



COURSE TITLE: Energy Storage

Number of contact hours: 45

Duration: 1 semester (spring)

ECTS credits: 4

Programme description:

This course introduces energy storage systems, including thermal, mechanical, chemical, and electrochemical methods. Focus is placed on their role in renewable energy integration, grid stability, and system optimization.

Learning Objectives: a) Understand principles and technologies of energy storage systems. b) Analyze performance and efficiency of storage devices. c) Evaluate energy storage's role in renewable systems. d) Design storage solutions for engineering applications. e) Address economic and environmental aspects.

Course Outline:

1. Introduction: Importance and classification of storage systems.
2. Thermal Energy Storage: Sensible, latent, and thermochemical storage.
3. Mechanical Storage: CAES, pumped hydro, flywheels.
4. Electrochemical Storage: Batteries, supercapacitors, fuel cells.
5. Chemical Storage: Hydrogen and synthetic fuels.
6. Renewable Integration: Storage in solar and wind systems.
7. Economic and Environmental Aspects: Cost, lifecycle, sustainability.

Course type: a) Lectures (15): Core concepts and case studies. b) Projects: Team-based design solutions (30).

Literature:

1. Huggins, R. (2016). Energy storage: Fundamentals, materials and applications. Springer International Publishing.
2. Ocloń, P. (2021). Renewable energy utilization using underground energy systems. Springer International Publishing.

Assessment method: Reports from individual computer simulation and individual project

Lecturer: Prof. Paweł Ocloń

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