



Appendices for the Master's Degree Programme(s) in Energy and Environmental Sciences

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Appendix I. Learning outcomes of the Degree Programme (art. 3.1)

Introduction

Appendix 1 presents the two parts of the EES learning outcomes. The first part of the learning outcomes is specific and concerns knowledge and skills. These learning outcomes are covered in the obligatory part of the EES programme.

The second part of the learning outcomes is more general. It focuses on the final skills a student is capable of. This part is mostly covered by the research projects.

Learning outcomes

The aims of the EES programme result in the following outcomes:

Specific academic knowledge and skills for the MSc EES

The graduate is able:

Sa) to analyse:

1. Energy and resource use and their impact on the environment and on the planet;
2. (Dis) advantages of the use of various energy sources from a sustainability viewpoint;
3. Current and future developments in the energy & environment research field;
4. Policy developments in the energy & environment field.

Sb) to assess how changes in societal, environmental or technical systems will affect energy and resource use and their consequences.

Sc) to evaluate the role of other academic non-natural science disciplines in the energy & environment research field.

Sd) to determine its career perspectives within the energy & environment field.

General academic skills for the MSc EES

The graduate is able:

G1. to write a review about literature in relevant subfields;

G2. to effectively gain information within the field of Energy and Environmental Sciences (EES);

G3. to formulate a research plan based on a general problem description or question in a subfield of EES;

G4. to analyze and assess state-of-the-art research information and draw conclusions from these results;

G5. to collaborate in a multidisciplinary team;

G6. to communicate its own findings to the scientific community (oral presentation, written report and debate);

G7. to design, conduct and evaluate experiments/scenarios/other scientific methods;

G8. to evaluate its own results and conclusions compared to knowledge in the literature;

G9. to function scientifically in a situation in which knowledge and research skills within the field of EES are required;

G10. to consider its own position in society to come to a sensible choice of profession.



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Appendix II. Tracks/specializations (art. 3.6)

The Degree Programme is not divided into tracks/specializations.



Appendix III. Content of the Degree Programme (art. 3.8)

Table 1: Overview of the obligatory courses.

Course unit	Course code	ECTS	Practical	Entry requirements
Data Analysis and Statistical Methods (DASM)	WMEE001-05	5	Yes	None
Impacts of Energy and Material Systems (IEMS) <i>Including workshop about reading and searching literature</i>	WMEE002-05	5	Yes	None
Sustainable Use of Ecosystems (SUE) <i>Including workshop about oral presentation</i>	WMEE003-05	5	Yes	None
Sustainability and Society (S&S)	WMEE005-05	5	Yes	None
Systems Integration and Sustainability (SIS)	WMEE006-05	5	Yes	None

Table 2: Overview of the different variants.

	Course code	ECTS	Practical	Entry requirements
<u>Variant 30/30</u>				
YEAR 1				
Obligatory courses		25		
Core electives, see Table 4		5 or 10 or 15 (at least one core elective is required)		
Electives, see Table 5 and 6		35 are required for (core) electives in total		
YEAR 2				
Research Project 1 <i>including instructions on academic writing</i>	WMEE905-30	30	Yes	Obligatory courses DASM, IEMS, SUE, S&S, SIS, at



				least one core elective and Scientific Integrity EES module
Research Internship/Research Project 2	WMEE906-30	30	Yes	Research project 1 and (core) elective(s) (to complete sufficient credits for electives)
<u>Variant 40/30</u>				
YEAR 1				
Obligatory courses		25		
Core electives, see Table 4		5 or 10 or 15 (at least one core elective is required)		
Electives, see Table 5 and 6		25 are required for (core) electives in total		
YEAR 2				
Research Project 1 <i>including instructions on academic writing</i>	WMEE905-40	40	Yes	Obligatory courses DASM, IEMS, SUE, S&S, SIS, at least one core elective and Scientific Integrity EES module
Research Internship/Research Project 2	WMEE906-30	30	Yes	Research project 1 and (core) elective(s) (to complete sufficient credits for electives)



Variant Science, Business and Policy				
YEAR 1				
Obligatory courses		25		
Elective, see Table 5 and 6		5		
Research Project 1 <i>including instructions on academic writing</i>	WMEE905-30	30		Obligatory courses DASM, IEMS, SUE, S&S, SIS and Scientific Integrity EES module
YEAR 2				
Introduction Science & Policy	WMSE002-10	10		
Introduction Science & Business	WMSE001-10	10		
Work Placement Business and Policy	WMSE902-40	40		Research project 1, Introduction to Science and Policy, Introduction to Science and Business

In addition to the above scheme, the following rules apply:

- Depending on the student's background and the topic of the intended research project(s), a package of electives (See Table 4, 5 and 6) is composed. This package of electives is discussed with the mentor (a senior staff member).
- The student is allowed to choose (an) elective(s) from another Master's Degree Programme, which is (are) not mentioned in Table 4, 5 or 6. The student needs to motivate its choice. The mentor and the Board of Examiners have to approve this choice.
- Research project 1 must be an internal project, performed at an ESRIG (Energy and Sustainability Research Institute) or affiliated group, under supervision of one of the examiners of the Degree Programme. For the assessment, two examiners of the Degree Programme must be involved.
- Research Internship/Research Project 2 may be performed at an ESRIG group, but may also be performed outside the university at a company, consultancy firm, government institution, research institute or another university. For the assessment, two examiners of the Degree Programme must be involved. The supervisor from the external organization has to be on academic level. The external supervisor is not an examiner, but is requested to give advice on the assessment.
- The subject of the SBP-work placement must be clearly related to the scientific domain of the EES master programme (see Appendix I, learning outcome Sa1). Therefore, two examiners must be involved in the assessment of the work placement: one SBP-examiner and one examiner of the Degree Programme.
- To pass the final assessment of the EES programme, the student has to have completed the following modules: Colloquia Energy and Environmental Sciences (WMEE017-00), Career Perspectives (EES) (WMEE018-00) and Scientific Integrity EES (WMEE019-00).



**Joint project options for obtaining a master's degree in a closely related programme
(see also Basic TER FSE Master's degree projects Art. 5.8.2)**

Table 3. Joint project options.

Course unit	Course code	ECTS credits	Entry requirements
Master's Research Project IEM-EES*	WMEE907-40	40	See entry requirements Research project 1 EES
Master's Research Project ME-EES**	WMEE909-50	50	See entry requirements Research Project 1 EES

*The joint Master's Research Project IEM-EES is available only to students enrolled in both the Energy and Environmental Sciences resp. Industrial Engineering and Management (IEM) MSc programmes. This joint project replaces, and cannot be combined with, the Research Project 1 EES. For the conditions and the entry requirements of IEM regarding this project, check the TER Appendices MSc IEM.

**The joint Master Research Project ME-EES is available only to students enrolled in both the Energy and Environmental Sciences resp. Mechanical Engineering (ME) MSc programmes. This joint project replaces, and cannot be combined with, the regular Research Project 1 EES. For the conditions and the entry requirements of ME regarding this project, check the TER Appendices MSc ME.



Appendix IV. Electives (art. 3.9.1)

Table 4. Overview of the core electives.

Course unit	Course code	ECTS	Practical	Entry requirements
Modeling Energy and Material Systems (MEMS)	WMEE009-10	10	Yes	
Global Change (GC)	WMEE008-05	5	Yes	

Table 5. Overview of the other electives offered by EES.

Course unit	Course code	ECTS	Practical	Entry requirements
Climate Modelling (CM)	WMEE012-05	5	Yes	Global Change
Conceptualizing and Modeling Human-Environmental Systems (CAMHES)	WMEE011-05	5	No	
Energy and Complexity Nexus (ECN)	WMEE18002	5	Yes	
Experimental Methods of Trace Gas Research (EMTGR)	WMEE007-05	5	Yes	
Fuel Cell Systems (FCS)	WMEE015-05	5	No	
Nuclear Power Technology (NPT)*	WMEE014-05	5	No	
Radiocarbon Dating and Analysis (RDA)	WMEE013-05	5	Yes	
Geo-Energy and Subsurface Processes**	WMEE004-05	5	No	

*It is not allowed to choose Nuclear Power Technology if the student already passed the Nuclear Energy course in its Bachelor's Degree Programme at the UG.

** It is not allowed to choose Geo-Energy and Subsurface Processes if the student already passed the Geo-Energy course in its Bachelor's Degree Programme at the UG.



Electives offered by other Degree Programmes

Students can select other electives from other Degree Programmes. For the number of ECTS, Practical, and Entry requirements, see the course catalogue Ocasys. Table 6 gives an overview of possible electives.

Table 6. Overview of possible electives offered by other Degree Programmes.

Electives of other Degree Programmes in the Faculty of Science and Engineering:

WMCE 007-05	Advanced Product Engineering
WMCE001-05	Bio-based Products
WMCE013-05	CFD for Engineers
WMCH027-05	Biocatalysis and Green Chemistry
WMCH011-05	Photovoltaics Science and Energy***
WMIE018-05	Bioprocess Technology
WMIE029-05	Engineering Design Integration
WMIE021-05	Systems Engineering
WMIE006-05	Technology Based Entrepreneurship
WMME029-05	Electrochemical Systems & Engineering
WMME019-05	Hydrogen, Fuels and Electrolysers
WMME018-05	Thermodynamics of Energy Conversion
WMSE001-10	Introduction Science and Business
WMSE002-10	Introduction Science and Policy
WMMB008-05	Marine Ecosystem Service and Global Change
WMMB009-05	Polar Ecosystems
WMPH027-05	Physics of Lasers
WMPH030-05	Statistical Methods in Physics
WMEC012-05	Citizen Science: Introduction, State of the Art, and Applications
WMEC006-05	Skills in Science Communication
TEM0105	Basiscursus Master Lerarenopleiding
TEM0205	Masterstage 1 Lerarenopleiding

***It is not allowed to choose Photovoltaics Science and Energy when the student already passed Solar Cells in its Bachelor's Degree Programme at the UG.



Electives of Faculty of Economics and Business:

EBM148B05	Regulating Energy Markets
EBM167A05	Energy Transition & Innovation
EBM201A05	Global Supply Chain Man & Sustainability
EBM192A05	Marketing and Consumer Well-being
EBM202A05	Sustainable Energy Supply

Electives of Faculty of Spatial Sciences:

GEMDILEIP	Dilemmas in Infrastructure Planning
GEMREENVPL	Reinventing Environmental Planning
GEMSOCIMAS	Social Impact Assessment
GEMTRWATM	Transitions in Water Management
GEMIPS	Interdisc Perspectives on Sustainability

Electives of Faculty of Behavioural and Social Sciences:

PSMSB-2	Environmental Psychology
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Appendix V. Entry requirements and compulsory order (art. 4.4)

The entry requirements and compulsory order of examinations are mentioned in Appendix III. The conditional entry requirements for individual modules (electives) and order of examinations are listed in Ocasys.



Appendix VI. Admission to the Degree Programme (art. 2.1A.1 + 2.1B.1)

Requirements for admission to the MSc Energy and Environmental Sciences:

Holders of the following Bachelor's degrees from the University of Groningen are considered to have sufficient knowledge and skills and will be directly admitted to the Master's Degree Programme in Energy and Environmental Sciences:

- Applied Mathematics
- Applied Physics
- Artificial Intelligence
- Astronomy
- Biology
- Biomedical Engineering
- Chemical Engineering
- Chemistry
- Computing Science
- Industrial Engineering and Management Science
- Life Science and Technology
- Mathematics
- Pharmacy
- Physics



Appendix VII. Transitional provisions (art. 7.1)

Students who started in 2019-2020 or earlier are still allowed to complete Variant 40/20 with a Research project 1 (WMEE905-40) of 40 ECTS and an Internship (WMEE903-20) of 20 ECTS. For the Internship, the student has to get the internship proposal approved by the Board of Examiners before the start.



Appendix VIII. Additional Requirements Open Degree Programmes (art. 3.10)

Students wishing to pursue an Open Degree Programme may file a request with the Board of Examiners. The Board of Examiners will evaluate whether the proposed curriculum meets the learning outcomes of the Degree Programme and can determine further conditions in their Rules and Regulations.