

Module title	1.3 Pathways to net zero GHG emissions in the energy and chemical sectors
Workload (ECTS)	3 ECTS
Module coordinator	Prof. Dr. Michael Hans-Peter Studer
Contributing lecturers	
Entry requirements	Builds on: <ul style="list-style-type: none"> • 0.1 Introduction to circular economy • 1.2 Biological cycle: environmental systems
Description	<p>An economy can only prosper if energy is available in sufficient quantities (and at an acceptable price). Today's economy is energetically driven by more than 85% fossil fuels on a global scale. This is problematic for two reasons: on the one hand, these energy sources used today are all of fossil origin (oil, gas, coal) and thus finite - i.e., they will run out in the coming years, or else the price will rise sharply as availability becomes scarcer. On the other hand, the use of these energy sources inevitably emits additional CO₂, known as the central GHG in the atmosphere, which heats up the earth's climate with known negative consequences for fauna, flora and thus very probably also for society. In addition, the plastics and chemical industries are also dependent on fossil fuels. Not only to drive the production process, but these energy sources are used primarily as a source of carbon. All plastics and organic chemicals contain carbon. The use of fossil carbon sources also produces CO₂ emissions at the end of life of the product and contributes thus to global warming.</p> <p>In a circular economy, the primary goal is to become independent of fossil energy sources and finite raw materials. This means that in a circular economy, both the driving energy of the economy and the carbon source for the plastics and chemical industries must be covered by renewable sources.</p> <p>In this module we will look at how the energy sector can be decarbonized, i.e., made carbon free, but also what opportunities exist today to defossilize the plastics and chemical industry, i.e., all newly manufactured products must be made from recycled carbon.</p> <p>We will look at the amounts of energy and carbon consumed in today's linear economy, learn about the alternative renewable energy sources available and their conversion processes to usable energy sources, but also examine the possible sources of recycled carbon with the associated conversion processes.</p>
Learning outcomes and competences	<p>Competences:</p> <p>Students</p> <ul style="list-style-type: none"> • will gain the knowledge to distinguish between decarbonization of the energy sector and defossilization of the chemicals/plastics sector. • will look at the different renewable energy supply processes, compared and contrasted in terms of rapid implementability. • will discuss the different available renewable carbon sources • will analyse the consequences and opportunities from their use



	Outcome: Students <ul style="list-style-type: none">• will be able to classify an energy production process in terms of systemic, environmental, economic advances and consequences.• will be able to evaluate which carbon source seems most appropriate for the production of chemicals and plastics.
Assessment of learning outcomes	<ul style="list-style-type: none">• oral exam
Didactic approach	<ul style="list-style-type: none">• self-study• online teaching• face-to-face teaching
Project-based learning	Case Studies and work on a practical example for the exam
Links to other modules	<ul style="list-style-type: none">• 1.4 Pathways to net zero GHG emissions in the mobility sector
Bibliography	Literature will be provided before the start of the module
Language	English
Location	Bern / Zollikofen