Faculty of Science

MNXB05, Physics and Chemistry of Green and Sustainable Energy, 4 credits

Fysik och kemi för grön och hållbar energi, 4 högskolepoäng

First Cycle / Grundnivå

Details of approval

The syllabus was approved by The Education Board of Faculty of Science on 2025-05-23. The syllabus comes into effect 2025-05-23 and is valid from the spring semester 2026.

General information

The course is given as a stand-alone course.

Language of instruction: English

Main field of study	*Specialisation*
-	G1N, First cycle, has only upper-secondary level entry requirements

Learning outcomes

On completion of the course, students are to have acquired a scientific foundation in green energy technologies and to bridge the gap between public discourse and technical reality. Core concepts such as kilowatt-hours (kWh), megawatts (MW), and limitations of energy storage will be introduced and discussed. The course also covers the underlying chemistry and physics of solar and wind power, electrification, and energy storage technologies. Furthermore, the student will develop the ability to critically evaluate environmental trade-offs, including the production costs of solar cells and battery recycling in electric vehicles.

Knowledge and understanding

On completion of the course, the student shall be able to:

- describe phenomena in nature and in technical systems using the concepts of energy, power, and energy conversion

- explain the principles of solar cells, wind turbines, and batteries from atomic to macroscopic scales.

Competence and skills

On completion of the course, the student shall be able to:

- apply fundamental formulas to determine energy and power in basic contexts
- compare energy technologies using metrics, e.g., efficiency, scalability, and lifecycle emissions
- interpret energy-related data, such as grid capacity and storage duration
- discuss complex concepts in green energy technologies to non-technical audienceconduct a critical analysis of claims about green energy in media and policy documents

Judgement and approach

On completion of the course, the student shall be able to:

- identify and critically discuss different conceptions regarding green energy technology.
- critically analyse claims about green energy in media and policy documents.

Course content

The course consists of three parts:

Part 1: Physics of Green Energy

- fundamental principles of energy and power
- photon energy, photoelectric effect and solar cells
- thermal and geothermal energy, environmental energy and heat pumps
- nuclear energy, fission, fusion and tokamaks

Part 2: Chemistry of Green Energy

- solar energy, specifically the chemistry behind howperovskites, silicon solar cells, and dye-sensitized systems works
- solar fuels, including the processes of water splitting, photocatalysis for hydrogen production, and artificial photosynthesis.
- electrochemistry, including batteries (Li-ion, Na-ion), supercapacitors, and fuel cells
- circular chemistry, focusing on the recycling of photovoltaic panels, battery materials, and rare-earth elements

Part 3: Interdiciplinary topics

In this part, policy versus reality will be discussed through case studies as well as future frontiers in energy, such as the potential of fusion, next-generation energy storage technologies, and the societal barriers to widespread adoption of green energy solutions.

Course design

Teaching consists of lectures, seminars and projekt work. Participation in seminars and project work ans associated elements is compulsary.

Assessment

Assessment takes the form of a written and oral presentation of the project report during the course, a written exam at the end of the course as well as participation in compulsary components.

Students who do not pass a regular assessment will be offered another opportunity for assessment soon thereafter.

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

Grades

Grading scale includes the grades: Fail, Pass
For a Pass grade on the whole course, the student must have Pass grades on the exam, the presentation, the project report and compulsory components.

The grading scale for the exam, the project report and the compulsory components is Fail, Pass.

Entry requirements

General requirements and studies equivalent of courses English 6, Mathematics 2a or 2b or 2c, and Science 1b or 1a1+1a2/Physics 1a or 1b1+1b2/Chemistry 1 from Swedish Upper Secondary School.

Further information

The course cannot be included in a Science degree.

The course is offered at the department of Chemistry, Lund University.