

Assessment report
Limited Framework Programme Assessment

Master Applied Earth Sciences

Delft University of Technology

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1. Executive summary

In this executive summary, the panel presents the main considerations which led to the assessment of the quality of the Master Applied Earth Sciences programme of Delft University of Technology, which has been assessed according to the standards of the limited framework, as laid down in the NVAO Assessment framework for the higher education accreditation system of the Netherlands, as published on 20 December 2016 (Staatscourant nr. 69458).

The programme objectives are relevant and sound. The panel welcomes the focus of the programme on the integration of engineering, geology and science, making this a unique programme in the Netherlands. The panel encourages the programme to maintain this profile and this unique position. The panel advises to adapt the programme to the energy transition trend, moving from hydrocarbon energy sources to new sources of energy. In addition, the panel advises to address mitigation and risk management subjects in the programme, and to focus on reservoir engineering with different fields of application. The programme objectives meet the Earth Sciences domain-specific reference framework. The panel appreciates the efforts by the joint Earth Sciences programmes in the Netherlands to draft this framework and regards this to be the sound and up-to-date description of this domain. The panel welcomes the programme having been benchmarked against programmes in other countries, demonstrating the profile and the specific features of the programme.

The panel approves of students being prepared to enter the international labour market, both for positions in a range of organisations and industries or to proceed to PhD trajectories.

The panel is positive about the tracks and specialisations offered within the programme, as these allow students to tailor the programme to their preferences. As the panel has observed, the jointly with foreign universities organised, triple-degree tracks are founded on comprehensive written agreements between Delft University of Technology and the universities concerned.

The general intended learning outcomes of the programme correspond to the programme objectives, are comprehensive and conform to the master level. The panel appreciates both the domain-specific knowledge and skills and the more general academic skills, articulated in the intended learning outcomes. The intended learning outcomes of the tracks address the specific aspects and features of these tracks. The tracks' intended learning outcomes are covered by the general learning outcomes of the programme.

The panel regards the entry requirements to be clear and relevant. The admission procedures are adequate. As the curriculum is very challenging, the panel advises to inform prospective students clearly about the high study load.

The curriculum of each of the tracks meets the intended learning outcomes of the programme. The courses in the curriculum are up to standard. The track-related concepts and theories are adequately addressed. The panel welcomes the real-life case studies and the practical laboratory and fieldwork components in the curriculum. The panel advises to foster the curriculum coherence across the tracks.

The panel regards the lecturers in the programme to be capable researchers and skilled lecturers. Their educational capabilities are up to standard, as may be deduced from the proportion of UTQ-certified lecturers. The panel feels the lecturers' workload to be challenging, but manageable.

Although the programme has an educational concept, the panel recommends to formalise this concept and tailor it to the challenging nature of the programme. The panel proposes to consider new study methods to allow students to proceed through the programme more easily. The panel also suggests to monitor the study load of courses and the scheduling of resits. The panel also advises to reorganise small courses into larger and more coherent blocks. The number of hours of face-to-face education and the students-to-staff ratio are satisfactory. To improve study guidance, the panel proposes to raise the number of academic counsellors for the programme. The panel perceives the number of drop-outs as well as the student success rates to be adequate.

The examinations and assessment rules and regulations of the programme are appropriate. Although the position and activities of the Board of Examiners are satisfactory, the panel advises the Board to be more pro-active in monitoring examinations and assessments. The examination methods of the courses are appropriate and are consistent with the course goals and contents. The panel considers the measures ensuring the validity, reliability and transparency of examinations and assessments to be satisfactory.

Students are offered appropriate supervision for the Master thesis projects. The panel advises to replace the procedure of submitting the thesis three weeks for the date due by a binding midterm evaluation, allowing students more time to remedy any shortcomings. The assessment procedures are up to standard, involving at least three examiners assessing the work on the basis of assessment scoring forms.

The Master theses the panel studied, match the intended learning outcomes and are adequate research projects. No theses were found by the panel to be unsatisfactory. The level and quality of the theses differ, which is reflected in the grades. The panel supports the grades given by the programme examiners.

The panel proposes to monitor current trends in the professional practice and, therefore, to organise feedback from the professional field on a structural basis.

The panel regards the programme graduates to have reached the intended learning outcomes. The panel is convinced programme graduates will do well on the labour market.

The panel that conducted the assessment of the Master Applied Earth Sciences programme of Delft University of Technology assesses this programme to meet the standards of the limited framework, as laid down in the NVAO Assessment framework for the higher education accreditation system of the Netherlands, judging the programme to be satisfactory. Therefore, the panel advises NVAO to accredit the programme.

Rotterdam, 28 March 2019

Prof. dr. ir. A. Veldkamp
(panel chair)

drs. W. Vercouteren
(panel secretary)

2. Assessment process

The evaluation agency Certiked VBI received the request by Delft University of Technology to organise the limited framework programme assessment process for the Master Applied Earth Sciences programme of this University. The objective of the programme assessment process was to assess whether the programme would conform to the standards of the limited framework, as laid down in the NVAO Assessment framework for the higher education accreditation system of the Netherlands, published on 20 December 2016 (Staatscourant nr. 69458).

Having conferred with management of the Delft University of Technology programme, Certiked invited candidate panel members to sit on the assessment panel. The panel members agreed to do so. The panel composition was as follows:

- Prof. dr. ir. A. Veldkamp, dean ITC Faculty of Geo-Information and Earth Observation, University of Twente, the Netherlands (panel chair);
- Drs. T.M. van Daalen, director Geological Survey of the Netherlands, Netherlands Organisation for Applied Scientific Research, the Netherlands (panel member);
- Prof. dr. P.A. van der Beek, full professor, Institut des Sciences de la Terre, Université Grenoble Alpes, France (panel member);
- Prof. dr. M. Landrø, full professor, Department of Petroleum Technology and Applied Geophysics, Norwegian University of Science and Technology, Norway (panel member);
- I.S. van Essen, student Bachelor Earth Sciences, Minor Solid Earth, VU Amsterdam, the Netherlands (student member).

On behalf of Certiked, drs. W. Vercouteren served as the process coordinator and secretary in the assessment process.

All panel members and the secretary confirmed in writing being impartial with regard to the programme to be assessed and observing the rules of confidentiality. Having obtained the authorisation by the University, Certiked requested the approval of NVAO of the proposed panel to conduct the assessment. NVAO have given their approval.

To prepare the assessment process, the process coordinator convened with management of the programme to discuss the outline of the self-assessment report, the subjects to be addressed in this report and the site visit schedule. In addition, the planning of the activities in preparation of the site visit were discussed. In the course of the process preparing for the site visit, programme management and the Certiked process coordinator regularly had contact to fine-tune the process. The activities prior to the site visit have been performed as planned. Programme management approved of the site visit schedule.

Well in advance of the site visit date, programme management sent the list of final projects of graduates of the programme of the most recent years. Acting on behalf of the assessment panel, the process coordinator selected the theses of fifteen graduates from the last few years. The grade distribution in the selection was ensured to conform to the grade distribution in the list, sent by programme management. The tracks in the programme were represented in the selection. Final projects of the Environmental Engineering were not yet available.

The panel chair and the panel members were sent the self-assessment report of the programme, including appendices. In the self-assessment report, the student chapter was included. In addition, the expert panel members were forwarded a number of theses of the programme graduates, these theses being part of the selection made by the process coordinator.

Well before the site visit date, the assessment panel chair and the process coordinator met to discuss the self-assessment report provided by programme management, the procedures regarding the assessment process and the site visit schedule. In this meeting, the profile of panel chairs of NVAO was discussed as well. The panel chair was informed about the competencies, listed in the profile. Documents pertaining to a number of these competencies were presented to the panel chair. The meeting between the panel chair and the process coordinator served as the briefing for panel chairs, as meant in the NVAO profile of panel chairs.

Prior to the date of the site visit, all panel members sent in their preliminary findings, based on the self-assessment report and the final projects studied, and a number of questions to be put to the programme representatives on the day of the site visit. The panel secretary summarised this information, compiling a list of questions, which served as a starting point for the discussions with the programme representatives during the site visit.

Shortly before the site visit date, the complete panel met to go over the preliminary findings concerning the quality of the programme. During this meeting, the preliminary findings of the panel members, including those about the theses were discussed. The procedures to be adopted during the site visit, including the questions to be put to the programme representatives on the basis of the list compiled, were discussed as well.

On 21 January 2019, the panel conducted the site visit on the Delft University of Technology campus. The site visit schedule was as planned. In a number of separate sessions, the panel was given the opportunity to meet with Faculty Board representatives, programme management, Board of Examiners members, lecturers and final projects examiners, and students and alumni.

In a closed session at the end of the site visit, the panel considered every one of the findings, weighed the considerations and arrived at conclusions with regard to the quality of the programme. At the end of the site visit, the panel chair presented a broad outline of the considerations and conclusions to programme representatives.

Clearly separated from the process of the programme assessment, assessment panel members and programme representatives met to conduct the development dialogue, with the objective to discuss future developments of the programme.

The assessment draft report was finalised by the secretary, having taken into account the findings and considerations of the panel. The draft report was sent to the panel members, who studied it and made a number of changes. Thereupon, the secretary edited the final report. This report was presented to programme management to be corrected for factual inaccuracies. Programme management were given three weeks to respond. Having been corrected for these factual inaccuracies, the Certiked bureau sent the report to the Board of Delft University of Technology, to accompany their request for re-accreditation of this programme.

3. Programme administrative information

Name programme in CROHO: M Applied Earth Sciences
Orientation, level programme: Academic Master
Grade: MSc
Number of credits: 120 EC
Specialisations: Geo-Engineering
Geoscience and Remote Sensing
Applied Geophysics
Geo-Resource Engineering
Petroleum Engineering and Reservoir Geology
Environmental Engineering
Location: Delft
Mode of study: Full-time (language of instruction English)
Registration in CROHO: 60360
Name of institution: Delft University of Technology
Status of institution: Government-funded University
Institution's quality assurance: Approved and valid until 20 November 2023

4. Findings, considerations and assessments per standard

4.1 Standard 1: Intended learning outcomes

The intended learning outcomes tie in with the level and orientation of the programme; they are geared to the expectations of the professional field, the discipline, and international requirements.

Findings

The Master Applied Earth Sciences programme is one of the four master programmes of the Faculty of Civil Engineering and Geosciences of Delft University of Technology. The Dean of the Faculty has the responsibility for research, education, operations and finance of the Faculty. The responsibility for the quality of the educational programmes has been delegated to the Director of Education of the Faculty. The Director of Studies of the Bachelor and Master Applied Earth Sciences programmes is responsible for the contents, quality and implementation of these programmes. The Director of Studies is assisted by two Bachelor coordinators and coordinators for each of the Master tracks. The Board of Studies, being composed of equal numbers of lecturers and students, advises programme management on quality issues. The Faculty Board of Examiners supervises the quality of examinations and assessments of this and the other programmes of the Faculty.

The Master Applied Earth Sciences programme of Delft University of Technology is a two-year, research-based, multi-disciplinary, academic master programme in the Earth Sciences domain. Within the Earth Sciences domain, the programme is directed towards Geology. The programme is quite unique in the Netherlands, as it is directed towards the integration of engineering, geology and science. The objectives of the programme are to train students in the earth sciences with strong technical backgrounds. Students are educated to explore, reveal and explain the potential of the subsurface to fulfil society's needs for resources and to implement technological interventions to change the subsurface properties and behaviour in safe and environmentally sound ways. Students are trained to solve problems in the programme domain by adopting science-based approaches and by using insights from earth sciences and engineering sciences.

The programme has been benchmarked against the domain-specific reference framework for the Earth Sciences in the Netherlands, which has been drafted by the joint programmes in the Netherlands. The objectives of the programme conform to this framework.

As has been said, the programme is unique in the Netherlands. The programme has been benchmarked against master programmes of reputed institutions abroad. Although being quite similar to these programmes in a number of ways, the Delft University of Technology programme distinguishes itself from the other programmes by having two years of study load and by offering a broad programme, be it with different tracks. The Delft programme, therefore, allows more time to spend on the individual research component in the curriculum.

The main objective of the programme is to prepare students for the labour market. Students are prepared for positions in industry, trade or government, for jobs in the international labour market or to proceed to PhD trajectories in the Netherlands or abroad.

The programme offers six distinct specialisations or tracks. These are Geo-Engineering, Geoscience and Remote Sensing, Applied Geophysics, Geo-Resource Engineering, Petroleum Engineering and Reservoir Geology, and Environmental Engineering. The Geo-Engineering track studies soft-soil engineering challenges. This track is offered in cooperation with the Master Civil Engineering programme of the Faculty of Civil Engineering and Geosciences. The Geoscience and Remote Sensing track, which is also offered in cooperation with the Master Civil Engineering programme, is directed towards the study of natural geophysics, atmospheric science, geodesy and remote sensing. The Applied Geophysics track is offered in cooperation with ETH Swiss Federal Institute of Technology, Switzerland and RWTH Aachen, Germany and educates students in theory, methods, fieldwork, data processing and interpretation, and training in physical and geological aspects of subsurface resources. Students in this track spend one out of four semesters at each of the participating universities and acquire a triple degree at completion of the track. The Geo-Resource Engineering track is geared towards understanding the various aspects of the global mining industry and the mining value chain. Within this track, two specialisations are offered, being Geo-Resource Engineering and Mineral Processing and Recycling. The first specialisation may be taken at Delft University of Technology or as an international two-year programme in collaboration with Aalto University, Finland and RWTH Aachen, Germany. The international programme adds multicultural awareness, practical skills and knowledge of international aspects of the mining industry. Students who complete the international track, are entitled to a triple degree. The second specialisation is offered in collaboration with Aalto University, Finland and allows students to spend one semester in Finland. The Petroleum Engineering and Reservoir Geology track has two specialisations, being Petroleum Engineering and Reservoir Geology. The first specialisation teaches students to locate, quantify and produce hydrocarbons. The second specialisation educates students to understand, quantify and predict the spatial distribution of salient subsurface rock properties. The Environmental Engineering track teaches students interdisciplinary technical competencies to research and design environmental processes, including the interaction of humans and the natural environment. Within this track, three specialisations are offered, addressing aspects of this field.

The programme objectives have been translated into general intended learning outcomes. These specify, as main points, specialised professional knowledge at high levels of complexity to develop or contribute to in-depth and original solutions of complex problems, knowledge and skills to make sound judgements, based upon broad and in-depth knowledge and taking into account environmental and economic aspects, and skills, attitude and awareness to update knowledge, to communicate findings and to take part in social debate in the programme domain. In line with Delft University of Technology guidelines, students are also taught academic skills, such as critical and analytical thinking competencies, knowledge of scientific foundations of engineering, analytical and modelling skills, problem-solving skills, design skills, and reflection upon socio-economic and ethical dimensions of technology. For each of the tracks mentioned, specific and detailed intended learning outcomes have been drafted.

Programme management presented the comparison of the intended learning outcomes to the general Dublin descriptors as well as the Dutch Universities of Technology Meijers' criteria for the master level.

Considerations

The panel considers the programme objectives to be relevant and sound. The panel welcomes the focus of the programme on the integration of engineering, geology and science, making this a unique programme in the Netherlands. The panel encourages the programme to maintain this profile and this unique position. The panel recommends to adapt the programme to the energy transition trend, moving from hydrocarbon energy sources to new sources of energy. In addition, the panel advises to focus on reservoir engineering with different fields of application. The panel also proposes to address mitigation and risk management subjects in the programme.

The programme objectives meet the domain-specific reference framework for the Earth Sciences programmes. The panel appreciates the efforts by the joint programmes in the Earth Sciences in the Netherlands to draft this framework and regards this to be the sound and up-to-date description of this domain.

The panel welcomes the programme having been benchmarked against programmes in other countries, demonstrating the profile and the specific features of the programme.

The panel approves of students being prepared to enter the labour market, both for positions in a range of organisations and industries or to proceed to PhD trajectories. The panel appreciates students may enter the international labour market.

The panel is positive about the tracks and specialisations offered within the programme, as these allow students to tailor the programme to their preferences. As the panel has observed, the jointly with foreign universities organised, triple-degree tracks are founded on comprehensive written agreements between Delft University of Technology and the universities concerned.

The general intended learning outcomes of the programme correspond to the programme objectives, are comprehensive and conform to the master level. The panel appreciates both the domain-specific knowledge and skills and the more general academic skills, articulated in the intended learning outcomes. The intended learning outcomes of the tracks address the specific aspects and features of these tracks. The tracks' intended learning outcomes are adequately covered by the general learning outcomes of the programme.

Assessment of this standard

These considerations have led the assessment panel to assess standard 1, Intended learning outcomes, to be satisfactory.

4.2 Standard 2: Teaching-learning environment

The curriculum, the teaching-learning environment and the quality of the teaching staff enable the incoming students to achieve the intended learning outcomes.

Findings

The inflow of students in the programme in the last five years increased from 95 students in 2012 to 143 students in 2016. About 30 % of the incoming students graduated from the Delft Bachelor Applied Earth Sciences programme. About 60 % of the students come from abroad. The remainder of the incoming students obtained degrees from Dutch universities or Dutch institutes for higher vocational education (hbo). The distribution of students across the tracks may to some extent be unbalanced. The Petroleum Engineering and Reservoir Geology track is becoming smaller, whereas the Environmental Engineering track has grown substantially. The entry requirements for the programme are Delft University of Technology Bachelor Applied Earth Sciences or Bachelor Civil Engineering degrees, Bachelor Engineering, Physics, Mathematics or Geology degrees from Dutch or foreign universities. Students having completed Bachelor Engineering degrees from Dutch institutes for higher vocational education may enrol only upon completion of the customised bridging programme. The contents of the programme depends upon the backgrounds of the incoming students and the track opted. The master track coordinators check the applications for the tracks, including applications for the international, triple-degree programmes.

The curriculum of the programme takes two years and carries 120 EC of study load. For all of the tracks in the programme, a table was presented, showing the mapping of the intended learning outcomes and the courses. The contents of the tracks differ substantially and overlap in courses across the tracks is rather limited. The curriculum structure of the tracks is, however, quite similar. The first quarter or period of the first year consists of compulsory core courses. In the other quarters or periods of the first year, track-dependent compulsory courses are scheduled. The second year is composed of track-specific elective courses and the Master Thesis project. This project, being an individual research project, carries the study load of 30 EC to 45 EC. In the beginning of the curriculum, students are taught core scientific track-related concepts and track-related theory. In the later parts of the curriculum, students are educated in specialised subjects and are required to apply knowledge and skills acquired to complex, real-life cases. These cases are derived from professional practice. Study association *De Mijnbouwkundige Vereeniging* regularly schedules extra-curricular events. In addition to formal student quality assurance surveys by the programme, the student societies organise evaluation meetings with students. The outcomes are discussed with the track coordinators.

A total number of about 73 lecturers are involved in the programme. Most of the lecturers are employed at the Faculty of Civil Engineering and Geosciences. Some lecturers are from other Faculties within the University. The lecturers are active researchers in their fields. Nearly all staff members have PhD degrees. Of the total number of lecturers 71 % are UTQ-certified and 12 % are in the process of acquiring the UTQ-certificate. Lecturers experience the workload as demanding, but manageable. New staff has been recruited to replace older lecturers. As staff left the Geo-Resource Engineering track, this track is to

some extent understaffed. Lecturers meet at the beginning and after completion of quarterly periods in the academic year to align courses. In addition, informal meetings among lecturers are scheduled.

The programme educational concept is meant to challenge students to apply and synthesise knowledge and skills acquired to address and solve problems in the programme domain and to promote students to engage actively in the learning processes. Students are expected to be largely self-directed in their studies. Self-study amounts to 65 % to 75 % of the total study load of the programme, being equivalent to about 25 to 30 hours per week. About 25 % to 35 % of the study load or 10 to 15 hours per week is spent on face-to-face education. Study methods adopted in the programme are lectures, instruction, laboratory work, projects, and fieldwork. Safety regulations for fieldwork are in place. New study methods, such as MOOCs and interactive classes with cell phones are being introduced. The students-to-staff ratio is 12/1. Academic counsellors may assist students and monitor study progress. The number of students per academic counsellor in the Faculty is, however, very large. The curriculum is very challenging. For some courses, the real study load may be more than the credits stated. As an example may be mentioned the *Numerical Modelling* course in the Geo-Engineering track. In some cases, scheduling of resits may hamper students' study pace. Particularly in the Petroleum Engineering and Reservoir Geology track, quite a number of courses with relatively small study loads are scheduled, making the programme rather hard to read. On average 10 % to 15 % of the students drop out of the programme. The average student success rates are 56 % after two years and 81 % after three years (figures for last four completed cohorts). For the last seven years, the average time for students take to complete the programme is little over two years.

Considerations

The panel regards the entry requirements to be clear and relevant. The admission procedures are adequate. As the curriculum is very challenging, the panel advises to inform prospective students clearly about the high study load.

The curriculum of each of the tracks meets the intended learning outcomes of the programme. The courses in the curriculum are up to standard. The track-related concepts and theories are adequately addressed. The panel welcomes the real-life case studies and the practical laboratory and fieldwork components in the curriculum. The panel advises to foster the curriculum coherence across the tracks by offering, for instance, joint theoretical or academic skills courses.

The panel regards the lecturers in the programme to be capable researchers and skilled lecturers. Their educational capabilities are up to standard, as may be deduced from the proportion of UTQ-certified lecturers. The panel feels the lecturers' workload to be challenging, but manageable.

Although the programme has an educational concept, the panel recommends to formalise this concept and tailor it to the challenging nature of the programme. The panel proposes to consider new study methods to allow students to proceed through the programme more easily. The panel also suggests to monitor the study load of courses and the scheduling of resits. The panel also advises to reorganise small courses into larger and more coherent blocks. The number of hours of face-to-face education and the students-to-staff ratio are satisfactory. To improve study guidance, the panel proposes to raise the number of academic counsellors for the programme. The panel perceives the number of drop-outs as well as the student success rates to be adequate.

Assessment of this standard

These considerations have led the assessment panel to assess standard 2, Teaching-learning environment, to be satisfactory.

4.3 Standard 3: Student assessment

The programme has an adequate system of student assessment in place.

Findings

The examination and assessment procedures of the programme are aligned with the Faculty of Civil Engineering and Geosciences Assessment Policy. As has been indicated, the Faculty Board of Examiners has the authority to monitor and ensure the quality of examinations and assessments of the programme.

The examination methods for the courses are selected in line with the course goals. In most courses, multiple examinations are scheduled. The examination methods in the programme are, among others, written examinations, assignments, projects, reports and presentations.

The Master thesis projects are individual research projects. In the projects, students are to demonstrate having achieved the intended learning outcomes of the programme. Before starting the project, the work plan has to be approved. Students are entitled to supervision by their individual supervisors. Supervisors and students meet regularly to discuss progress made. About three weeks prior to the date due, students present the draft version of their work. Students are given approval to submit the thesis, if this is considered to be at least satisfactory. Master thesis projects are assessed by assessment committees, consisting of at least three examiners, one of whom comes from a different research group. Thesis assessment scoring forms are being used. Theses are assessed on the basis of the written report and the oral defence by the student. In the international, triple-degree programmes, examiners from participating universities meet to discuss projects' quality. Assessment of these projects is governed by the agreements concluded between the universities. All theses are checked for plagiarism.

Programme management and the Board of Examiners have taken a number of measures to promote the validity, reliability and transparency of examinations and assessments. The Board of Examiners appoints examiners, who are UTQ-certified. For the courses, assessment matrices have been drafted. These matrices indicate the relations between the course goals and the examinations. Examinations' drafts may be peer-reviewed by fellow-examiners. Students are informed about types of examinations and the grading schemes. They are also presented trial examinations. Sub-committees of the Board of Examiners inspect on a regular basis samples of examinations and samples of Bachelor theses. Plagiarism and fraud rules for the programme are in place. Both students and lecturers are informed about these rules. Cases of plagiarism or fraud are to be reported to the Board of Examiners, who will handle these cases.

Considerations

The panel considers the examinations and assessment rules and regulations of the programme to be appropriate, these being in line with the Faculty of Civil Engineering and Geosciences Assessment Policy. Although the position and activities of the Board of Examiners are satisfactory, the panel advises the Board to be more pro-active in monitoring examinations and assessments.

The panel approves of the examination methods adopted by the programme. The methods are consistent with the goals and contents of the courses.

The supervision and assessment processes for the Master thesis projects have been organised adequately. Students are offered appropriate supervision. The panel advises to replace the procedure of submitting the thesis three weeks for the date due by a binding midterm evaluation, allowing students more time to remedy any shortcomings. The assessment procedures are up to standard, involving at least three examiners assessing the work on the basis of assessment scoring forms.

The panel considers the measures ensuring the validity, reliability and transparency of examinations and assessments to be satisfactory.

Assessment of this standard

The considerations have led the assessment panel to assess standard 3, Student assessment, to be satisfactory.

4.4 Standard 4: Achieved learning outcomes

The programme demonstrates that the intended learning outcomes are achieved.

Findings

As has been said, the Master thesis projects are individual research projects. In these projects, students have to show having reached the intended learning outcomes of the tracks and, therefore, the intended learning outcomes of the programme. The Master thesis projects are assessed on analytical knowledge and skills demonstrated, competencies to synthesise and abstract, and abilities to find solutions, also applicable in other cases. The panel reviewed fifteen Master theses of programme graduates of the last two years. For the last years, the average grade for the Master thesis projects is 7.9, whereas the grade point average of the students in the programme is 7.8.

The programme maintains contacts with the professional field through joint research programmes, conducted in collaboration with industry and through Master thesis projects by students on topics, suggested by industry.

As has been indicated, programme graduates are prepared to enter the labour market. Results of a survey conducted by the programme among alumni show programme graduates to find appropriate positions before or very early after graduation. Programme graduates expressed the programme prepared them well for the professional field. Graduates find positions in various industries. Most of them are employed by companies in the petroleum industry, while others have found jobs in mining, civil engineering, materials or energy companies. A limited number of graduates finds work in academia.

Considerations

The Master theses the panel studied, match the intended learning outcomes and are adequate research projects. No theses were found by the panel to be unsatisfactory. The level and quality of the theses differ, which is reflected in the grades. The panel supports the grades given by the programme examiners.

The panel proposes to monitor current trends in the professional practice and, therefore, to organise feedback from the professional field on a structural basis.

The panel regards the programme graduates to have reached the intended learning outcomes and to be qualified to find positions in this domain. The panel is convinced programme graduates will do well on the labour market.

Assessment of this standard

The considerations have led the assessment panel to assess standard 4, Achieved learning outcomes, to be satisfactory.

5. Overview of assessments

Standard	Assessment
Standard 1. Intended learning outcomes	Satisfactory
Standard 2: Teaching-learning environment	Satisfactory
Standard 3: Student assessment	Satisfactory
Standard 4: Achieved learning outcomes	Satisfactory
Programme	Satisfactory

6. Recommendations

In this report, a number of recommendations by the panel have been listed. For the sake of clarity, these have been brought together below. These panel recommendations are the following.

- To adapt the programme to the energy transition trend, moving from hydrocarbon energy sources to new sources of energy.
- To focus on reservoir engineering with different fields of application.
- To address mitigation and risk management subjects in the programme.
- To inform prospective students clearly about the high study load.
- To foster the curriculum coherence across the tracks by offering, for instance, joint theoretical of academic skills courses.
- To formalise the educational concept and to tailor it to the challenging nature of the programme.
- To consider new study methods to allow students to proceed through the programme more easily.
- To monitor the study load of courses and the scheduling of resits.
- To reorganise small courses into larger and more coherent blocks.
- To raise the number of academic counsellors for the programme to allow more individual guidance of students.
- For the Board of Examiners to be more pro-active in monitoring the examination and assessment processes.
- To replace the procedure of submitting the thesis three weeks for the date due by a binding midterm evaluation, allowing students more time to remedy any shortcomings.
- To monitor current trends in the professional practice and, therefore, to organise feedback from the professional field on a structural basis.