

lecture: Special topics from renewable resources and energy
(working title)

Hours / CP:

degree programme: Mechanical engineering (bachelor)

responsible: Prof. Beneke / Prof. Pietzsch

lecture begins... From ...

Date	content	details	duration	university lecturer
1.	Introduction / Basics	<ul style="list-style-type: none"> ▪ need for energy and raw material, available supplies ▪ actual development / trends ▪ demands for renewable resources / energy ▪ areas of application ▪ significance for mechanical engineering ▪ ... 		
2.	Types of making renewable resources available / ways of utilization (overview)	<ul style="list-style-type: none"> ▪ material utilization ▪ energy recovery ▪ thermal utilisation ▪ ... ▪ Central and peripheral approaches ▪ making renewable resources available for industrial applications 		
3.	solar technology (1) – photovoltaics	<ul style="list-style-type: none"> ▪ solarization ▪ Direct and diffuse solar radiation ▪ Electricity from the sun – how does photovoltaics work? ▪ Photovoltaic facilities ▪ Calculation and efficiency factor ▪ engineering design ▪ Storage of electricity 		
4.	solar technology (2) – solar heat	<ul style="list-style-type: none"> ▪ Heat from solar energy ▪ Options for thermal utilization of solar energy ▪ solar power plants (solar updraft tower, Dish-Stirling power plant, solar furnace) ▪ Cooling with solar energy ▪ small scale plants ▪ Calculation and efficiency factor ▪ engineering design ▪ Storage of heat 		

5.	near-surface geothermal energy	<ul style="list-style-type: none"> ▪ What is geothermal energy? ▪ Natural geothermal energy ▪ Technical utilization of geothermal energy / devices ▪ small scale plants ▪ Calculation ▪ engineering design 		
6.	heat pumps and Organic Rankine Cycles	<ul style="list-style-type: none"> ▪ synthetic and natural refrigerants ▪ thermodynamics of the refrigerant cycle ▪ types of reservoirs and heat pumps ▪ ORC-Process 		
7.	wind power	<ul style="list-style-type: none"> ▪ wind appearance, wind speed / velocity distribution, subject to altitude ▪ wind utilization, energy from wind ▪ wind power plant calculation ▪ Thermodynamics of solar updraft towers ▪ onshore and offshore wind power plants, construction details ▪ wind farms ▪ environmental effects 		
8.	hydropower (?)	<ul style="list-style-type: none"> ▪ hydropower plants ▪ turbines ▪ tidal power station ▪ Energy balances and calculation of hydropower plants 		
9.	Biomass (1)	<ul style="list-style-type: none"> ▪ Types of biomass, growth of plants ▪ Opportunities for biomass usage (thermal, material, ...) → small scale plants, biomass power plants,... ▪ Biomass sources / generation and usage of existing mass flows 		
10.	Biomass (2)	<ul style="list-style-type: none"> ▪ Harvest technologies and conditioning ▪ Supply chains (e.g. pellets) 		
11.	Biogas (fermentation gas)	<ul style="list-style-type: none"> ▪ Biogas process ▪ Possible input material ▪ Supply chains: from substrate cultivation / delivery of residual material to usage and handling of residual material ▪ Biogas plants, engineering design ▪ Gas storage, conditioning and gas distribution system feeding-in ▪ electricity generation / block heat and power plant ▪ heat use 		

12. Combustion of natural materials	<ul style="list-style-type: none"> ▪ Combustion reactions and balance equations ▪ preparation and drying ▪ energy balance, air consumption and combustion temperature
13. Biofuel (green fuel) and biolubricants	<ul style="list-style-type: none"> ▪ Biodiesel, bioethanol ▪ rapeseed oil ▪ Lubricants ▪ hydraulic fluid ▪ Biofuel combustion (characteristics, exhaust emission, particles) ▪ Engines / technology, modification
14. raw material for industrial applications	Biopolymers (?)
15. Outlook / perspective	<ul style="list-style-type: none"> ▪ Possible future trends ▪ Actual studies ▪ key technologies ▪ Need for further research ▪ job situation

Additional: hydrogen / hydrogen fuel cell?