Syllabus – Elective Course

Course title:

Energy Transition and Renewable Energies

Credits:

6 ECTS credits

Teaching language:

English

Target students:

Undergraduate students from all study areas with an interest in/who would like to learn renewable energies.

Teacher in charge of the course:

Prof. Dhaker ABBES (Junia, *Université Catholique de Lille*)
DR. Khaled ALMAKSOUR (Junia, *Université Catholique de Lille*)

COURSE PRESENTATION

Prerequisite:

To take this course, the students should have a good university level and should normally have completed at least one semester at university. They must have some ability to work as a group and be able to communicate easily in English at a standard university level. In other respects, the course is intended to serve a mix of profiles and learning backgrounds for a more diverse international learning experience.

Content:

This course will provide students with fundamentals of energy and an overview of renewable energies and their applications. Topics to be covered will normally include: - Fundamentals of Energy. - Energy transition and Renewable Energy Sources. - Photovoltaic installation. - Solar Thermal Energy Systems. - Wind Energy Systems. - Biomass and other sources. - LCC and LCA of renewable energy sources.

Learning Outcomes:

At the end of the course, the students should be able to: - Assess renewable sources potentials. - Evaluate the load of a building or a city.

- Choose the adequate source of energy according to the situation and to the load.
- Model, simulate, control and correctly connect an assembly of a wind turbine chain or a photovoltaic chain.
- Design of a standalone or a grid connected renewable energy system.
- Being able to tackle the issues related to renewable energy systems.
- Being able to make the difference between solar thermal energy and solar photovoltaic energy.
- Being able to make a technological survey and to innovate.
- To read and analyze the technical manual of a photovoltaic panel or a wind turbine.
- To be able to assess the economic and ecologic cost of a renewable energy based solution
- Use of simulation tools: HOMER energy.

WORKLOAD

French contact hours = 60 minutes (in some countries/institutions, 1 contact hour = 45-50 minutes)

Form	Number of hours	Comments
Face-to-face, in-class, on-site learning	20 hours	▪ Chapter 1: Fundamentals of Energy (3h). ▪ Chapter 2: Energy transition and Renewable Energy Sources (3h). ▪ Chapter 3: Photovoltaic installation (3h). ▪ Chapter 4: Solar Thermal Energy Systems (3h). ▪ Chapter 5: Wind Energy Systems (3h). ▪ Chapter 6: Biomass and other sources (2h). ▪ Chapter 7: LCC and LCA of renewable energy sources (3h).
Tutorials and exercises	5 hours	
Practical labs	9 hours	▪ Practical lab 1: Study of a photovoltaic system (3h). ▪ Practical lab 2: Estimation of wind turbine energy (3h). ▪ Practical lab 3: Dimensioning of a hybrid system Photovoltaic-Wind Turbine Connected to the Network with the HOMER software (3h).
Visits	6 hours	▪ Site visit 1 (3h). ▪ Site visit 2 (3h).
Approximate personal work / homework	40 hours	
Student total workload	**80 hours**	

EDUCATIONAL METHODS

Lecture, discussion, presentations, sharing of experiences, group work, guided visits, on-site education, tutorials, practical labs, mini projects.

RESOURCES

All course materials will be supplied in class. References may be made to the following resources:

- Le Manifeste négaWatt “En route pour la transition énergétique !” Coédition Actes Sud/Association négaWatt - Collection : Babel.
- L'autonomie énergétique : Une nouvelle politique pour les énergies renouvelables »- Hermann Scheer – Actes sud.
- « déchiffrer l'énergie » - Benjamin Dessus – Edition Belin.
- Robyns, B., François, B., Davigny, A., Sprooten, J., & Henneton, A, Electricity production from renewables energies. Book, Wiley, 2012.
- Dhaker Abbes, Gérard Champenois, André Martinez, Benoit Robyns, Modeling and simulation of a photovoltaic system: An advanced synthetic study, Research paper, 3d International Conference on Systems and Control (ICSC13), 29 to October 31, 2013, in Algiers, Algeria.
- ABBES, Dhaker, MARTINEZ, André, et CHAMPENOIS, Gérard. Life cycle cost, embodied energy and loss of power supply probability for the optimal design of hybrid power systems. Mathematics and Computers in Simulation, 2014, vol. 98, p. 46-62.
- Messenger, Roger, and Amir Abtahi. Photovoltaic systems engineering. CRC press, 2017.
- ABBES, Dhaker. Contribution au dimensionnement et à l’optimisation des systèmes hybrides éoliens-photovoltaïques avec batteries pour l’habitat résidentiel autonome. 2012. Thèse de doctorat. Ph. D. thesis, Université de Poitiers.
- Ewald F. Fuchs l Mohammad A.S. Masoum, Power Conversion of Renewable Energy Systems, Book, ISBN 978-1-4419-7978-0 e-ISBN 978-1-4419-7979-7, DOI 10.1007/978-1-4419-7979-7, Springer New York Dordrecht Heidelberg London.

ASSESSMENT

Form	Number	Comments
Continuous assessment (20%)	2	Quizzes, Presentations, Exercises.
Final exam (60%)	1	Examination covering all aspects of course.
Practical labs (20%)	3	Participation on and results of practical labs.

This syllabus is based on information available at the time of publication (January 2025). Changes may occur.

For updated information about course content, please contact us: lilleprograms@univ-catholille.fr