Module Name	Chemical Thermodynamics
Module Number	EuI-RES-E-ChTD
Responsible Lecturer	Prof. Cornelia Breitkopf cornelia.breitkopf@tu-dresden.de
Qualification Objectives	Students are able to distinguish and calculate thermal equations of state for ideal and real gases and name applications of real gas equations. They are capable of applying thermodynamic terminology, such as state and process variables, as well as the first and second laws of thermodynamics, to material transformation processes, such as phase transitions of pure substances, formation of mixed phases, and chemical reactions. Furthermore, students can describe material transformation processes using the respective phase diagrams and fundamental thermodynamic laws. They are familiar with the fundamental equations characteristic of chemical thermodynamics and can describe their temperature and pressure dependence and apply them to material transformation processes. Students are also acquainted with energy- and process-engineering-relevant characteristics of mixtures and their applications.
Contents	The module covers thermal equations of state for ideal and real gases, including virial equations and the van der Waals equation; state variables of mixtures, such as partial molar quantities; thermochemistry of material transformation processes, i.e., reaction enthalpy, Hess's law, and the temperature and pressure dependence of thermochemical state variables; general laws of equilibrium and non-equilibrium, i.e., fundamental equations, Gibbs and Helmholtz energy, chemical potential, and their applications to material transformation processes. Additional topics include phase equilibria of pure substances, considering phase diagrams, vapor pressure, melting pressure, sublimation pressure curves, Clausius-Clapeyron equation, and the classification of phase transitions according to Ehrenfest. Other topics include mixed-phase equilibria, particularly solvent equilibria with freezing point depression, boiling point elevation, colligative properties, and their applications; solubility and distribution equilibria with Henry's coefficient, Nernst distribution factor, and their applications; vapor-liquid equilibria with Raoult's and Dalton's laws, temperature and pressure composition diagrams, and their applications; systems with liquid and solid phases, such as melting equilibria with complete and incomplete miscibility of solid phases, eutectics, and their applications, such as the Fe-C diagram and latent heat storage; chemical equilibria with van 't Hoff's reaction isotherm, the law of mass action, handling equilibrium constants, and the temperature and pressure dependence of equilibrium constants.
Teaching and Learning Forms	2 hours per week of lectures, 2 hours per week of exercises, and self-study.
Prerequisites for Participation	Competencies acquired in the module Thermodynamics Basics are required.
Usability	The module is an elective module from the elective area "Competence Deepening" in accordance with § 6 paragraph 3 SO and § 33 paragraph 3 PO in the main study phase of the diploma program Renewable Energy Systems.
Prerequisites for the Award of Credit Points	Credit points are awarded when the module examination is passed. The module examination consists of a written exam lasting 120 minutes.
Credit Points and Grades	5 credit points can be earned through the module. The module grade corresponds to the grade of the written exam.
Frequency of the Module	The module is offered every winter semester.
Workload	The total workload is 150 hours.

Duration of the Module	The module lasts one semester.