessment methods

Multiple choice questions.

MC31: Energy justice and poverty

MC title	Energy justice and poverty		
MC long title	-		
ISCED codes	*Primary*: 031	*Complementary*: 041, 071	**ECTS:** 2.5
Suitable for	☐ STEM ☒ NON-STEM		**EQF level:** 6

Background of the proposed micro-credential

Economy, environment, society and technologies represent the main pillars of a sustainable development. While assessments and tools for measuring the impact on the technology, economy and environment dimensions are relatively well established, the social dimension remains in a developmental stage, lacking quantifiable variables and robust assessment tools. Therefore, there is a critical need to explore and strengthen the social dimension of sustainability, with a particular focus on areas like energy justice and poverty. Addressing energy justice is essential as it ensures that vulnerable and marginalized populations are not disproportionately burdened by the transition to sustainable energy sources. Furthermore, poverty alleviation is intricately linked to sustainability, as socio-economic well-being is a fundamental aspect of human development. Sustainable policies should address poverty and income inequality, creating opportunities for upward mobility and enhancing the overall quality of life.

Overview of the micro-credential

This MC aims to assess the social dimension of sustainability by specifically focusing on the poverty and justice issues of policy and technology implementations. Learners will first leaner the definition of energy poverty in different countries. There are many definitions, and there is no consensus on one single definition. The measures of energy poverty will be an additional topic to be covered. Linked to energy poverty, the MC will cover procedural, distributional, and recognition justice. The importance of these two main concepts on policy development and technology uptake will also be covered.

Learning objectives

On the completion of the micro-credential, the learner:

- Understand the concept of the energy poverty
- Understand the energy poverty measurements
- Understand the energy justice concept
    - Procedural Justice
    - Distributional Justice
    - Recognition Justice
- Understand the policy development by using energy poverty and justice concepts.

Table of contents

- Definition of energy poverty
- How energy poverty is measured
- The different implementations of the energy poverty policies in Europe
- Definition and pillars of Energy Justice
- Energy policy and social issues

Teaching and learning methods

The following teaching and learning methods will be used:

- Video lecturer, presentations, data sheets, case studies, teaching aids, and reading materials

Prerequisites

Basics understanding on sustainable development and climate change.
Basic knowledge of energy policy.

Assessment methods

Multiple choice questions.

MC32: Social acceptance of technologies

MC title	Social acceptance of technologies		
MC long title	-		
ISCED codes	*Primary*: 031	*Complementary*: 041	**ECTS:** 2.5
Suitable for	☐ STEM ☒ NON-STEM		**EQF level:** 6
Background of the proposed micro-credential			
The social dimension of sustainability is a vital aspect that requires deeper exploration, with one crucial element being the social implications of implementing sustainable technologies. Understanding the barriers and concerns faced by consumers, investors, and policymakers is crucial for successful and inclusive technological diffusion. Engaging with the public allows for a comprehensive understanding of societal needs and values, ensuring that technological solutions align with the preferences and aspirations of the communities they will impact. It helps identify potential challenges and ensures that the technology is accessible and beneficial to all segments of society, including marginalized and vulnerable populations. Therefore, incorporating public engagement as a fundamental step in sustainable technological implementation is imperative for addressing social concerns and ensuring that technological advancements align with the broader vision of a sustainable and equitable future.			
Overview of the micro-credential			
This module aims to assess the social dimension of sustainability by specifically focusing on the social acceptance of technology by society. Learners will first learn the definition of social acceptance and its importance for technology implementation and policy development. Then, the three-pillar approach to social acceptance will be covered: socioeconomic acceptance, market acceptance and community acceptance. A framework for quantifying social acceptance will also be presented. Quantified social acceptance will help decision-makers in a data-driven decision process.			
Learning objectives			
On the completion of the micro-credential, the learner: • Understand the concept of social acceptance • Understand the methods of public engagement for technology • Understand the importance of social acceptance in decision making			
Table of contents			
• Definition of social acceptance • How social acceptance is measured • How barriers to technology implementation are determined • The framework for social acceptance determination • Energy policy and social acceptance			
Teaching and learning methods			
The following teaching and learning methods will be used: • Video lecturer, presentations, data sheets, case studies, teaching aids, and reading materials			
Prerequisites			
Basic knowledge on sustainable transition and energy policies			
Assessment methods			
Multiple choice questions. Assignments			

MC33: Hydrogen technology for urban areas

MC title	Hydrogen technologies for urban areas		
MC long title	-		
ISCED codes	*Primary*: 072	*Complementary*: 041, 071	**ECTS:** 2.5
Suitable for	☒ STEM ☒ NON-STEM		**EQF level:** 6

Background of the proposed micro-credential

The momentum behind hydrogen is currently unprecedented, with governments and companies worldwide initiating numerous policies, projects, and plans. Hydrogen is being presented as a promising solution to expedite the transition away from fossil fuels for heating and cooling in urban areas. This versatile element has the potential (i) to foster the integration of more renewables, bolstering storage and maximising renewable energy potential, (ii) to be combined with carbon capture and storage (CCS), (iii) to decarbonise hard-to-abate sectors and (iv) to enhance energy security by diversifying the energy mix. However, challenges persist. Costs must decrease, infrastructure development is crucial, and cleaner hydrogen production methods are needed. Additionally, regulatory barriers hinder progress, and experts debate the uncertainties and risks of potential lock-in effects.

Overview of the micro-credential

This MC tries to raise the following questions: Are we in a golden age of hydrogen? Is hydrogen efficient? Is hydrogen cost-competitive? What infrastructure for the use of hydrogen in the cities? Is the use of hydrogen rather easy or disruptive for citizens? When will the hydrogen and fuel cell technologies be ready to provide clean transportation and heat cities? Learners will navigate among the different hydrogen technologies and application to understand their main features, challenges and opportunities.

Learning objectives

On the completion of the micro-credential, the learner will:

- acquire knowledge and competences to evaluate current and future challenges concerning development, deployment and implementation of CO2 free H2 value chain.
- be able to identify opportunities to solve problems of H2 supply chain needed to reach climate goals.
- understand the H2 trading and delivery systems.

Table of contents

- Introduction to hydrogen technologies and value chains:
- Hydrogen production, transportation and storage.
- Hydrogen application per sector.
- New strategies for the development of new H2 technologies.
- Clean H2 economy, safety and regulations.

Teaching and learning methods

The following teaching and learning methods will be used:

- Video lecturer, presentations, data sheets, case studies, and reading materials

Prerequisites

None

Assessment methods

Multiple choice questions.
Quantitative exercises.

MC34: Decision-making for energy projects under uncertainty

MC title	Decision making for energy projects under uncertainty		
MC long title	-		
ISCED codes	*Primary*: 041	*Complementary*: 061	**ECTS:** 2.5
Suitable for	☒ STEM ☒ NON-STEM		**EQF level:** 6-7-8
Background of the proposed micro-credential			
Dynamic optimization and real options theory are essential concepts in economics and finance. Dynamic optimization involves making decisions over time, considering the dynamic nature of economic systems. It helps address complex problems with significant future implications. Real options theory extends financial options to real-world investment decisions, allowing for flexibility and risk management in uncertain environments. The energy sector is intrinsically dynamic, since it is influenced by policy, regulations, and technological advancements, making dynamic optimization and real options invaluable in decision-making. They inform resource allocation, investment strategies, and risk mitigation, contributing to sustainable and adaptive solutions.			
Overview of the micro-credential			
This MC aims to introduce participants to theoretical aspects of dynamic optimization and considers implications of real options theory to decision-making process. Applications will focus on problems in energy and environmental economics. Policy and regulation uncertainty and their impact on the investment decision and behavior of investors will also be examined. Learners will be trained on classical investment analysis approach (e.g., NPV) and will learn how to model a decision-making process related to energy investments under uncertainty. Tools and methods to identify the optimal time to invest and the option value will be provided, together with practical examples solved in common software (e.g., Excel and Matlab).			
Learning objectives			
On the completion of the micro-credential, the learner will: • acquire skills on modelling in energy economics. • be able to model a decision-making process related to energy investments under uncertainty • be able to compare different investment strategies in uncertain context to choose the optimal one • apply conceptual and analytical economic models to real life problems			
Table of contents			
• Introduction on economist's toolbox for investment decisions • Limits of traditional approaches under uncertainty • Fundamentals on market uncertainty and assessment methods • Usefulness and limits of a real options approach • Optimal investment timing and option value • Strategic options in real investments: examples from energy and environmental field			
Teaching and learning methods			
The following teaching and learning methods will be used: • Video lecturer, presentations, data sheets and data colelction, case studies, and reading materials			
Prerequisites			
Interest in energy economics, energy technology. Basics of mathematics and numerical models			
Assessment methods			
Multiple choice questions. Exercises and tests.			

MC35: Strategic behaviour in energy markets – options and games.

MC title	Strategic behaviour in energy markets: option and games		
MC long title	-		
ISCED codes	*Primary*: 061	*Complementary*: 041	**ECTS:** 2.5
Suitable for	☐ STEM ☒ NON-STEM		**EQF level:** 7-8

Background of the proposed micro-credential

Since the 1990s, feed-in tariffs have been one of the most widely applied energy policies to stimulate renewable energy. Nevertheless, feed-in tariff schemes have been victims of their own success and have been criticized for leading to unreasonable and uncontrollable costs. Auctions have been proposed as an alternative to feed-in tariffs and are becoming an increasingly popular energy policy to promote renewable energy. The aim of auctions is to create more competition to reduce production costs. Thus, by fixing in advance the volume of energy that will be put up for auction, the public budget made available can be controlled in advance, which is not the case with an open window in the case of a feed-in tariff. In this context, various economics tools allow to assess the effect on investor's decision of an increased competition under market uncertainties.

Overview of the micro-credential

This MC lies at the crossroads of economics and operational research, with primary objectives focused on various aspects of market design for auctions across different European countries and technologies, such as green hydrogen and biogas. The course aims to establish a benchmark for these designs, outlining key elements and associated economic modeling frameworks. Participants will gain insights into the results and limitations of different auction frameworks, particularly in the context of renewable electricity. Additionally, the MC will delve into the utilization of option games modeling to explore strategies and uncertain payoff functions within diverse market models, including duopolies, oligopolies, and two-sided platforms. By examining these topics, attendees will develop a comprehensive understanding of auction mechanisms and their implications, enabling them to make informed decisions and devise strategies in complex and dynamic economic environments.

Learning objectives

On the completion of the micro-credential, the learner will:

- acquire skills in using energy economics toolbox and decision-making criteria.
- be able to valuate energy projects under competition, strategic behavior, and price uncertainty.
- develop critical thinking of complex market strategies with an option-games approach.

Table of contents

- Introduction on general auction theory of market design
- Market models for strategic interactions between economic agents.
- Game theory description and real options approach
- Real case study examples on a small energy project

Teaching and learning methods

The following teaching and learning methods will be used:

- Video lecturer, presentations, data collection and analysis, numerical case studies and reading materials

Prerequisites

Interest in energy economics, energy technology.
Basics of mathematics and numerical models

Assessment methods

Multiple choice questions.
Exercises and tests.

MC36: Energy policy and flexible technologies

MC title	Energy policy and flexible technologies		
MC long title	-		
ISCED codes	*Primary*: 041	*Complementary*: 061	**ECTS:** 2.5
Suitable for	☒ STEM ☒ NON-STEM		**EQF level:** 7-8
Background of the proposed micro-credential			
The increasing adoption of flexible technologies, such as electric vehicles, energy storage systems, and decentralized renewable energy sources, presents unique challenges and opportunities for the distribution network infrastructure. To effectively deploy these technologies, new investments or the modernization of existing networks become essential. Furthermore, understanding the economic implications of flexible technology integration is vital for policymakers, investors, and industry players seeking to build a sustainable, adaptive, and efficient energy landscape for the future.			
Overview of the micro-credential			
This MC aims to address the economy of flexible technology integration. Flexible technology like electric vehicle, storage and decentralized renewable energy need a specific distribution network to be deployed by new investments or modernizing existing networks. The MC drives students in understanding how to assess the theoretical business model for coordinating investments in network and flexible technologies. It includes elements related to: (i) distribution network investments, (ii) economy of flexible technologies, (iii) business models of flexible technologies, (iv) investment coordination strategies.			
Learning objectives			
On the completion of the micro-credential, the learner will: • acquire knowledge on flexible technologies. • understand business models for flexible technologies. • be able to identify strategies to coordinate investments in network and flexible technologies.			
Table of contents			
• Introduction on long-term distribution network investments. • Definition of flexible technologies. • Economic dimension of flexible technology. • Strategies to support the coordination of investments.			
Teaching and learning methods			
The following teaching and learning methods will be used: • Video lecturer, presentations, data collection and analysis, numerical case studies and reading materials			
Prerequisites			
Interest in energy economics and energy technology. Basics on business models in the electricity sector.			
Assessment methods			
Multiple choice questions. Exercises and tests.			

MC37: Renewable energy investments

MC title	Renewable energy investments		
MC long title	Renewable energy investments and electricity markets.		
ISCED codes	*Primary*: 041	*Complementary*: 071	**ECTS:** 2.5
Suitable for	☒ STEM ☒ NON-STEM		**EQF level:** 6-7
Background of the proposed micro-credential			
Renewable energy investment has emerged as a critical driver in the global transition towards a sustainable and low-carbon future. Renewable energy investment involves financing projects that harness natural resources such as solar, wind, hydro, geothermal, and biomass to generate clean electricity. These investments play a pivotal role in accelerating the deployment and advancement of renewable technologies, fostering energy security, and creating economic opportunities. The attractiveness of renewable energy investment lies not only in its environmental benefits but also in the declining costs and technological advancements, making it increasingly competitive with traditional fossil fuel-based energy sources.			
Overview of the micro-credential			
This MC aims to give an overview on the main challenges and barriers to investments in renewable generation. It describes the theory and the practices regarding EU electricity markets design and how they deal with renewable market integration in line with network access and use practices specific to renewable. It covers topics such as: electricity market design, renewable energy tariffs and prices, renewable network access and utilization, challenges and opportunities for renewable energy investments.			
Learning objectives			
On the completion of the micro-credential, the learner will: • acquire knowledge on renewable energy market. • understand incentive tools and strategies for renewable investments. • be able to navigate the different energy investment strategies.			
Table of contents			
• Introduction on electricity market design and operation. • Renewable long-term investment strategies. • Coordination policies for renewable investments. • EU best practices			
Teaching and learning methods			
The following teaching and learning methods will be used: • Video lecturer, presentations, data collection and analysis, numerical case studies and reading materials			
Prerequisites			
Interest in energy economics and renewable energy technology. Basics on electricity markets			
Assessment methods			
Multiple choice questions. Exercises and tests.			

MC38: Economics and physics of energy storage

MC title	Economic and physics of energy storage		
MC long title	-		
ISCED codes	*Primary*: 071	*Complementary*: 041, 072	**ECTS:** 2.5
Suitable for	☒ STEM ☐ NON-STEM		**EQF level:** 7-8

Background of the proposed micro-credential

Electricity mixes with high shares of Variable Renewable Energies (VRE) require the combination of flexibility options. Urban areas being dense and diverse in energy consumers are expected to contribute to these flexibilities, with the opportunity to warm and store domestic hot water and more generally store heat (maybe in heat networks) and load electric cars at the most critical times to help the grid operators and maximise the use of available renewable energies. The frequency of use of storages and then its economic model depends on technical design options such as peak power, energy stored and efficiencies but also on the actual variability of demand combined with the one of supply that can be rich in VRE and/or rich in flexible generations.

Overview of the micro-credential

The aim of this MC is to link the different time and space scales and to link technical and economic aspects of the design of storages. Storages of electricity or heat are usually seen as a bridge between the time of consumption and the one of production, in energy mixes with high shares of Variable Renewable Energies (VRE). With the development of Heat-pumps and electric cars, storages are also bridges between energy uses. In fact, they are also a bridge between different space-scales as dense urban areas are well connect to regional and continental grids. Those grids are not only used as backups, but they also allow for excessive local production to be used elsewhere and reciprocally the local uses or storages may be able to contribute to the need of flexibility of the larger scales. The participants will use on-line notebooks of growing complexities to model small energy systems, link the technical and economic aspects of energy storages, link energy usages, and connect time and space scales.

Learning objectives

On the completion of the micro-credential, the learner will be able to:

- Design local energy storage systems as a function of available Variable Renewable Energies
- Adjust the design of local storages as a function of flexibility needs of different space scales, eg. building and national grids.
- Link technical aspects with economic model of storages.

Table of contents

Simple local energy models of growing complexities will be used:

- One simple local model with 2 or 3 sources to discuss the need for storage at different timescales.
- Addition of flexible electricity uses: heat storage and smart charging of Electric Vehicle (G2V) and optional Vehicle to Grid (V2G).
- One model with 2 simple, energy systems to connect local storages with regional grids and markets to introduce the economic questions.

Teaching and learning methods

The following teaching and learning methods will be used:

- Online videos with self-tests will be used to drive the students in the definitions.
- Reading materials, numerical models and tools.

Prerequisites

Basic knowledge of mathematics and physic at EQF 6.
Basic programming skills are required.

Assessment methods

Multiple choice questions.

MC39: Biogas systems for climate transition

MC title	Biogas systems for climate transition		
MC long title	Biogas production and use for sustainable cities		
ISCED codes	*Primary*: 072	*Complementary*: 052, 071	**ECTS:** 2.5
Suitable for	☒ STEM ☐ NON-STEM		**EQF level:** 6

Background of the proposed micro-credential

Biogas systems offer cities numerous benefits, transforming urban landscapes sustainably. By utilizing household waste, sewage sludge, and industrial organic waste, cities can manage organic waste effectively, reducing landfill usage and pollution. These systems promote circular economies, enhancing energy self-sufficiency and resilience. Biogas contributes to combating climate change by curbing greenhouse gas emissions and serves as a renewable transportation fuel, reducing air pollution. Furthermore, the implementation of biogas infrastructure generates employment opportunities, bolstering the local economy. By embracing biogas technology, cities can lead the way in green innovation and environmental stewardship, ensuring a brighter and more sustainable future.

Overview of the micro-credential

This MC provides a thorough introduction to the fascinating microbiological processes that facilitate oxygen-free digestion and its role in biogas production. Exploring the impact of various substrates and parameters on biogas generation, students gain a profound understanding of optimizing the process. The course delves into different digestion systems and processes, allowing students to comprehend their unique applications and advantages. As the course progresses, students are exposed to diverse application options for biogas and digestion residues, uncovering the versatility of this renewable resource. A pivotal aspect of the curriculum lies in the in-depth analysis of the environmental and economic benefits associated with biogas systems. By the end of this course, learners are equipped with the knowledge and skills to contribute meaningfully to the sustainable energy landscape, addressing environmental concerns while recognizing the economic viability of biogas systems.

Learning objectives

On the completion of the micro-credential, the learner will be able to:

- describe different types of oxygen-free digestion systems and those most common constituent components in these, as well as being able to describe the most likely applications for these technologies.
- understand the most important environmental issues related to the digestion process, biogas and residue, as well as being able to clarify the meaning of these in relation to environmental protection issues.
- explain the different areas of use for biogas. From given conditions be able to justify which areas of use bring the greatest profit with a perspective on sustainable development.
- evaluate how biogas technology can contribute to a long-term Sustainable Development

Table of contents

- Simple local energy models of growing complexities will be used:
- Microbiology of anaerobic digestion and substrates for biogas production
- Classification of digestion systems
- Use of biogas in society, environmental benefits and biogas for climate transition
- Sustainability of the biogas system

Teaching and learning methods

The course is delivered as a distance course where the student works independently and computer-based; reads texts, writes essays, answers multiple choice questions and perform simpler calculations. The student will also have access to video lectures and other teaching materials.

Prerequisites

None

Assessment methods

Multiple choice questions.

MC40: Circular economy for sustainable cities

MC title	Circular economy for sustainable cities		
MC long title	Circular economy: from household waste to material recycling		
ISCED codes	*Primary*: 052	*Complementary*: 072	**ECTS:** 2.5
Suitable for	☒ STEM ☒ NON-STEM		**EQF level:** 6

Background of the proposed micro-credential

The circular economy is an imperative for fostering sustainability in societies and companies. Sustainable cities benefit immensely from circular systems, spanning household waste management, material recycling, waste-water treatment, and renewable energy. Embracing circularity enhances resource efficiency, reduces waste, and promotes environmental well-being. Efficient household waste handling, through recycling and composting, minimizes landfill impact while channelling resources back into the economy. Circular waste-water treatment allows for valuable nutrient and energy recovery, ensuring water conservation. Circular energy systems, utilizing renewables like solar and wind power, reduce reliance on finite resources and combat climate change. By implementing circular practices, cities can create greener, more resilient urban environments, forging a path towards a sustainable and prosperous future.

Overview of the micro-credential

This MC offers students a comprehensive understanding of the significance of transitioning towards a circular economy to address pressing sustainability challenges. Exploring the principles of environmental economics and various policy instruments, learners gain insights into the critical issues surrounding sustainability. Emphasizing the interconnectivity of circular approaches in both private and public spheres, the course illuminates the far-reaching impact of circularity on diverse sectors. By delving into the design and effectiveness of policies and instruments supporting this transition, students grasp how circularity can drive sustainable practices. Through this course, participants will be equipped with knowledge and tools to contribute to shaping a more sustainable and resilient future, both at individual and systemic levels.

Learning objectives

On the completion of the micro-credential, the learner will be able to:

- identify and describe basic linear and circular economic concepts at the micro, meso and macro level as well as account for which control instruments are used for a sustainable economy.
- develop a deeper understanding of dynamics and complexity in the interaction between circularity and economic development.
- critically review academic research and argue for different forms of explanations about industrial change and company actions with particular focus on resource efficiency.
- analyze and discuss relevant policies and instruments for the circular economy.

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- Circular versus linear economy, waste handling
- Recycling of materials and water
- Tools for circular economy assessments
- Environmental benefits with circular economy and sustainability
- Business models to support circularity.

Teaching and learning methods

The course is delivered as a distance course where the student works independently and computer-based; reads texts, writes essays, answers multiple choice questions and perform simpler calculations. The student will also have access to video lectures and other teaching materials.

Prerequisites

None

Assessment methods

Multiple choice questions.

MC41: Management of innovation projects

MC title	Management of innovation projects		
MC long title	-		
ISCED codes	*Primary*: 041	*Complementary*: 031, 072	**ECTS:** 2.5
Suitable for	☒ STEM ☒ NON-STEM		**EQF level:** 6

Background of the proposed micro-credential

The transition towards sustainable energy solutions has amplified the significance of project management skills tailored to renewable energy systems. As societies worldwide strive to reduce their carbon footprint and embrace cleaner alternatives, renewable energy projects have become instrumental in achieving these environmental objectives. From solar and wind power installations to bioenergy and geothermal initiatives, these projects encompass a diverse range of technologies. Effectively managing innovation projects in the renewable energy sector requires a unique blend of technical expertise and proficient project management methodologies. Precise planning, optimal resource allocation, risk assessment, and collaboration with stakeholders are vital for successful project execution. Additionally, staying up to date with the latest renewable energy technologies and industry advancements is crucial for making informed decisions and driving project success.

Overview of the micro-credential

This MC delves into innovation from a project management standpoint, with a specific focus on three critical areas: new product development projects, projects for internal process change, and multiproject environments. These domains share a common characteristic: high uncertainty and a multitude of influencing factors, involving interdependent stakeholders. Through this course, students will gain valuable insights into handling the complexities and challenges associated with innovative projects. They will learn effective planning techniques, risk management strategies, and stakeholder engagement approaches tailored to each area. The curriculum will equip learners with the necessary skills to navigate the intricate web of dependencies and uncertainties, ensuring successful outcomes in diverse innovation contexts.

Learning objectives

On the completion of the micro-credential, the learner will:

- possess an in-depth understanding of change projects in internal processes.
- know the management procedures for multi-project environments.
- be able to handle new product development projects, how to lead them during their typical life cycle.

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- Project management principles: organization, planning, tools and technologies, implementation process, stakeholders and communication and risk management of innovation projects.
- New product development project: history, agile and iterative methods and lifecycle analysis, process management.
- Internal innovation strategies for new processes and new business models.
- Organizational structures and processes, management roles and responsibilities in multi-project environments.

Teaching and learning methods

The course is delivered as a distance course where the student works independently and computer-based; reads texts, writes essays, answers multiple choice questions and perform simpler calculations. The student will also have access to video lectures and other teaching materials.

Prerequisites

Basics on engineering and/or business

Assessment methods

Multiple choice questions.

MC42: Small scale wind turbines

MC title	Small scale wind turbines		
MC long title	-		
ISCED codes	*Primary*: 071	*Complementary*: 052	**ECTS:** 2.5
Suitable for	☒ STEM ☐ NON-STEM		**EQF level:** 6-7

Background of the proposed micro-credential

In the future electric grid, customers can earn extra income by agreeing to intermittent disconnections. Small-scale wind power serves as a valuable complement, especially in urban areas or buildings designed for islanding operation. Combined with solar PV generation and battery storage, this setup creates a reliable and sustainable energy solution. However, successful implementation relies on precise knowledge of the wind resource, understanding different small-scale wind turbine concepts, and maintenance considerations. By mastering these factors, stakeholders can fully harness the potential of small-scale wind power, contributing to a greener and more resilient energy future while actively participating in the energy transition.

Overview of the micro-credential

The course offers a comprehensive introduction to various small-scale wind turbine concepts, including vertical-axis and horizontal-axis wind turbines. Participants will explore the fundamental principles of energy conversion in these devices and learn how to estimate production using online tools at specific locations. The course also addresses important considerations such as the environmental impact, including noise and vibrations, as well as economic factors. Moreover, participants will gain insights into the robustness of small-scale wind systems when combined with other generation technologies.

Learning objectives

On the completion of the micro-credential, the learner will be able to:

- describe the energy conversion in relevant concepts for small-scale wind turbines.
- explain how small-scale wind turbines affect the local environment.
- evaluate the performance of a wind turbine with the help of the power curve and online wind resource characteristics.
- analyse the value of adding wind generation based on a specific context.

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- History of small-scale wind turbines
- Vertical -xis wind turbines: working principles, Savonious turbines, Darriues turbines.
- Horizontal-axis wind turbines: working principles.
- Production calculation with the support of online tools
- Environmental impact
- System considerations

Teaching and learning methods

The course is delivered as a distance course where the student works independently and computer-based; reads texts, writes essays, answers multiple choice questions and perform simpler calculations. The student will also have access to video lectures and other teaching materials.

Prerequisites

Basics on engineering science

Assessment methods

Multiple choice questions.

MC43: Gender mainstreaming and intersectionality

MC title	Gender mainstreaming and intersectionality		
MC long title	-		
ISCED codes	*Primary*: 031	*Complementary*: 041	**ECTS:** 2.5
Suitable for	☐ STEM ☒ NON-STEM		**EQF level:** 6

Background of the proposed micro-credential

The energy sector faces a pressing issue of gender diversity and imbalance, necessitating a move towards a more gender-inclusive industry. Boosting women's participation in the transition to renewable energy systems is critical. Research consistently highlights the positive impact of diversity on innovation and creativity, underscoring the need to promote inclusivity within the energy sector. By bridging the gender gap, the industry can access a broader talent pool and diverse perspectives, leading to more effective problem-solving and innovative solutions. Creating a gender-inclusive environment involves providing equal opportunities, supporting women's career growth, and challenging unconscious biases. A gender-inclusive energy sector is not only an equity imperative but also a strategic move to drive progress in sustainable energy. Embracing diversity unlocks the industry's full potential, paving the way for a more resilient and sustainable energy future.

Overview of the micro-credential

This MC places a strong emphasis on gender mainstreaming within the energy sector and aims to tackle the crucial issue of enhancing women's participation in the industry. Participants will delve into multifaceted strategies and approaches required to achieve greater gender equality and inclusivity within the sector. The course delves into identifying and understanding the barriers that hinder women's active involvement in the energy workforce. Societal norms, cultural stereotypes, limited opportunities, and ingrained biases are among the challenges explored. The course also explores the various drivers that can empower and encourage women to take on prominent roles in the energy sector. Supportive policies, mentorship programs, and gender-inclusive organizational practices are highlighted as catalysts for positive change. Moreover, participants will gain insights into the concept of intersectionality, recognizing that gender intersects with other social factors like race, ethnicity, class, and age, shaping women's unique experiences and opportunities in the industry.

Learning objectives

On the completion of the micro-credential, the learner will be able to:

- Understand basic concepts related to gender mainstreaming and intersectionality.
- Understand the relation between social constructions and barriers for women.
- Evaluate cases with both gender inclusive and gender exclusive behaviours and scenarios.

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- What is gender mainstreaming?
- How can intersectional aspects help us to see new patterns for a diverse workforce?
- Social constructions as barriers or drivers?
- Gender inclusion – best practice

Teaching and learning methods

The following teaching and learning methods will be used:

- Video lectures, reading materials, individual tests.

Prerequisites

None

Assessment methods

Multiple choice questions.

MC44: Sustainable business models

MC title	Sustainable business models		
MC long title	-		
ISCED codes	*Primary*: 041	*Complementary*: 072	**ECTS:** 2.5
Suitable for	☐ STEM ☒ NON-STEM		**EQF level:** 6

Background of the proposed micro-credential

The background of this topic involves the exploration and analysis of sustainable business models, with a particular focus on those applicable to renewable energy. These models aim to incorporate economic, environmental, and social considerations to ensure a holistic approach to business operations. The focus on renewable energy arises due to the growing importance of transitioning to cleaner and more sustainable energy sources. Understanding the unique challenges and opportunities in the renewable energy sector is essential for creating effective and impactful business models. Factors such as financing strategies, policy and regulatory frameworks, and stakeholder engagement play crucial roles in shaping sustainable business models for renewable energy ventures. By fostering innovation and aligning with sustainable development goals, these models contribute to building a greener and more sustainable future.

Overview of the micro-credential

This MC delves into sustainable and strategic approaches for organizations to develop effective and environmentally responsible business models and value creation. Participants will gain comprehensive knowledge of four crucial elements: value proposition, value creation and delivery, value capture, and value intention, all while considering the long-term sustainability of these models. Understanding the unique value a product or service offers, designing processes for delivery, generating revenue, and aligning organizational goals with sustainable strategic direction are key focal points. Real-world case studies and practical exercises empower participants to apply their knowledge, fostering the ability to innovate and strategize effectively within dynamic business environments while ensuring environmental stewardship.

Learning objectives

On the completion of the micro-credential, the learner will be able to:

- Understand basic concepts related to sustainable business models.
- Overall have knowledge about challenges (drivers, barriers) of business models for renewable energies.
- Analyse and evaluate a sustainable business model.

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- Business models; (i) value proposition, (ii) value creation and delivery, (iii) value capture and (iv) value intention.
- Sustainable and circular business models
- Challenges related to sustainable business models for renewable energies
- Drivers and barriers of business models

Teaching and learning methods

The following teaching and learning methods will be used:

- Video lectures, reading materials, individual tests.

Prerequisites

None

Assessment methods

Multiple choice questions.
Group assignments.