

Programme-specific part of the Education and Examination Regulations 2022-2023

Graduate School of Geosciences: Master's degree programme in Energy Science

The Master's degree programme *Energy Science* offers the programme *Energy Science*.

Art. 2.1 – Admission requirements

1. The following conditions for admission apply:

Admission to the **Energy Science** programme is granted to students with a Dutch or foreign diploma confirming that they have acquired the knowledge, insight and skills at the university Bachelor's level. Furthermore, students need to prove that they have gained the following specific knowledge, insight and skills:

- a) knowledge in the field of *Environmental Sciences, Science and Innovation Management, Physics* or *Chemistry* at the advanced level of the major *Environmental Sciences, Science and Innovation Management, Physics* or *Chemistry* at Utrecht University (or equivalent to that level)
 - b) knowledge of *Thermodynamics, Energy Analysis* and *Mathematics*
 - c) insight into *Environmental Sciences, Science and Innovation Management, Physics* or *Chemistry* at the advanced level of the major *Environmental Sciences, Science and Innovation Management, Physics* or *Chemistry* at Utrecht University (or equivalent to that level)
 - d) academic and research skills at the advanced level of the major *Environmental Sciences, Science and Innovation Management, Physics* or *Chemistry* at Utrecht University (or equivalent to that level)
2. Students will be selected based on objective standards regarding:
- a) their previous academic performance in a relevant subject area
 - b) relevant skills
 - c) their command of the language or languages used in the programme
 - d) the following additional selection criteria with proven relevance for the opinion on the suitability of the candidate:
 - motivation
 - average grade

This information is used to consider whether the student concerned will be able to complete the Master's Programme successfully within the set time period.

The admission requirements have been formulated clearly and transparently so that candidates know in advance what requirements must be met in order to qualify for selection.

Art. 3.1 – Aim of the degree programme

1. The degree programme aims to:
 - provide students with specialised knowledge, skills and understanding in the field of *Energy Science* so that they can achieve the final qualifications as mentioned in Article 3.1.2
 - prepare students for professional employment in one or more disciplines of *Energy Science*
 - prepare students for training as researchers in the field of *Energy Science*
2. Graduates in *Energy Science*
 1. have advanced knowledge and understanding of the dynamics and challenges of *Energy Science* in the context of both organisations and society at large
 2. can conduct research on the dynamics and challenges of *Energy Science* in a creative and independent way
 3. can apply knowledge and research methods as well as problem-solving abilities in broader contexts related to the dynamics and challenges of *Energy Science*
 4. have insight into the complex interactions between science, innovative technology and society and are able to reflect critically on the roles of science and technology in society
 5. have professional and academic skills, particularly in relation to the dynamics and challenges of *Energy Science*
 6. can apply knowledge and understanding in such a way that they demonstrate a professional approach to their work
 7. can communicate their conclusions, as well as the knowledge, reasons and considerations underlying these conclusions, to an audience of specialists and non-specialists alike

More programme-specific qualifications are listed in the prospectus of the programme.

Art. 3.6 – Components of the Master’s programme

1. Appendices 1 and 2 describe the required courses of the programme, including the course load per course.
2. Students may choose optional courses. The course load of the optional courses are listed in Appendices 1 and 2. The rules for choosing optional courses are listed in Appendix 3.
3. The requirements for the Annotation Sustainable Entrepreneurship and Innovation can be found in Appendix 4.
4. The prospectus gives a detailed description of the content and type of courses in the programme, including prior knowledge that is required to participate successfully.

Art. 4.2 – Course admission requirements

The Executive Board decides the order in which the required components of a Master’s degree programme must be completed. This has been listed in Appendix 5.

Art. 4.7 –Evaluation of the quality of education

1. The Director of Education monitors the quality of education, and ensures that both the courses and the curriculum are evaluated. The Director takes into consideration the advice and suggestions given by the Education Committee regarding improving and ensuring the quality of the programme.
2. Students are informed of the outcomes of the course and curriculum evaluations.

Appendices

Appendix 1: Exam programme Energy Science, track Systems Analysis

1. Compulsory components (52.5 EC)

-	Energy in the Context of Sustainability	7.5 EC
-	Energy conversion Technologies I	7.5 EC
-	Energy conversion Technologies II	7.5 EC
-	Advanced Energy Analysis	7.5 EC
-	Energy Systems Modelling	7.5 EC
-	Consultancy Project ES	15 EC

2. Thesis components (30 EC or 45 EC)

-	Master's thesis	30 EC
-	Master's thesis	45 EC

3. Optional components (22.5 EC or 37.5 EC)

Students should select optional courses for a total of 22.5 EC or 37.5 EC.

4. Conversion of former courses

Not applicable in 2022-2023

Appendix 2: Exam programme Energy Science, track Natural Science

1. Compulsory components (97.5 EC)

-	Energy in the Context of Sustainability	7.5 EC
-	Energy conversion Technologies I	7.5 EC
-	Energy conversion Technologies II	7.5 EC
-	Advanced Energy Analysis	7.5 EC
-	Energy Systems Modelling	7.5 EC
-	Master's thesis	30 EC
-	Natural Science Research Project	30 EC

2. Optional components (22.5 EC)

Students should select natural science courses for a total of 15 EC.

Students should select other optional courses for a total of 7.5 EC.

3. Conversion of former courses

Not applicable in 2022-2023

Appendix 3: Rules for choosing elective courses

1. Students in the Master's programme choose elective courses from another or their own Master's programme. Courses that are obligatory in the exam programme cannot be used as elective courses.
2. Honours programmes for Master's students (e.g. Young Innovators, GHIS, Leadership Programme) do not count towards the electives in the programme.
3. Electives as mentioned in the student's academic progress review in Osiris are pre-approved by the programme leader and by the Board of Examiners. Students can enrol for those courses via Osiris. It remains the student's responsibility to make sure that the points mentioned under 6 d-f are met. If the course is from another department than the Copernicus Institute, it may be that other students have priority and that they are therefore placed on a waiting list.
4. It is possible to choose other courses than the pre-approved courses mentioned in Osiris. Any non-pre-approved elective courses must be subjected in advance to the programme leader and the Board of Examiners for approval. The programme leader will advise the Board in this matter.
5. The application for a non-pre-approved elective is done by a written request (form) to the programme leader. Written information on the content, the level, and the study load of the course (preferably by means of a copy of the course's description from the course catalogue) must be attached. The 'Application Form Elective courses Copernicus' can be found in the Blackboard community Energy Science.
6. The programme leader tests the proposed elective course(s) on the following criteria:

- a. It must be thematically linked to the Master's programme;
- b. It concerns a course at master level (M);
- c. There is no overlap in content with courses still to be taken or already taken.

The student is responsible for making sure that:

- d. The course is available to students of the ES programme;
 - e. The student fulfills the entrance requirements of the course (if applicable). Actual participation is only possible if students satisfy the course's entrance conditions; in case of doubt they should contact the course coordinator first;
 - f. The course is not taught in the same period and timeslot as another course the student has selected.
7. If the programme leader has declared that the elective course(s) meet the criteria under 6a-c (by either signing the application form or by email), the student sends the (signed) application form (and programme leader's email if applicable) and the course information to the Board of Examiners (Boardofexaminers.geo@uu.nl). The Board of Examiners takes the final decision on whether or not the elective is approved.
8. In the programme's course schedule, room has been reserved for taking electives. However, the student is free to deviate from this planning, e.g. because she/he wishes to take an interesting elective course in another period. If this causes delay in the study planning, the responsibility is for account of the student! Students are therefore advised to take their electives in the reserved periods and timeslots, or use a part of the time planned for their internship and/or Master's thesis.

Appendix 4: Requirements for the Annotation Sustainable Entrepreneurship and Innovation

In order to qualify for the annotation, the following three requirements must be fulfilled:

- 1) having passed the examinations of one of these two courses:
 - Innovation Management (GEO4-2268; 7,5 EC) with an assignment regarding a sustainability subject;
 - or:*
 - Sustainable Entrepreneurship (ECMSE; 7,5 EC).
- 2) having passed the examinations of one of these (elective) courses, which may not be the same course as the course passed for fulfillment of requirement 1 mentioned above:
 - GEO4-2521: Bio-based economy
 - GEO4-2514: Energy in the Context of Sustainability
 - GEO4-2604: Governance and Change Management for Sustainability (SBI students have priority)
 - GEO4-2268: Innovation Management
 - GEO4-5501: Techniques of Futuring
 - ECMSE: Sustainable Entrepreneurship
- 3) having conducted a research project of at least 15 EC related to the subject of Sustainable Entrepreneurship & Innovation. This must be achieved with the Master's Thesis (GEO4-2510; 30 EC or GEO4-2523; 45 EC) or with the Consultancy Project (GEO4-2519; 15 EC) on a subject related to Sustainable Entrepreneurship & Innovation.

The requirements for the research component are:

- It is about newly developed or to be developed sustainable production processes, products, and/or services created by firms (within established firms and/or new start-ups);
- These activities need to be new to the current business activities of these firms;
- It needs to include some form of data collection about these new business activities.

Appendix 5: Entrance requirements 2022-23

Course	Entry requirements/recommended prerequisites
Sustainable Food Systems (GEO4-2005)	Letter of acceptance of a Master's programme
Energy conversion technologies I (GEO4-2502)	Recommended prerequisites: <ul style="list-style-type: none"> - Strong foundation of thermodynamics, heat transfer and calculus
Energy conversion technologies II (GEO4-2503)	Recommended prerequisites: <ul style="list-style-type: none"> - Strong foundation of thermodynamics and calculus

Advanced Energy analysis (GEO4-2508)	Recommended prerequisites: <ul style="list-style-type: none"> - Strong foundation of Energy Analysis and calculus
Master's thesis 30 EC (GEO4-2510)	<ul style="list-style-type: none"> - Letter of acceptance MSc Energy Science - At least 45 EC passed within the programme Energy Science including: <ul style="list-style-type: none"> • Advanced Energy Analysis (GEO4-2508) • Energy Conversion Technologies I (GEO4-2502) • Energy Conversion Technologies II (GEO4-2503) • Energy Systems Modelling (GEO4-2515) Recommended prerequisites: <ul style="list-style-type: none"> - Consultancy Project (GEO4-2519)
Photovoltaic Solar Energy Physics and Technology (GEO4-2513)	Recommended prerequisites: <ul style="list-style-type: none"> - Basic knowledge of solid state physics or condensed matter physics - Calculus skills
Energy in the Context of Sustainability (GEO4-2514)	<ul style="list-style-type: none"> - Letter of acceptance MSc Energy Science or MSc Innovation Sciences
Energy Systems Modelling (GEO4-2515)	Recommended prerequisites: <ul style="list-style-type: none"> - Energy Analysis (GEO3-2223) - Advanced Energy Analysis (GEO4-2508)
Tailor made course ES (GEO4-2517)	<ul style="list-style-type: none"> - Letter of acceptance MSc Energy Science - At least 45 EC passed within the programme
Natural Science Research Project (GEO4-2518)	<ul style="list-style-type: none"> - Obligatory for Natural Science track - Letter of acceptance MSc Energy Science Passed examinations of: <ul style="list-style-type: none"> - Advanced Energy Analysis (GEO4-2508) - Energy Conversion Technologies I (GEO4-2502) - Energy Conversion Technologies II (GEO4-2503) Recommended prerequisites: <ul style="list-style-type: none"> - At least one natural science elective - Energy Systems Modelling (GEO4-2515)
Consultancy project (GEO4-2519)	<ul style="list-style-type: none"> - Letter of acceptance MSc Energy Science - Only open to students in track Systems Analysis Recommended prerequisites: <ul style="list-style-type: none"> - Advanced Energy Analysis (GEO4-2508) - Energy Systems Modelling (GEO4-2515)
Internship Energy Science 22.5 EC (GEO4-2520)	<ul style="list-style-type: none"> - Only open to students in track Systems Analysis - Letter of acceptance MSc Energy Science Passed examinations of: <ul style="list-style-type: none"> - Advanced Energy Analysis (GEO4-2508) - Energy Conversion Technologies I (GEO4-2502) - Energy Conversion Technologies II (GEO4-2503) - Energy Systems Modelling (GEO4-2515) Recommended prerequisites: <ul style="list-style-type: none"> - Consultancy Project (GEO4-2519)
Bio-based Economy (GEO4-2521)	<ul style="list-style-type: none"> - Letter of acceptance MSc Energy Science or MSc Innovation Sciences or MSc Sustainable Development or MSc Sustainable Business & Innovation or MSc Chemistry Recommended prerequisites: <ul style="list-style-type: none"> - Advanced Energy Analysis (GEO4-2508) - Life Cycle Analysis (GEO3-2124; BSc course) - Toolbox 1 (GEO4-2602) - Science and Technology for Sustainable Development (SK-BCHDO; BSc course)
Energy in the Built Environment (GEO4-2522)	<ul style="list-style-type: none"> - Letter of acceptance MSc Energy Science or MSc Innovation Sciences or MSc Sustainable Development or MSc Sustainable Business & Innovation Recommended prerequisites: <ul style="list-style-type: none"> - Basic principles of energy flows in the built environment, i.e. electricity, heat and gas networks. - Basic knowledge on power system planning & operation and electricity markets.
Master's thesis 45 EC (GEO4-2523)	<ul style="list-style-type: none"> - Letter of acceptance MSc Energy Science - At least 45 EC passed within the programme Energy Science including: <ul style="list-style-type: none"> • Advanced Energy Analysis (GEO4-2508) • Energy Conversion Technologies I (GEO4-2502) • Energy Conversion Technologies II (GEO4-2503) • Energy Systems Modelling (GEO4-2515)

	Recommended prerequisites: - Consultancy Project (GEO4-2519)
Internship Energy Science 15 EC (GEO4-2524)	- Only open to students in track Systems Analysis - Letter of acceptance MSc Energy Science Passed examinations of: - Advanced Energy Analysis (GEO4-2508) - Energy Conversion Technologies I (GEO4-2502) - Energy Conversion Technologies II (GEO4-2503) - Energy Systems Modelling (GEO4-2515) Recommended prerequisites: - Consultancy Project (GEO4-2519)
Techniques of Futuring (GEO4-5501)	None