

List of courses with bioresource contents planned to offer in TU Twente and TU Graz Master programmes within the BET-project compared to courses Hamburg University of Technology and Center of Wood Science Hamburg actually offers

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Annex to the Higher education survey for the Hamburg region in the bioresource sector

(Part 1 in the Task “Regional higher education and business survey in the bioresource sector” within work packages 3 & 4 “Linking business and higher education institutions on bioresource education” and “Creating regional outreach networks” in the EU-Project “Bioenergy Train”)

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Courses to develop for the TU Graz and TU Twente Master studies within the BET project	Bioresource and energy related courses at the Hamburg University of Technology (TUHH) included in different actual Master studies	Courses in the actual “Wood Management” Master study at the Center of Wood Science Hamburg (ZHH)
(1) Thermochemical conversions for bioresources	Thermal Utilization of Biomass** Thermal Waste Treatment* Energy from Biomass***	<i>Partly included in some lectures</i>
(2) Business models for bioresource utilization	Creation of Business Opportunities* Entrepreneurial Finance* Entrepreneurship* Energy Trading**	Marketing for Wood Products Market Research and Sales Planning
(3) Crop Bioresources - Characterisation and properties	<i>Partly included in some lectures</i>	<i>Partly included in some lectures</i>
(4) Bioresources value chain optimisation	Biosystems Engineering* Wastewater Systems - Collection, Treatment and Reuse* Bioresource Management* International Logistics and Transport Systems*	Wood- and Forest management Forestry Production Wood Harvest and Logistics <i>And partly included in some other lectures (Mainly 5 and 19)</i>
(5) Chemical engineering of biobased products	Bioreactor Design and Operation* Biotechnical Processes*** Solid Matter Process Technology for Biomass** Food Technology**	Chemical Wood Technology Mechanical Wood Technology
(6) LCA of bio-resource value chains	Ecological Town Design - Water, Energy, Soil and Food Nexus* Sustainability Management**	Facility Planning and Eco Balancing
(7) By - product and waste Bioresources	Waste and Environmental Chemistry*** Waste Recycling Technologies* Advanced Topics in Waste Resource Management* Biological Waste Treatment* Biological Wastewater Treatment* Waste to Energy* International Waste Management* Resources Oriented Sanitation: High and Low-Tech Options* <i>Partly included in some lectures</i>	<i>Partly included in some lectures</i>
(8) Ligno-cellulose bio-resources -characterisation and properties		Characteristics of Wood and Wood Compounds Wood Quality Wood Biology Wood Anatomy and Wood Physiology Molecular Biology of Renewable Resources and their harmful Organisms

Courses to develop for the TU Graz and TU Twente Master studies within the BET project ^A	Bioresource and energy related courses at the Hamburg University of Technology (TUHH) included in different actual Master studies ^B	Courses in the actual “Wood Management” Master study at the Center of Wood Science Hamburg (ZHH) ^C
(9) Introduction to Biorefineries	Biorefineries - Concepts and Plants** Biorefinery Technology*	Utilization of Wood and annual plants in biorefineries
(10) Algae biorefineries	<i>Partly included in some lectures</i>	
(11) At-Line monitoring techniques for microbial processes optimization	<i>Included in other lectures (mainly 4 and 5)</i>	
(12) Biomass fractionation processes for the biorefineries	<i>Included in other lectures (mainly 4 and 5)</i>	<i>Included in other lectures (mainly 4 and 5)</i>
(13) Cell factories as biorefinery platforms for the conversion of non-woody Mediterranean feedstock	<i>Partly included in some lectures</i>	
(14) Computer-Aided Biorefinery's Processes Design	<i>Partly included in some lectures</i>	
(15) Novel thermochemical processes for the biorefinery	<i>Partly included in some lectures (mainly 1)</i>	<i>Partly included in some lectures (mainly 5)</i>
(16) Operations management in bioresource chains: A modelling approach	Applied Bioinformatics* Process Modelling of Wastewater Treatment*** <i>Partly included in some lectures</i>	
(17) Dynamic simulation of co-generation of heat and power	System Simulation**	
(18) Renewable based energy mixes	Biofuels Process Technology** Steam Turbines in Renewable and Conventional Applications** Electrical Power Systems** Electrical Energy Transmission and Distribution** Electrical Power Supply** Energy Storages** Energy Systems and Energy Industry** Environmental Technology and Energy Economics***	
(19) Bio- resources and bio-based products	Biomaterials* <i>Partly included in some lectures</i>	Wood damages and Wood Protection Solid Wood Technology Wood material Technology Wood in Building Industry Fiber materials and Paper Biopolymers from Wood and Annual Plants
(20) Environmental challenges in bio-refineries	Environmental Aquatic Chemistry* <i>Partly included in some lectures (mainly 9)</i>	Environmental Technologies in Wood- and paper Industry

* Courses in English; ** Courses in German, *** Courses in German and English; **Synergetic competences of TUHH and ZHH highlighted in orange**

A – Included in the Master studies “Biorefinery Engineer” and “Bioresource Value Chain Manager”; additional more general lectures are included; **B** – Included among others in the Master Studies International Production Management Logistics, Infrastructure and Mobility, Bioprocess Engineering, Water and Environmental Engineering, Joint European Master in Environmental Studies Cities and Sustainability, Energy Systems, Energy and Environmental Engineering, Environmental Engineering, International Management and Engineering, Renewable Energies, Process Engineering; **C** - Additional more general lectures are included in the Master study, the listed courses are in German