GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2021-2022

Sustainable Energy (E035421)

Due to Covid 19, the education and evaluation methods may vary from the information displayed in the schedules and course details. Any changes will be communicated on Ufora.

Course size *(nominal values; actual values may depend on programme)*

Credits 3.0 **Study time 90 h** **Contact hrs** 30.0 h

Course offerings and teaching methods in academic year 2022-2023

A (semester 1)	English	Gent	lecture	22.5 h
			excursion	7.5 h
B (semester 1)	Dutch		guided self-study	30.0 h

Lecturers in academic year 2022-2023

Mertens, Jan	TW08	lecturer-in-charge

Offered in the following programmes in 2022-2023	**crdts**	**offering**
Bridging Programme Master of Science in Electromechanical Engineering (main subject Electrical Power Engineering)	3	A
Bridging Programme Master of Science in Electromechanical Engineering (main subject Mechanical Energy Engineering)	3	A
Master of Science in Electromechanical Engineering (main subject Control Engineering and Automation)	3	A
Master of Science in Electromechanical Engineering (main subject Control Engineering and Automation)	3	B
Master of Science in Electromechanical Engineering (main subject Electrical Power Engineering)	3	A
Master of Science in Electromechanical Engineering (main subject Electrical Power Engineering)	3	B
Master of Science in Electromechanical Engineering (main subject Maritime Engineering)	3	A
Master of Science in Electromechanical Engineering (main subject Maritime Engineering)	3	B
Master of Science in Electromechanical Engineering (main subject Mechanical Construction)	3	A
Master of Science in Electromechanical Engineering (main subject Mechanical Construction)	3	B
Master of Science in Electromechanical Engineering (main subject Mechanical Energy Engineering)	3	A
Master of Science in Electromechanical Engineering (main subject Mechanical Energy Engineering)	3	B
International Master of Science in Sustainable and Innovative Natural Resource Management	3	A

Teaching languages

Dutch, English

Keywords

Power generation, Sustainability aspects of power generation (Life Cycle Assessment), Emissions, Carbon Capture and Utilisation, Power to Gas, Power to X, Green gasses including Hydrogen, Sustainability of emerging energy technologies

Position of the course

The main objective of the course is to increase the student's awareness on the sustainability of new emerging and existing energy technologies with the main focus on power production. After the course, the student will have acquired a mindset and dispose of a set of tools to quickly evaluating the true potential of a new emerging energy technologies and the related technical and sustainability challenges. Sustainability not only being environmental (although Life Cycle

Assessment is discussed in some detail in the course) but also social and economic aspects of new technologies are discussed throughout the course.
Traditional fossil based large scale centralised electricity production (Gas, Nuclear, Coal) is still briefly discussed in the course, focus again being on sustainability aspect. More attention is given to decentralized renewable power production (wind, photovoltaic, Marine, Geothermal, ...) and the challenges related to the intermittency of these renewables are discussed in more detail. The intermittency of renewable electricity generation makes that today, electricity storage and even use are very much interconnected and thus are also discussed in the course. Moreover, concepts such as Power to gas (hydrogen), Power to X (with X being hydrocarbons such as methane, methanol, formic acid, ... or even ammonia), Carbon Capture and Utilisation using both chemical and biological pathways are discussed since believed to be part of the energy transition that we are living in.

Contents

Context. The Energy Transition

- The Energy Transition. What is the 2 Degree Scenario? What does it imply?
- What is Sustainability? Focus on LCA
- Thermal electricity production (coal, nuclear, gas)
- Photovoltaic and Concentrated solar power
- Wind, Marine and geothermal energy
- Biomass
- Carbon Capture Utilization and Storage
- Hydrogen and biogas
- Life Cycle Cost of Electricity
- Storage: Compressed Air Energy Storage, flywheels, Batteries, thermal storage, ...

Initial competences

Basic engineering skills and mindset, interest in energy transition ans sustainability aspects of it.

Final competences

1 The main objective of the course is to increase the student's awareness on the sustainability of new emerging and existing energy technologies with the main focus on power production.
2 After the course, the student will have acquired a mindset and dispose of a set of tools to quickly evaluating the true potential of a new emerging energy technologies and the related technical and sustainability challenges. Sustainability not only being environmental (although Life Cycle Assessment is discussed in some detail in the course) but also social and economic aspects of new technologies are discussed throughout the course.

Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract

This course unit cannot be taken via an exam contract

Teaching methods

Guided self-study, excursion, lecture, seminar: practical PC room classes

Extra information on the teaching methods

Lectures: During the lectures the important elements of the course are highlighted and illustrated with a ppt presentation. Interaction with the students is highly welcomed.
Self-study: During the lectures, references to websites of technology developers, public authorities, utilities, associations, organizations like IEA, ... are given. It is recommended that students consult these references as to develop their critical view on their potential and sustainability.
Emerging technology assignment: In small groups of 4-5 students, the students are demanded to study in depth an emerging energy technology with respect to its technical potential, technical challenges and sustainability aspects. The two pager that is requested should discuss both the press coverage of the technology as well as the peer reviewed academic papers behind the technology. Comparing these different sources should allow the students to report a critical evaluation of the technology. Finally, the two pagers should be presented to the rest of the students through a set of slides.
Excursion: visit of an offshore wind substation production facility

Learning materials and price

Ppt presentations (available in electronic format, free of charge)

References

Websites as referred to in the ppt presentations.

Course content-related study coaching

Evaluation methods

end-of-term evaluation and continuous assessment

Examination methods in case of periodic evaluation during the first examination period

Open book examination, oral examination, assignment

Examination methods in case of periodic evaluation during the second examination period

Open book examination, oral examination, assignment

Examination methods in case of permanent evaluation

Open book examination, oral examination, assignment

Possibilities of retake in case of permanent evaluation

not applicable

Extra information on the examination methods

- 40 % of the marks on the two-pager presenting the critical evaluation of the new emering energy technology
- 20 % of the marks on the oral presentation of this 2-pager to the rest of the students through a set of slides
- 40 % of the marks on an oral examination with written open-book preparation

Calculation of the examination mark