

Master study course Renewable Energy Systems (M. Eng.)

Module – No.	854	Mandatory module	
Module name	Bioenergy Systems I - Solid Biomass		
Module coordinator	Prof. Dr.-Ing. Joachim Fischer		
Title	Bioenergy Systems I - Solid Biomass		
Title of examination	Bioenergy Systems I - Solid Biomass		
Semester	1		
Course type	Language	Lecture with excursion	English
SWS/ ECTS/ Workload	4 V	5	150
Requirements for attendance	Successfully completed technical study course (e.g. Bachelor of Engineering)		

1. Content and objectives			
Objective			
<p>The objective of this course is to understand state-of-the-art technologies for thermal biomass conversion. Based on the properties of different biofuels and the fundamentals of thermal conversion processes the course covers conversion processes as combustion, gasification, torrefaction and pyrolysis. Furthermore, emissions from thermal biomass conversion are addressed; methods for their reduction are explained. Additionally, economical aspects of solid biofuel systems are covered.</p>			
Module content:			
<ul style="list-style-type: none"> - Biomass for thermal processes: origins and properties - Fundamentals of thermal biomass conversion processes - Combustion of biomass: technologies - Gaseous and particulate emissions: formation processes and abatement technologies - Power generation from solid biomass, technologies and plant layout - Synthesis gas production: Biomass gasification - Mastering the tar problem in biomass synthesis gas - Pyrolysis and torrefaction: additional pathways for solid biomass conversion - Hydrothermal conversion processes - Economical aspects of thermal bioenergy conversion processes 			
On-line Lecture notes and training material will be available.			
Recommended Literature:			
John Love (Editor): Biofuels and Bioenergy , Wiley Blackwell 2017			
Andreas Hornung: Transformation of Biomass: Theory to Practice, Wiley, 2014			
Learning goals:			
<p>Students acquire competent knowledge in modern technologies of thermal biomass conversion. In addition to fundamental knowledge of the physical and chemical properties, students are familiar with the formation of gaseous emissions and particulate matter and their abatement. Students are enabled to recognize and evaluate the application and limitations of solid biomass technologies compared to conventional technologies and to draw appropriate conclusions considering technical and economic aspects.</p>			
2. Method(s) of instruction			
Lecture in combination with an excursion to a biomass- CHP - plant			
3. Requirements for attendance			
No course specific requirements			
4. Usability of this module			
The module is offered as mandatory course in the master study course „Renewable Energy Systems“ (M.Eng.)			
5. Requirements for assessment			
<ul style="list-style-type: none"> - Participation in the the integrated excursion is mandatory - Assessment is performed either as written examination (90 minutes) or oral examination - Students need to pass the module examination, which encompasses all contents of the lecture. 			
6. ECTS credits			

- 5 ECTS credits
7. Frequency of offer
- Annually in the spring semester.
8. Work load
150 h of total work load, therefrom <ul style="list-style-type: none"> - 80 h of presence at lectures - 40 h of self-study - 30 h preparation for examination
9. Duration of module
1 semester