TREATY

Course Handbook

Empowering European Universities to Lead Deep Tech Innovation in *Sustainable Energy & Clean Technologies*

Diversification of autonomous energy systems based on renewable sources

Instructors: Nataliia Dyman, Mykola Tregub.

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EIT HEI Initiative – Innovation Capacity Building for Higher Education – eit-hei.eu

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Course Information

Diversification of autonomous energy systems based on renewable sources

Instructor(s): Mykola Tregub, Nataliia Dyman.

ECTS credits: 2

Course structure:	60 hours
Lecture classes	10 hours
Laboratory classes	10 hours
Personal Activities	40 hours

Mode of delivery: hybrid

Course Summary

The course aims to develop a deep understanding among course participants of the principles of diversification of autonomous energy systems based on Renewable Energy Sources (RES). Modern approaches to the design, optimization, and performance evaluation of systems combining solar, wind, biomass energy, and energy storage means are considered. Special attention is paid to the technical, economic, and environmental aspects of using RES in local and autonomous energy networks.

Upon completion of the course, participants will gain the knowledge to assess the potential of renewable energy sources, design and analyze the structure of autonomous systems. They will be able to determine the energy efficiency (KPD) and effectiveness of storage systems, justify the choice of the optimal configuration for a diversified energy system, and apply sustainable development principles to autonomous energy supply.

The competencies gained during the course will enable effective work in the field of renewable energy, environmental consulting, energy project management, and contribute to achieving sustainable development goals.

Course Participants

This course is designed for a diverse audience: both **students and specialists** in engineering fields who wish to expand their knowledge of renewable energy systems and the specifics of renewable energy operation.

Potential participants are:

- ✓ Bachelor's, Master's, or Doctoral level students in engineering, agronomy, or related fields who wish to expand their knowledge of renewable energy sources and distributed generation systems;

- ✓ Specialists and practitioners working in the field of renewable energy, energy management, or technical design;
- ✓ Academic and non-academic staff of research institutes, universities, and companies interested in research and development of sustainable energy technologies based on RES.

Prerequisites:

- ✓ Basic knowledge of electrical engineering, energy systems, and physics would be an advantage
- ✓ Participants should have an initial understanding of the operating principles of solar, wind, and bioenergy installations;
- ✓ Interest in the issues of energy efficiency, energy security, and environmental sustainability.

Learning Outcomes

Upon completion of the course, participants will be able to:

1) Assess the available potential of renewable energy resources for autonomous energy systems.
2) Calculate generating capacities and the energy balance of the system.
3) Analyze the effectiveness and efficiency (KPD) of different types of energy storage systems.
4) Compare configurations of diversified systems using RES.
5) Justify the selection of optimal technical solutions for autonomous energy supply.
6) Propose engineering solutions based on diversified systems using RES.

Assessment

In order for each participant to complete successfully the course and be awarded the corresponding ECTS credits, they must pass the course assessment. The outcome of the assessment can be either Pass or Fail.

Assessment methods

- Exam. 30 different topics are offered to assess the obtained by the participants' competencies. The content of the exam work includes: topic importance, description of state-of-the-art level of technologies and modern practical trouble killers, tendencies of development. An exam work must include schemes, formulas, plots, text, etc. Number of words > 500. Provided calculations benefit an exam work. The proper format: A4, 14 pt + Times New Roman.

Assessment Methods	Examples of Assessment
• Analyze available renewable resources and their potential	Exam + Report
• Calculate the capacity of an autonomous energy supply system	Exam + Oral Presentation

• Model the structure of a diversified generation system	Exam + Report
• Evaluate the effectiveness of energy storage systems	Exam + Quiz
• Justify the feasibility of using different combinations of RES	Exam + Presentation
• Explain the structure and principles of a diversified generation system	Exam + Quiz

Mentoring

As part of the course, participants will receive individual mentoring during the completion of their assignment/project, or gain practical experience in analysis, information gathering, and selecting optimal renewable energy technologies.
Depending on their experience and interests, they may focus on areas such as:

- ✓ Research on the potential of renewable energy sources;
- ✓ Development of models for autonomous energy systems with multiple RES sources;
- ✓ Assessment of solar, wind, and bioenergy potential in local communities;
- ✓ Analysis of the effectiveness of energy storage means;
- ✓ Modeling the impact of climatic factors on the performance of energy systems.

This mentoring component ensures that each participant develops practical competencies while adapting the learning outcomes to their individual professional or academic goals.

Bibliography

1. Zoulias, E. I., & Lymberopoulos, N. (2008). Hydrogen-based autonomous power systems: Techno-economic analysis of the integration of hydrogen in autonomous power systems. Springer. https://doi.org/10.1007/978-1-84800-247-0
2. Scheer, H. (2006). Energy autonomy: The economic, social and technological case for renewable energy. Earthscan.
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8. Optimal design and analyzing the techno-economic-environmental viability for different configurations of an autonomous hybrid power system. (2024). Electrical Engineering, 106(4), 1543–1561. https://doi.org/10.1007/s00202-024-02252-8

Other Important Information

Course evaluation: Upon successful completion of the course, participants are required to fill in the course evaluation questionnaire.

Certificate: Upon successful completion of the course, participants will be issued a certificate of achievement provided by The Cyprus Institute and EIT Climate KIC.

Plagiarism: CyI has explicit rules concerning academic dishonesty including plagiarism. Course participants are reminded that all work submitted as part of the requirements for any examination (including coursework) of CyI must be expressed in their own words and incorporated in their own ideas and judgements.

Course Timetable

Session	Date and Time	Instructor	Venue
1st	November 3th, 14.00-15.20	Mykola Tregub, Nataliia Dyman	Auditorium 137, Campus 5
2nd	November 4th, 14.00-15.20	Mykola Tregub, Nataliia Dyman	Auditorium 137, Campus 5
3rd	November 5th, 14.00-15.20	Mykola Tregub, Nataliia Dyman	Auditorium 137, Campus 5
4th	November 6th, 14.00-15.20	Mykola Tregub, Nataliia Dyman	Auditorium 137, Campus 5
5th	November 7th, 14.00-15.20	Mykola Tregub, Nataliia Dyman	Auditorium 137, Campus 5
6th	November 10th, 14.00-15.20	Mykola Tregub, Nataliia Dyman	Auditorium 137, Campus 5
7th	November 11th, 14.00-15.20	Mykola Tregub, Nataliia Dyman	Auditorium 137, Campus 5
8th	November 12th, 14.00-15.20	Mykola Tregub, Nataliia Dyman	Auditorium 137, Campus 5
9th	November 13th, 14.00-15.20	Mykola Tregub, Nataliia Dyman	Auditorium 137, Campus 5
10th	November 14th, 14.00-15.20	Mykola Tregub, Nataliia Dyman	Auditorium 137, Campus 5

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