Eunice EUROPEAN UNIVERSITY

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EUROPEAN UNIVERSITY FOR CUSTOMISED EDUCATION

# STUDY GUIDE

## ADVANCES IN RENEWABLE ENERGY

**Organised by**

**University of the Peloponnese**

b-tu Brandenburg University of Technology Cottbus - Senftenberg · UC Universidad de Cantabria · Università di Catania · Université Polytechnique Hauts-de-France · UMONS University of Mons · University of the Peloponnese · Vaasan yliopisto University of Vaasa · Politécnico de Viseu

| 1. IDENTIFYING DATA. | |
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| **· Course Name.** | Advances in Renewable Energy |
| **· Coordinating University.** | University of the Peloponnese |
| **· Partner Universities Involved.** | - |
| **· Course Field(s).** | RENEWABLE ENERGY SOLUTIONS |
| **· Related Study Programme.** | Mechanical Engineering and other Engineering |
| **· ISCED Code.** | 07 – Engineering, manufacturing and construction |
| **· SDG.** | Affordable and clean energy (SDG 7); Industry, innovation and infrastructure (SDG 9); Sustainable cities and communities (SDG 11); Responsible consumption and production (SDG 12); Climate action (SDG 13) |
| **· Study Level.** | the course is open for Master (M) and PhD level students |
| **· EUNICE Key Competencies** | • Green – strongly<br>• Orange - moderately<br>• Red – partially<br>• Blank cell - not at all |

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| Problem solving | |
| Teamworking | |
| Communication | |
| Self-management | |
| Cognitive flexibility | |
| Digital competence | |

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| | Technical competence | |
| | Global intercultural competence | |

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| **· Number of ECTS credits allocated.** | *5 ECTS* |
| **· Mode of Delivery.** | the course can be delivered "Online live" (Synchronous) and "Online self-study"(Asynchronous) |
| **· Language of Instruction.** | English |
| **· Course Dates.** | 12-Oct-2026 to 18-Jan-2027 |
| **· Precise Schedule of the Lectures.** | Weekly lectures; Assignments; Discussions; Guest instructors; Student presentations [2 hours]<br>Monday Oct. 12, 09.00 – 11.00 Central European Time (CET)<br>Monday Oct. 19, 09.00 – 11.00 (CET)<br>Monday Oct. 26, 09.00 – 11.00 (CET)<br>Monday Nov. 02, 09.00 – 11.00 (CET)<br>Monday Nov. 09, 09.00 – 11.00 (CET)<br>Monday Nov. 16, 09.00 – 11.00 (CET)<br>Monday Nov. 23, 09.00 – 11.00 (CET)<br>Monday Nov. 30, 09.00 – 11.00 (CET)<br>Monday Dec. 07, 09.00 – 11.00 (CET)<br>Monday Dec. 14, 09.00 – 11.00 (CET)<br>Monday Dec. 21, 09.00 – 11.00 (CET)<br><br>Monday Jan. 11, 09.00 – 11.00 (CET)<br>Monday Jan. 18, 09.00 – 11.00 (CET) |
| **· Key Words.** | Energy Innovation; Renewable Energy; sustainability; energy demand; green transition |
| **· Catchy Phrase.** | Spark the Future: Navigating Clean Energy Innovation |

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| **· Prerequisites and co-requisites.** | Recommended prerequisites: 'Fundamentals of Engineering' or equivalent;<br>- The study levels this course is available for MA & PhD |

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| **· Number of EUNICE students that can attend the Course.** | 25 |
| **· Number of EUNICE students that can attend the course per institution** | Max 20 |
| **· Course inscription procedure(s).** | the standard EUNICE process |

| **2. CONTACT DETAILS.** | |
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| **· Department.** | Mechanical Engineering |
| **· Name of Lecturer.** | George Xydis |
| **· E-mail.** | gxydis@go.uop.gr |
| **· Other Lecturers.** | Guest lecturers from the industry |

## 3. COURSE CONTENT.

Exploring Renewable Energy Challenges and Solutions:
Delve into the realm of renewable energy by examining the intricate challenges and innovative solutions that define its landscape. From global sustainability dilemmas to local implementation barriers, this course navigates the complexities of transitioning towards cleaner, more sustainable energy sources. Explore the benefits, hurdles, and policy frameworks shaping the renewable energy sector while honing strategies and tools to overcome obstacles and foster impactful change.

## 4. LEARNING OUTCOMES.

Developing innovative approaches to renewable energy engineering and business development.
Analyzing real-world cases to understand past experiences and future trends in renewable energy.
Discussing unique characteristics of cleantech within a global context.
Integrating perspectives from both the private and public sectors.

## 5. OBJECTIVES.

Subject Areas and Key Topics:

Defining Renewable Energy Engineering and Innovation
Theories of Renewable Energy, Innovation, and Technical Change
Mitigation and Adaptation Strategies for Climate Change
Sustainable Business Practices in the Renewable Energy Sector
Wind Energy: Technology and Applications

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| Industrial Ecology and Sustainable Design Principles<br>Smart Grid Technologies and Electricity Market Dynamics<br>Promoting Green Growth and Leadership in the Renewable Energy Industry<br>Innovation Clusters and the Role of Hydrogen in Renewable Energy<br>Overcoming Barriers and Policy Frameworks for Cleantech Adoption<br>Case Studies in Successful Implementation of Renewable Energy Solutions |

| **6. COURSE ORGANISATION.** | |
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| **UNITS** | |
| 1. | Unit 1: Introduction to Renewable Energy Engineering and Innovation<br><br>Definition and scope of renewable energy<br>Key concepts in sustainability and innovation<br>Overview of global and local challenges in renewable energy |
| 2. | Unit 2: Theoretical Foundations and Technological Innovations<br><br>Theories of energy, innovation, and technical change<br>Emerging technologies and innovations in renewable energy<br>Role of research and development in advancing renewable energy solutions |
| 3. | Unit 3: Climate Change Mitigation and Adaptation Strategies<br><br>Impacts of climate change on energy systems<br>Mitigation strategies for reducing greenhouse gas emissions<br>Adaptation strategies to address climate change impacts on renewable energy infrastructure |
| 4. | Unit 4: Business Perspectives on Sustainability<br><br>Principles of sustainable business practices<br>Economic analysis of renewable energy projects<br>Financing mechanisms and investment opportunities in the renewable energy sector |
| 5. | Unit 5: Wind Energy: Technology and Applications<br><br>Fundamentals of wind energy conversion<br>Design and operation of wind turbines<br>Integration of wind power into electricity grids |
| 6. | Unit 6: Industrial Ecology and Sustainable Design<br><br>Principles of industrial ecology<br>Design for sustainability and life cycle assessment<br>Cradle-to-cradle approach in renewable energy systems |

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| 7. | Unit 7: Smart Grid Technologies and Electricity Markets<br><br>Concepts and components of smart grids<br>Demand-side management and energy efficiency<br>Market mechanisms for promoting renewable energy integration |
| 8. | Unit 8: Promoting Green Growth and Leadership<br><br>Strategies for fostering green growth in the renewable energy industry<br>Leadership and governance in sustainable energy transitions<br>Role of public-private partnerships in advancing renewable energy goals |
| 9. | Unit 9: Innovation Clusters and Hydrogen Technologies<br><br>Formation and characteristics of innovation clusters in renewable energy<br>Potential of hydrogen technologies in decarbonizing energy systems<br>Case studies of successful innovation clusters and hydrogen projects |
| 10. | Unit 10: Overcoming Barriers and Policy Frameworks<br><br>Barriers to the adoption of renewable energy technologies<br>Policy instruments and regulatory frameworks for supporting renewable energy deployment<br>International cooperation and agreements for promoting renewable energy transitions |
| 11. | Unit 11: Construction and Implementation of Renewable Energy Projects<br><br>Project management principles for renewable energy initiatives<br>Site selection criteria and feasibility studies for renewable energy installations<br>Engineering design considerations and construction techniques for various renewable energy technologies |
| 12. | Unit 12: Case Studies in Renewable Energy Solutions<br><br>Analysis of real-world case studies showcasing successful renewable energy projects<br>Lessons learned and best practices for implementing renewable energy solutions<br>Group discussions and presentations on selected case studies |
| 13. | Unit 13: Student Presentations, Preparation for the Exams, and Sum-up |

**LEARNING RESOURCES AND TOOLS.**

learning resources and tools:

- Textbooks and academic articles on renewable energy technologies, sustainability, and innovation.
- Case studies highlighting successful renewable energy projects and their implementation strategies.
- Online platforms and databases for accessing research papers, industry reports, and statistical data related to renewable energy.

- Simulation software for modeling renewable energy systems and analyzing their performance.
- Interactive lectures and presentations by industry experts, researchers, and policymakers.
- Group discussions and debates to encourage critical thinking and knowledge exchange among students.
- Online forums or discussion boards for collaborative learning and sharing of resources.
- Educational videos and documentaries exploring various aspects of renewable energy technology, innovation, and sustainability.

**PLANNED LEARNING ACTIVITIES AND TEACHING METHODS.**

Lectures
Group Discussions
Problem-Solving Exercises
Guest Speakers
Case Studies
Presentations
Online Learning Modules

## 7. ASSESSMENT METHODS, CRITERIA AND PERIOD.

Oral exam with a presentation and a report/paper (Take-home assignment) submitted.

**OBSERVATIONS.**

The report/paper is expected to include the following sections:

Abstract
Introduction, delineating the main objective
Literature review providing theoretical foundation
Methodology detailing research design, methods, data collection and analysis procedures
Results, describing empirical findings
Discussion, analyzing theory and empirical findings in parallel
Conclusion
References

The paper should be approximately 10-12 standard pages.

In the oral examination, students are required to deliver a dynamic PowerPoint presentation of their scientific paper. The focus lies on delivering independent, pertinent, and factual content that captures the interest of peers. Utilizing diverse visual aids like tables, graphs, figures, and animations, students should effectively illuminate the key points of their paper. Moreover, students are encouraged to provide insightful perspectives and self-reflections regarding the

paper's constraints and potential enhancements. Subsequent to the presentation, a defense of the paper is expected, followed by a discussion on specific topics from the curriculum.

The course is graded.

## 8. BIBLIOGRAPHY AND TEACHING MATERIALS.

-Arent, D., Arndt, C., Miller, M., Tarp, F., & Zinaman, O. (2017). Introduction and synthesis. The political economy of clean energy transitions, 1, 292-312, Available from: https://academic.oup.com/book/16547
- Kerlin, T. W. (2021). Future Energy: Opportunities & Challenges, Available from: https://open.umn.edu/opentextbooks/textbooks/future-energy-opportunities-challenges

Additional readings will be posted