

Appendices Teaching and Examination Regulations Master's Degree Programme 2010-2011

Energy and Environmental Sciences

Appendix A Teaching outcomes of the degree programme (art. 1.3)

Energy and Environmental Sciences (EES) Master General
A KNOWLEDGE
A1) The Master has knowledge of principles, basic assumptions and historic development and the interdisciplinary and international character of EES.
A2) The Master has extensive knowledge of basic concepts and methods of EES and has knowledge of the interdisciplinary context of these concept and methods.
A3) The Master has knowledge of the quantitative and qualitative character of EES and has knowledge of the methodologies used in EES, including application and design of models.
A4) The Master has specialised knowledge of a number of recent issues and related methods within EES.
B SKILLS AND ATTITUDES
B1 Performing research
The Master can independently make a research plan and complete the research based on his specialism. The Master can deal with the complexity of the research process and if necessary can redirect the research with regard to external circumstances and/or new insights. The master is capable of evaluating and reflecting on scientific research within his specialism.
B2 Solving (design) problems
The Master can independently and based on his specialism formulate research questions and can address and evaluate them. The master can participate in an interdisciplinary team in order to jointly solve complex (design) problems.
B3 Collecting data
The Master can collect relevant information and data and is able to critically assess its scientific value. The Master is able to draw conclusions based on incomplete or limited information.
B4 Cooperating
The Master can cooperate in a multidisciplinary team aimed at solving complex problems.
B5 Communicating
The Master can verbally and in writing communicate, in English, his research as well as the underlying knowledge, motives and considerations to an audience of specialists and/or non-specialists.
B6 Reflecting
The Master can act critically and largely independently in an academic, scientific and professional context. The Master takes into account social and ethical considerations related to his research. The Master can make relevant choices with regard to the start of his career.

Final qualifications for the specializations

The EES Master's degree programme has two specializations:

- "System Studies on Energy and Environment"
- "Experimental Studies of Energy and Climate"

Specialization "System Studies on Energy and Environment"
teaching outcomes (in addition to "EES master general").

"System Studies on Energy and Environment"
A KNOWLEDGE
A1-1) The master has knowledge of the complex relations between energy and other resources (renewable en non-renewable) and societal functions related to various scales in space and time in the context of a transition to sustainability and environmental quality.
A1-2) The Master has knowledge of the relation between production and consumption systems in the context of a transition to sustainability and environmental quality.
A1-3) The Master has knowledge of technological and scientifically based methodologies within EES and can consider them within an individual, societal and policy context from an interdisciplinary perspective.
B SKILLS AND ATTITUDES
B1-1) The Master can independently perform scientific research based on methodologies to analyse and evaluate energy and resource issues from an integrated systems perspective.
B1-2) The Master can design realistic models and scenarios of energy and resource issues within clearly delineated system boundaries. The Master can evaluate model and scenario results with respect to sustainability, feasibility and acceptability.
B1-3) The Master can critically evaluate various data sources and can integrate them in his own research.

The specialization "Experimental Studies of Energy and Climate" has the following additional teaching outcomes:

Specialization "Experimental Studies of Energy and Climate"
teaching outcomes (in addition to "EES master general").

"Experimental Studies of Energy and Climate"
KNOWLEDGE
A2-1) The Master has knowledge of the various characteristics of the earth climate system, especially climate history, climate change and its contributing factors and more specifically the carbon cycle.
A2-2) The Master has knowledge of naturally occurring stable and radioactive isotopes. This comprises especially the chemical and physical aspects of the variation in isotope occurrence.
A2-3) The Master has knowledge of the use of natural isotopes as tracers, especially regarding applications in climate history and global cycles like that of water and carbon.
A2-4) The Master has knowledge of the principles of various measurement systems used in environmental research
SKILLS AND ATTITUDES
B2-1) The Master can independently perform experimental scientific research using laboratory equipment and methods.
B2-2) The Master is able to apply sophisticated software systems to run measuring equipment, analyse data, and to design and execute basic models.

Appendix B: Specializations of the degree programme (art. 2.2)

The Msc. Energy and Environmental Sciences programme has two specializations:

1. "System Studies on Energy and Environment"
2. "Experimental Studies of Energy and Climate"

Appendix C: Content of the degree programme (art. 2.3)+ Appendix E: compulsory order of examinations (art. 3.2)

1. "System Studies on Energy and Environment":

module	ECTS	entry requirements	assessment	practical
Introduction to Energy and Environmental Sciences (Intro EES) **	5	-	paper, oral presentation, assignments, exam **	
Resources and Sustainable Development (R&SD)**	15	Intro EES	assignments, presentations, papers, exam **	computerlab
Energy and Materials (E&M)	10	R&SD	projectwork, presentations, assignments, reports, exam	computerlab
Current Topics in Energy and Environmental Sciences (Current Topics)	5	R&SD	assignments, written report	
Optional modules	25	see appendix D	see appendix D	see app. D
Training Thesis*	25-45	R&SD, E&M, Current Topics	plan, process, presentation, written report	research
Master Thesis*	25-45	R&SD, E&M, Current Topics, optional courses, training thesis	plan, process, presentation, written report	research

* training thesis and master thesis together at least 60 ECTS; ** all separate parts that are assessed have to be passed.

2. "Experimental Studies of Energy and Climate":

module	ECTS	entry requirements	assessment	practical
Introduction to Energy and Environmental Sciences (Intro EES) **	5	-	paper, oral presentation, assignments, exam **	
Resources and Sustainable Development (R&SD) **	15	Intro EES	assignments, presentations, papers, exam **	computerlab
Experimental Methods of Trace Gas Research (EMTGR)	5		assignments, lab reports, exam	laboratory work
Global Change	10	R&SD	assignments, written report, exam	computerlab
Current Topics in Energy and Environmental Sciences (Current Topics)	5	R&SD	assignments, written report	
Optional modules	20	see appendix D	see appendix D	see app. D
Training Thesis*	25-45	R&SD, EMTGR, Global Change, Current Topics	plan, process, technical and/or laboratory skills, presentation, written report	research
Master Thesis*	25-45	R&SD, EMTGR, Global Change, Current Topics, optional courses, training thesis	plan, process, (technical and/or laboratory skills), presentation, written report	research

* training thesis and master thesis together at least 60 ECTS; ** all separate parts that are assessed have to be passed.

Appendix D: Optional modules of the degree programme (art. 2.4)

Each specialization has a separate package of optional modules.

1. "System Studies on Energy and Environment"

The specialization "System Studies on Energy and Environment" has 25 ECTS of optional modules. At least 15 ECTS have to be chosen from the following list of modules:

Optional course	EC	Faculty/Department
Experimental Methods of Trace Gas Research	5	FWN/EES (CIO)
Global Change A (+B)	5 (+5)	FWN/EES (CIO)
Global Development Studies	6	Center for Development Studies
Zonnecellen (in Dutch)	5	FWN/Chemistry
Infrastructure Planning	5	Spatial Sciences
Environmental Planning	5	Spatial Sciences
Ruimtelijke Informatiekunde: geografische informatiesystemen	5	Spatial Sciences
Water Management and Integrated Coastal Zone Management	5	Spatial Sciences
Process and Projectmanagement	5	Spatial Sciences
Environmental Economics	5	Economics & Business
Environmental Psychology	5	Behavioural & Social Sciences
Omgevingsrecht 1 (in Dutch)	6	Law
Omgevingsrecht 2 (in Dutch)	6	Law
Energy Law	5	Law
European Environmental Law	6	Law

After approval of the Board of Examiners 10 ECTS of optional modules can be chosen from other modules than the courses in the list or can be added to the Training Thesis or Master Thesis.

2. "Experimental Studies of Energy and Climate":

The Specialization "Experimental Studies of Energy and Climate" has 20 ECTS of optional modules. At least 10 ECTS have to be chosen from the following list of modules (Possibilities depend on your background):

Optional course	EC	FWN Department
Energy & Materials	10	FWN/EES (IVEM)
Mathematical Methods for Physicists	5	Physics
Physics of Continuous Media	5	Physics
Device Physics	5	Physics
Principles of Measurement Systems	5	Physics
Statistical Methods in Physics	5	Physics
Scientific visualization	5	Physics
Zonnecellen (in Dutch)	5	Chemistry
Biocatalysis & Green Chemistry	5	Chemistry

After approval of the Board of Examiners 10 ECTS of the optional modules can be chosen from other modules than the courses in the list or can be added to the Training Thesis or Master Thesis.

Appendix F Admission requirements (art. 4.1; 4.2)

The Msc. Energy and Environmental Sciences programme has two specializations:

1. "System Studies on Energy and Environment"
2. "Experimental Studies of Energy and Climate"

Each specialization has different admission requirements.

1. Requirements for admission to the specialization "System Studies on Energy and Environment":

2. Requirements for admission to the specialization "Experimental Studies of Energy and Climate":

Holders of the following Bachelor's degrees from the University of Groningen are considered to have sufficient knowledge and skills and will be admitted to the specialization "Experimental Studies of Energy and Climate" of the Master's degree programme in Energy and Environmental Sciences on that basis:

- a Bachelor's degree in Chemistry
- a Bachelor's degree in Chemical Engineering
- a Bachelor's degree in Physics
- a Bachelor's degree in Applied Physics
- a Bachelor's degree in Astronomy