University of Ljubljana
Faculty of Mechanical Engineering

Chemical Energy Carriers 5 ECTS

Lecturer: **A. Senegačnik**

Lectures: 30h | Tutorials: 18h | Labs: 12h | Project: 0h | Lang. :

Objectives

- To know the basic physical and chemical properties of chemical energy carriers.
- To know the production and preparation of fossil fuels for use.
- To learn about renewable biofuels, their available potential and their interaction with food production.
- Know the procedures for extracting secondary fuels from waste materials.
- Understand the principles of energy storage.
- Understand the principles of designing and integrating energy storage systems into energy systems.

Programme

Basic physical-chemical characteristics of fuels. Types and structure of chemical energy carriers; chemical potential; thermodynamics of reactions. Fuels, extraction and preparation of fuels for combustion; for solid, liquid and gaseous fuels. Secondary fuels from waste: procedures for obtaining secondary fuels from packaging waste; industrial waste; municipal wastes, biofuels. Integration of biofuels and secondary fuels with fossil fuels; wider environmental aspect of the production and use of biofuels and secondary fuels. Advanced Fuel Production and Processing Procedures: hydraulic fracturing; gasification of solid fuels; wood liquefaction; recovery of plastic waste. Synthetic fuels. System heat storage: reversible chemical reactions; thermochemical storage tanks; sensible and latent storage. Integration of storage tanks into energy systems.

Prerequisites

Meeting the enrolment conditions for the Master's study programme of Mechanical Engineering - Research and Development program.

Learning outcomes

After attending this course, the student will:

- Acquire knowledge of the composition, generation and usage of chemical energy carriers - fuels and the characteristics of their preparation for use. They will also acquire knowledge of renewable biofuels, synthetic fuels, waste materials and surplus energy storage from renewable energy sources.
- Be able to evaluate an individual energy carrier with respect to its usefulness for generating energy in relation to unwanted emissions into the environment.
- Be able to design and integrate renewable energy storage tanks into energy systems.
- Be able to critically evaluate the integration and efficiency of conversions in the storage and release of excess energy through various energy systems.

Assessment

- Theory (lectures) – 40 %
- Practical coursework – 30 %
- Seminar work – 30 %

Literature

- Schorbert H., Chenistry of fossil fuesl and biofuels, Cambridge University Press, 2013.
- Lecomte T. et al, Best Available Techniques (BAT) Reference Document for Large Combustion Plants, Industrial Emissions Directive 2010/75/EU Integrated Pollution Prevention and control, European IPPC Bureau, Evropska komisija, Bruselj, 2017.
- Barnes F. S. Large Energy Storage Sytems Handbook, CRC Press, 2011.
- Baukal C. E., Industral Burners Handbook, CRC Press, 2004.
- Rogoff M. J., Screve F., Waste-to-Energy: Technologies and Project Implementation, 3rd ed., Elsevier, 2019.