UCLouvain

lenvi2007

2023

Renewable energy sources

5.00 credits	45.0 h + 15.0 h	Q1

Teacher(s)	De Jaeger Emmanuel ;Gerin Patrick (coordinator) ;Jeanmart Hervé ;
Language :	English > French-friendly
Place of the course	Louvain-la-Neuve
Prerequisites	Background in physics and (bio)chemistry Dedicated introductory modules are available for ENVI students (self learning) Dedicated modules are available for EPL/AGRO students (self learning)
Main themes	The course aims at providing the students with a broad, diversified and multidisciplinary background on renewable energy. It gives a global view of the various renewable energy sources and uses, with emphasis on the available resources, conversion technologies, environmental impacts, and socio-economical aspects of their development.
Learning outcomes	**At the end of this learning unit, the student is able to :** **a. Contribution of the course to the program objectives (N°)** EPL : Partim A and B : AA1.1, AA1.2, AA1.3, AA6.1, AA6.3 Partim B : AA2.1, AA2.2, AA2.3, AA6.2 AGRO : Partim A and B : AA2.1, AA2.3, AA2.4, AA7.3 Partim B : AA4.1, AA4.2, AA4.3, AA4.4, AA4.5 **b. Specific learning outcomes of the course** Partim A: 1 • Utilize the main orders of magnitude and units in the field of renewable energy • Master the main physical, chemical, biological, technical and environmental aspects of renewable energy systems and technologies • Calculate the preliminary sizing of renewable energy technologies • Compare the conversion technologies from different perspectives (technical, energy, and environmental) • Critique scientific documents on renewable energy related topics. Partim B : • Select the right conversion technologies for an application considering technical, environmental and economic aspects • Model the components of renewable technologies towards their simulation and optimization • Design (optimize) a renewable energy system for a specific application
Evaluation methods	Written examination (Parts A&B) + continuous assessment (Part B) The problem-based learning and related continuous assessment (Part B) are organized only once during the quadrimester and academic year. The marks obtained for the continuous assessment on the problem based learning are final, and will be associated with all exam sessions. The exam on Part B can include questions on topics that were covered in the continuous assessment during the quadrimester. The final mark is determined as the weighted arithmetic average of the various assessments: exam Part A, exam Part B and continuous assessment. Note: The use of generative AI software such as chatGPT is permitted only for assistance in writing of the reports requested in this course. In this instance, however, an appendix will be required detailing, for each of the sections concerned, how the AI was used (information search, drafting and/or correction of the text, ...). Furthermore, external sources of information must be systematically cited in compliance with bibliographic referencing standards.
Teaching methods	• Formal lectures • Seminar by experts • Reading of scientific papers • Problem based learning (Part B)
Content	*Part A - Introduction to renewable energy* General introduction (energy outlook, energy efficiency, place of renewable energy in the transition) (2h) Solar energy (solar resource characterization, photovoltaic effect, PV panels, Converters, etc.) (8h)

	Wind energy (mechanical aspects, Betz law, BEM, electrical aspects) (4h) Hydro power (types of turbines, efficiency, fluid aspects) (2h) Biomass (solar to biomass conversion, biomass composition, thermochemical conversion, biological conversion) (4h) Energy storage (electrical, mechanical, thermal) (3h) *Partim B - Advanced topics in renewable energy* Concentrated solar Power CSP / solar drying (6h-6h) Design and control of wind turbines (4h-4h) Design of a small hydraulic turbine (3h-3h) Mass and energy balance of biomass conversion routes (4h-4h) Design of an energy storage unit (4h-4h)
Inline resources	Moodle
Faculty or entity in charge	ENVI

Programmes containing this learning unit (UE)

Program title	Acronym	Credits	Prerequisite	Learning outcomes
Master [120] in Environmental Science and Management	ENVI2M	4		
Master [120] in Chemical and Materials Engineering	KIMA2M	5		
Master [120] in Mechanical Engineering	MECA2M	5		
Interdisciplinary Advanced Master in Science and Management of the Environment and Sustainable Development	ENVI2MC	5		
Master [120] in Electrical Engineering	ELEC2M	5		
Master [120] in Electro-mechanical Engineering	ELME2M	5		
Master [120] in Energy Engineering	NRGY2M	5		