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STUDY GUIDE

ECOLOGICAL ASPECTS OF ENERGY STORAGE: A REVIEW OF DIFFERENT TECHNOLOGIES

Organised by

Poznan University of Technology

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.	
· Course Name.	Ecological aspects of energy storage: an overview of different technologies
· Coordinating University.	Poznan University of Technology (PUT)
· Partner Universities Involved.	-
· Course Field(s).	Energy storage technologies
· Related Study Programme.	N/A
· ISCED Code.	06 Information and Communication Technologies (ICTs)
· SDG.	Goal 4: Quality education,
· Study Level.	Bachelor (B), Master (M)
· EUNICE Key Competencies	[Indicate the Key Competencies required for the course.] • Green – strongly • Orange- moderately • Red – partially • Blank cell - not at all

Problem solving	MODERATELY
Teamworking	MODERATELY
Communication	STRONGLY
Self-management	STRONGLY
Cognitive flexibility	MODERATELY
Digital competence	
Technical competence	MODERATELY
Global intercultural competence	PARTIALLY

· Number of ECTS credits allocated.	3
· Mode of Delivery.	Online live
· Language of Instruction.	English
· Course Dates.	1.03.2026-31.05.2026
· Precise Schedule of the Lectures.	-
· Key Words.	Energy storage, hydrogen, fuel cell
· Catchy Phrase.	This course opens my eyes to the real environmental impact of energy storage solutions!

· Prerequisites and co-requisites.	This course is designed as a supplement to existing knowledge and offers a fascinating scientific perspective on the ecological aspects of energy storage. It is available for students at the Bachelor (Engineering) and Master levels. There are no strict prerequisites, but participants are expected to have a basic understanding of energy technologies and environmental sciences. The required linguistic skills are at a communicative level, allowing students to engage with course materials and discussions effectively.
· Number of EUNICE students /staff members that can attend the Course.	20
· Course inscription procedure(s).	Application through the Eunice website

2. CONTACT DETAILS.	
· Department.	Department of Chemical Technology
· Name of Lecturer.	Beata Kurc
· E-mail.	beata.kurc@put.poznan.pl
· Other Lecturers.	-

3. COURSE CONTENT.

Introduction: The importance of energy storage in renewable energy integration, environmental benefits.
Energy Storage Technologies:
- Battery Energy Storage Systems (BESS): Lithium-ion, solid-state, and flow batteries.
- New Development: Sodium-ion Batteries as an alternative.
- Thermal Energy Storage: Molten salt, phase change materials (PCM).
- Hydrogen Energy Storage: Green hydrogen production, electrolysis, fuel cells.

Environmental Benefits, Challenges, and Future Innovations

4. LEARNING OUTCOMES.

KNOWLEDGE
Upon completion of this course, students will:

- Understand various energy storage methods and their environmental impact.
- Gain knowledge of hydrogen and thermal energy technologies.
- Analyze challenges and future trends in energy storage.

SKILLS

Upon completion of this course, students will:

- Assess sustainability and battery recycling processes.

SOCIAL COMPETENCES

Upon completion of this course, students will:

- Recognize the societal and environmental importance of sustainable energy storage solutions.
- Demonstrate awareness of the ethical and global implications of energy technologies.

5. OBJECTIVES.

- Provide an overview of energy storage technologies and their role in sustainable development.
- Discuss the ecological benefits and challenges associated with various storage methods.
- Explore future trends and advancements in energy storage solutions.

6. COURSE ORGANISATION.

UNITS

1.	Introduction to energy storage.
2.	Battery energy storage systems.
3.	Thermal and hydrogen energy storage.
4.	Hydrogen fuel cells
5.	Virtual tour of the “hydrogen house”.
6.	Environmental benefits and challenges.
7.	Increased integration of renewable energy sources

LEARNING RESOURCES AND TOOLS.

Online learning platforms: Microsoft Teams, Zoom, Google Meet.
Multimedia presentations: PowerPoint, Google Slides.
Virtual tour of the Hydrogen House.
Online meetings with industry experts.

PLANNED LEARNING ACTIVITIES AND TEACHING METHODS.
Online lectures. Multimedia-enhanced presentations. Interactive discussions and Q&A sessions. Case study analysis and project-based learning.

7. ASSESSMENT METHODS, CRITERIA AND PERIOD.
Assessment methods (to choose): - Individual/group presentations. - Essay or analytical report. - Online discussions and active participation. Assessment Criteria: - Clarity and depth of understanding. - Analytical and critical thinking skills. - Engagement and participation in discussions.
OBSERVATIONS.
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8. BIBLIOGRAPHY AND TEACHING MATERIALS.
Publications on energy storage technologies. Scientific articles on batteries and thermal storage. Course materials provided by lecturers. Energy Storage Fundamentals, Materials and Applications 2016 Robert Huggins Energy Storage Systems: Fundamentals, Classification and a Technical Comparative 2023 José Manuel Andújar Márquez , Francisca Segura Manzano , Jesús Rey Luengo