

Energy Storage

Module title	Energy Storage			Module-Code	TBD
Duration	1 semester	Semester	Fall/Spring Semester	Module-Start	1,2,3
Credit points	4CP	Workload	180 h	Contact hours	48 h
				Individual study	132 h
Module coordinator	TBD			Language	English
Syllabus	<ul style="list-style-type: none"> • Necessity of energy storage, especially with regard to Renewable Energies • Application areas for electrical and thermal energy storage: portable devices, consumer products, industrial processes, solar systems, power grids, vehicles • High-and low-temperature thermal storage systems • Mechanical systems for electrical energy storage: flywheel, pumped storage, compressed air energy storage, hydroelectric stations • Electric storage (inductors, capacitors, super caps) • Electrochemical energy storage for electrical energy: primary batteries, rechargeable electrochemical energy storage • Various types batteries: Lead-acid, Lithium-Ion, NiCad and others • Hydrogen Storage Systems • Feasibility studies for various applications, e.g., storage in power grids • Economic analysis of energy storage systems • Completion of case studies for big storage systems • Safety aspects, recyclability • Questions of material availability discussed. • Conversion of mechanical energy • Conversion of thermal energy • Energy conversion without thermal energy 				
Learning outcomes	<p>On successful completion of this module, the students should be able to:</p> <ul style="list-style-type: none"> • Understand various technologies of energy storage and storage systems • Evaluate various storage systems and calculate and size the components of a storage system • By the use of a universal storage model, independently of the used technology, they can solve various energy storage problems 				
Literature	<ol style="list-style-type: none"> 1. Robert Huggins, Energy Storage: Fundamentals, Materials and Applications, 2nd, (Springer, 2015) 2. Francisco Diaz-Gonzales, Andreas Sumper, Energy Storage in Power Systems, (Wiley, 2016) 				
Form of teaching	<p>Lecture (2UoI) Recitation (2UoI)</p>				

Assessment methods	Written examination (90 min.) and academic performance
Associated study program	<i>All Programs</i>
Prerequisites for participation	None
Requirements for receiving credit points	Passing the examinations
Grading system	The final grade consists of the academic performance during the module, accounting for 30%, and the module examination accounting for 70%.