

<b>Number of module: 4</b>	<b>Module: Bioenergy - Biofuels</b>
<b>Coordinator of module</b>	<b>Prof. Dr.-Ing. Th. Willner</b>
<b>Lecturer</b>	Prof. Dr.-Ing. Th. Willner
<b>Period</b>	1 <sup>th</sup> and 2 <sup>nd</sup> semester
<b>Credits</b>	5 CP
<b>Workload</b>	on campus program: 64 h, self study: 86 h
<b>Status</b>	Optional obligatory module
<b>Prerequisites</b>	Basic knowledge in Thermodynamics and Chemistry
<b>Max. number of participants</b>	40
<b>Language</b>	German or English
<b>Skills to be acquired / Learning objectives</b>	
<p><b>Subject based and methodical skills</b>  The students are able to ...</p> <ul style="list-style-type: none"> <li>• identify and assess global challenges of energy supply quantitatively based on material and energy flow data;</li> <li>• analyze and present concepts of alternative fuel generation based on thermodynamic, chemical, ecological, economical and scientific data;</li> <li>• estimate potentials and climate relevance of biofuel scenarios;</li> <li>• analyze and assess publicly discussed statements concerning problems of alternative fuel supply, climate change and food production based on own calculations;</li> <li>• evaluate and discuss own concepts of biofuel production including optimization options;</li> <li>• use literature sources according to scientific requirements.</li> </ul> <p><b>Personal and social skills</b>  The students are able to ...</p> <ul style="list-style-type: none"> <li>• reach the learning objectives by creative learning and adequate time management</li> <li>• present scientific assessment results based on literature data and own calculations</li> <li>• generate and present results from team work</li> </ul>	
<b>Contents</b>	
<ul style="list-style-type: none"> <li>• global challenges of energy supply considering demand, potentials, climate change and CO<sub>2</sub> balances</li> <li>• thermodynamic, chemical, ecological and economical fundamentals of conventional and alternative fuels</li> <li>• Chemistry of biomass</li> <li>• Chemistry and thermodynamics of biological and thermochemical conversion of biomass into liquid and gaseous fuels</li> <li>• 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> generation biofuels considering latest research and development results including activities at the Hamburg University of Applied Sciences</li> </ul>	

<b>Related courses • Biofuels</b>	
<b>Teaching skills</b>	Seminar type lecture Team work presentations
<b>exam</b>	1. Written examination (graded performance test) 2. Report and oral presentation of analyzed literature data (ungraded performance test)
<b>Literature / Teaching aids</b>	<p>Lecture training manuscript and handouts. Examples of literature related to biofuels:</p> <ul style="list-style-type: none"> <li>• Overend, Milne, Mudge Eds.: Fundamentals of Thermochemical Biomass Conversion. Elsevier, London 1985</li> <li>• Soltes, Milne: Pyrolysis Oils from Biomass – Producing, Analyzing and Upgrading. ACS Symposium Series 376, Washington DC 1988</li> <li>• Bridgewater, Kuester Eds.: Research in Thermochemical Biomass Conversion. Elsevier, London 1988</li> <li>• Bridgewater, Grassi: Biomass Pyrolysis Liquids Upgrading and Utilisation. Elsevier, London 1991</li> <li>• Fachagentur Nachwachsende Rohstoffe e.V.: Biocrudeoil. Gülzower Fachgespräche Band 28, Gülzow 2008-10-30</li> <li>• Fachagentur Nachwachsende Rohstoffe e.V.: Diverse Informationsbroschüren zu allen Arten von Biokraftstoffen; <a href="http://www.fnr.de">www.fnr.de</a></li> <li>• Geitmann: Mit neuer Energie in die Zukunft – Erneuerbare Energien &amp; Alternative Kraftstoffe. European Energy Consult Holding (EECH) AG, Hamburg; Hydrogeit Verlag, Kremmen 2005</li> <li>• Kaltschmitt, Hartmann: Energie aus Biomasse – Grundlagen, Techniken und Verfahren. Springer, Berlin 2001</li> <li>• Reiser: Ermittlung von motor- und verbrennungstechnischen Kenndaten an einem Dieselmotor mit Direkteinspritzung bei Betrieb mit unterschiedlich aufbereitetem Rapsöl. Dissertation, Universität Hohenheim 1997</li> <li>• Klee: Charakterisierung verschiedener Pflanzenölkraftstoffe hinsichtlich ihrer Eignung als Dieselmotorsubstitute unter besonderer Berücksichtigung ihrer chemischen und physikalischen Eigenschaften. Dissertation, Universität Kaiserslautern, 1999</li> </ul>

