ASIIN Seal & European Labels

Accreditation Report

Bachelor's Programmes
Energy and Information Technology

Master's Programmes
Energy and Information Technology
Industrial Systems Analytics

Provided by
University of Vaasa, Finland

Version: 03 December 2020

Table of Content

A About the Accreditation Process

Name of the degree programme (in original language)	(Official) English translation of the name	Labels applied for [1]	Previous accreditation (issuing agency, validity)	Involved Technical Committees (TC)[2]
Tekniikan kandidaatintutkinto, Energia- ja informaatiotekniikan ohjelma	Bachelor's programme in Energy and Information Technology	ASIIN, EUR-ACE® Label	–	02
Diplomi-insinöörin tutkinto, Energia- ja informaatiotekniikan ohjelma	Master's programme in Energy and Information Technology	ASIIN, EUR-ACE® Label	–	02
Industrial Systems Analytics	Master's programme in Industrial Systems Analytics	ASIIN, EUR-ACE® Label	–	**02**, 04

Date of the contract:

Submission of the final version of the self-assessment report: 27.06.2019

Date of the onsite visit: 08./09.10.2019

at: Vaasa, Finland

Peer panel:

Prof. Dr.-Ing. Reinhard Möller, University of Wuppertal;

Prof. Dr. Bettina Harriehausen-Mühlbauer, University of Applied Sciences Darmstadt;

Dr.-Ing. Diedrich Baumgarten, formerly Volkswagen AG.

No student available on request.

[1] ASIIN Seal for degree programmes; EUR-ACE® Label: European Label for Engineering Programmes

[2] TC: Technical Committee for the following subject areas: TC 01 – Mechanical Engineering/Process Engineering; TC 02 – Electrical Engineering/Information Technology

Representative of the ASIIN headquarter: Dr. Siegfried Hermes
Responsible decision-making committee: Accreditation Commission for Degree Programmes
Criteria used: European Standards and Guidelines as of 15.05.2015 ASIIN General Criteria, as of 28.03.2014 Subject-Specific Criteria of Technical Committee 01 – Mechanical Engineering/Process Engineering and 02 – Electrical Engineering and Information Technology as of 09.12.2011

B Characteristics of the Degree Programmes

a) Name	Final degree (original/English translation)	b) Areas of Specialization	c) Corresponding level of the EQF[3]	d) Mode of Study	e) Double/Joint Degree	f) Duration	g) Credit points/unit	h) Intake rhythm & First time of offer
Energy and Information Technology	B.Sc. in Technology	- Electrical Engineering and Energy Technology - Information Technology - Industrial Engineering and Management	6	Full time	./.	6 Semester	180 ECTS	Autumn semester
Energy and Information Technology	M.Sc. in Technology	- Electrical Engineering -Energy Technology -Automation and Computer Science	7	Full time	./.	4 Semester	120 ECTS	Autumn semester
Industrial Systems Analytics	M.Sc. in Technology	./.	7	Full time	./.	4 Semester	120 ECTS	Autumn semester

For the Bachelor's degree programme Energy and Information Technology, the institution has presented the following profile in the self-assessment report:

"This three-year Bachelor´s degree programme provides broad multi-disciplinary foundations in mathematics, physics, information technology, energy systems, and business understanding for all students. Moreover, students select one specialisation option that gives them practical expertise and the required prerequisites to continue into a Master's programme in that field. The three specialisation options are:

- Information technology (starting from 2019-2020: Automation and Computer Science)
- Electrical Engineering and Energy Technology

[3] EQF = The European Qualifications Framework for lifelong learning

- Industrial Engineering".

For the Master's degree programme Energy and Information Technology, the institution has presented the following profile in self-assessment report:

"This master programme has been designed to be a continuation to the Bachelor's programme, although students with a suitable Bachelor's from another HEI can apply to the programme, too. The three specialisation options of the programme have a common structure, but major studies have little in common as the differentiation of studies has started already in the Bachelor's studies. The specialisation options are:

- Automation and Computer Science
- Electrical Engineering
- Energy Technology".

For the Master's degree programme Industrial Systems Analytics, the institution has presented the following profile in self-assessment report:

"This international Master's programme has a system-level focus on energy systems. Data analytics, quality and project management, systems engineering, as well as rational decision-making, including both statistical methods and a human factor, are combined with engineering studies to respond to the demand of engineers of complex systems in the labour market. All teaching in the programme is in English."

C Peer Report for the ASIIN Seal[4]

1. The Degree Programme: Concept, content & implementation

Criterion 1.1 Objectives and learning outcomes of a degree programme (intended qualifications profile)

Evidence:

- Respective chapter of the SAR
- Study schedules, Appendix 02 B of the SAR (for the Bachelor and Master Energy and Information Technology in Finnish only)
- Objectives-Module matrices, Appendix 31b of the SAR
- Audit discussions

Preliminary assessment and analysis of the peers:
Study objectives and learning outcomes have been formulated for each of the programmes under review. It seems that students, applicants and other stakeholders are familiar with them and have them easily accessible in the respective study handbooks. Since these have not been provided to the peers, the panel assumes the accessibility of the study objectives, but at the same time states, that evidence for this assumption is lacking so far.

Moreover, only the international Master's programme in Industrial Systems Analytics is taught in English altogether, which is generally laudable from an internationalization perspective. On the other hand, the Energy and Information Technology study programmes are essentially taught in Finnish with only a few modules being delivered in English. Presumably, the programme-specific learning outcomes for these programmes are presented in Finnish only and might be communicated in an English version as well in the course of a further internationalization of the programmes.

[4] This part of the report applies also for the assessment for the European subject-specific labels. After the conclusion of the procedure, the stated requirements and/or recommendations and the deadlines are equally valid for the ASIIN seal as well as for the sought subject-specific label.

It is positively noted that there is a well-established process of gathering the feedback of both alumni/graduates and industry partners about the significance of the learning outcomes of the degree programmes and the qualification profile of graduates. Reportedly, learning outcomes are reviewed annually in a curriculum development process, thereby taking into account the demands and needs of the main stakeholders. Intercourse between professors and industry partners seems to be close and continuous. Results from alumni surveys and other feedback from external stakeholders largely corroborate the functionality of the quality assurance processes described in the SAR (see for sec. 6 of this report). In conjunction with this, it is appreciable that the degree programmes under consideration clearly reflect and are further developed in accordance with the mission and strategy of the University of Vaasa.

The peer panel concludes that, principally, the programme learning objectives defined by the University of Vaasa School of Technology and Innovations to a greater or lesser extent cover the core engineering competence fields “Knowledge and Understanding”, “Engineering analysis”, “Engineering design”, “Engineering practice and product development” as well as “Transferable skills” are and thus correspond to the ASIIN Subject-Specific Criteria (SSC). The peers welcome that the University has also indicated in the SAR, where and why the programmes deviate from those “ideal” qualifications profiles. In connection with the assessment of the curricula (see chap. 3.1), the peers will decide whether the programmes do match the SSC of the relevant ASIIN Technical Committee Electrical Engineering and Information Technology in such manner that they at the same time qualify for the EUR-ACE Engineering label.

Besides, the programme-related objectives adequately express the level of the awarded degree (EQF level 6 for the Bachelor’s programme and EQF 7 for the Master’s respectively).

Regarding the Bachelor’s programme Energy and Information Technology, the panel positively notes the Schools intention to address the different competence profiles of the distinctive study specialisations (“Information Technology”, “Electrical Engineering and Energy Technology”, “Industrial Management and Engineering”). Apart from generic and general engineering skills and competences common to all specialisations, the School named several track-related competences students are supposed to acquire through the modules attributed to the respective specialisation. The peers consider this necessary with a view to transparency demands vis-à-vis students and other stakeholders such as potential employers. Moreover, they point out that – according to the SAR – the School has launched three “admission targets” (one for each specialisation) in order to make the specialisation options more visible and in the end have more applications and students admitted to the degree programmes. However, this also contributes to emphasising the specialisations

over the common programme denominator and thereby requires their clear distinction and differentiation.

Furthermore, supplementary skills and competences highlighting the specialisations must fit not only with the curriculum, but also with the title of the degree programme. Ultimately, the name of the programme is what holds the different tracks together; and, in turn, the tracks need to accord with the title. The peers understand that the programmes under review are strongly related to the demands of the local energy sector. In fact, Vaasa is said to have the biggest energy cluster across the Nordic countries. Consequently, the University has designed its technological programmes "around the applications in the energy sector", as the SAR (p. 12) states.

The additional learning objectives marking the different specialisations of the Bachelor's programme Energy and Information Technology apparently refer to this indicating that, for instance, students are not supposed to generally specialise in Information Technology, but to acquire specific knowledge in possible applications of Information Technology in the field of Energy.[5] Likewise, students of the specialisation "Electrical Engineering and Energy Technology" are expected to acquire electrical engineering-related competences with a special view to applications in Energy Technology. And basically the same applies to the Industrial Management and Engineering track. However, the panel finds the energy-concerned learning objectives of the Information Technology track as well as the Industrial Management and Engineering specialisation only barely covered in the modules of the specialisations – at least judged by their names, as module descriptions in English are not available yet.

Regarding the Master's programme Energy and Information Technology, the learning objectives of the offered specialisations are generally[6] tailored according to the Energy focus of the whole programme too. However, here again the implementation of energy-related applications in the curricula are varying from very strong in the Electrical Engineering and Energy Technology tracks to seemingly more modest in the Automation and Computer Science specialisation. Without knowing the module content (s. chap. 5.1), the peers could hardly conceive how far the respective curricula do actually realise the intended learning outcomes.

[5] Unfortunately, different versions of those track-specific learning objectives are provided in the SAR and in the translated curricula submitted on request before the onsite-visit. The latter more clearly indicate the connection and are referred to in this report (as well as in its annexes).

[6] Different versions do this on a different scale in the Master programme too.

Particularly with a view to the Energy and Information Technology programmes, the peers underscore that the programme-specific learning objectives must resonate with the programme title and the curricular contents. To this regard, the panel observes a certain mismatch in both programmes.

The programme learning objectives of the newly developed Master Industrial Systems Analytics in the opinion of the peers at least partly match with the core Engineering-specific learning outcomes as defined exemplarily in the SSC of the ASIIN Technical Committee Electrical Engineering and Information Technology. For that matter, particularly objectives relating to "Engineering Design" besides others referring to "Engineering Methods", "Engineering Analysis" and "Engineering Practice" are formulated and apparently implemented to some extent in the "'Technology Studies" (20 ECTS) and "Major Studies" (30 ECTS) of the curriculum. Whether peers consider the amount of technological modules and the learning outcomes to be expected therein as sufficient to justify the award of the EUR-ACE label as well, will be discussed in connection with the curriculum (see below chap. 1.3).

Generic learning objectives defined for the degree programmes do consider important aspects such as communication and team working skills, analytical and problem solving skills as well as business management skills on the level of qualification. However, the peers miss a reference to professional ethics, responsibilities and norms of engineering practice in the qualification profile defined for the Bachelor's and Master's programmes. As programme managers and lecturers admitted in the audit discussion, these aspects of the engineering profession are only barely explicitly expressed in the learning objectives and dealt with in the programmes, although at the same time they point to a more implicit handling of the issue in certain modules. Nevertheless, the panel considers this an obligatory study and learning objective with reference to the SSC.

Criterion 1.2 Name of the degree programme

Evidence:

- Relevant chapter of the SAR
- Audit discussions

Preliminary assessment and analysis of the peers:

The title of the Bachelor's and Master's degree programmes of Energy and Information Technology – according to the SAR – should indicate the multidisciplinary concept of the programmes on the one side and the qualification profiles directed towards the highly dominant energy branch in Vaasa on the other. Nevertheless, apart from specialisations directly linked to energy technology by title, the different tracks do follow pathways in their

own right, as the programme managers point out, although with a more or less outspoken focus on applications in the Energy field. This becomes obvious, when looking at the track-related learning objectives, and is evident from the 2019 specialisation-related admission procedure in the Bachelor's programme too. Because of the relative self-containing specialisations, it is even more necessary from the peers' point of view that their common ground under the umbrella title "Energy and Information Technology" remains visible. If "Energy" and the Energy branch is the common denominator of the different study specialisations in both the Bachelor's and the Master's programmes, the different tracks, their denomination, supplementary learning objectives and core modules should reasonably correspond to the umbrella name.

In connection with this, both the Electrical Engineering as well as the Energy Technology specialisations in the Master Energy and Information Technology are aimed at applications in the energy sector. While seen from a primarily Electrical Engineering perspective in the first case, the "Energy" track apparently treats the topic predominantly from a Mechanical Engineering perspective. The title of theses specialisations therefore may also be considered distractive in that respect.

Regarding the Master Industrial Systems Analytics, the peers share the programme managers' view that the name at least is not familiar in the international Higher Education market. Judged from the curriculums end, the programme has very much in common with Industrial Engineering programmes combining business management and technical competences for specialised occupations particularly in the Energy sector. However, the programme must not be likened with these programmes, and that is why the peers agree with the suggestion that the name adequately reflects the core competence fields in quality and project management, systems engineering and data analytics respectively.

Criterion 1.3 Curriculum

Evidence:

- Relevant chapter of the SAR
- Recommended Study Schedules, Appendix 02B of the SAR
- Curricula of the programmes, translated version submitted on request
- Objective-Module Matrices Field of Technology, Appendix 31B of the SAR
- Module Description Examples, Appendix 14 of the SAR
- Audit discussions

Preliminary assessment and analysis of the peers:
At first glance, the curricula of the degree programmes under review yield reasonable and solid degree programmes in the Electrical Engineering and Information Technology field with a special focus on Energy. The general satisfaction of the students, alumni and industry partners with the degree programmes as well as the skills and competences they convey add to this first-hand impression. In addition, generally closed and functioning quality loops (see below chap. 6) ensure through the participation of the main stakeholders (particularly students, teaching staff and industry) that the programmes remain in accordance with scientific standards and the needs of economy and society.

However, since module descriptions have not been available in an English translation before the visit (see below chap. 5.1), the peers' assessment how far the already discussed learning objectives are actually implemented in the degree programmes draws largely on the SAR, the curricula, the objective-module matrices as well as the information given during the on-site discussions.

Thus, the Bachelor's programme in Energy and Information Technology encompasses a broad array of basic modules in Physics, Mathematics, Information Technology, Electrical Engineering and Energy Technology fundamentals in the first study period. The chosen specialisation consists of a significant amount of modules in either track "Information Technology", "Electrical Engineering and Energy Technology" or "Industrial Management and Engineering" (ca. 56 ECTS). Language and Communication modules, electives and finally modules relating to the Bachelor's Thesis round up the curriculum. The peers conclude that the Bachelor's curriculum essentially accords with the qualification objectives defined for the programme. They also find the curriculum for the most part adequately reflecting the main engineering competence areas as exemplarily outlined in the SSC of the Technical Committee Electrical Engineering and Information Technology. Hence, basic competences in Mathematics and Natural Sciences, methodological / analytical competences, design competences, competences in the field of Engineering Practice as well as generic skills are broadly covered as illustrated in the objectives-module matrices. This is nevertheless subject to the peers' observation that the energy references in the title and in the learning objectives are not self-explaining and might be even distracting (see above chap. 1.1). Both apparently should be connecting with the locally dominant energy industry, but as far as specialisation-specific qualifications are concerned, do not necessarily deal with competences exclusively applicable there.

Nevertheless, the peers appreciate that the curriculum has not only been subjected to the SSC, but that meaningful deviations have also been justified. However, the peer panel does not fully agree with the School's explanations of its curricular decisions. Thus, at several instances in the SAR as well as in the audit discussions, the School explicitly states "Ethics

does not play a major role except when it comes to sustainability in the energy field". Consequently, professional ethics and related personal attitudes have not been made a distinct learning objective and module target, as already discussed (see chap. 1.1). By contrast, the peers consider issues of professional ethics and sense of responsibility as integral parts of the engineering education, which consequently need to be addressed in the Bachelor's programme as well from their point of view.

With regard to the engineering fundamentals and the different specialisations, this Bachelor's programme in the eyes of the peers characterizes an Electrical Engineering/Information Technology programme with various focus areas – irrespective of the chosen umbrella name (see chap. 1.2). Therefore, the peers consider relevant competences in certain disciplinary subjects such as Control Engineering, Analogue and Digital Circuits as well as in the broad field of Systems Safety and Security an integral part of a programme aimed at conveying a broad education in engineering basics before specialising the students' knowledge in different directions. As this applies across the line of individual specialisations, the peers generally recommend strengthening the student's competences in the mentioned areas.

The curriculum of the Master Energy and Information Technology reasonably continues the Bachelor of the same name. The inaugurated re-naming of the specialisation Information Technology to "Automation and Computer Science" (starting from winter term 2019/20) plainly illustrates this in imitating the title of the related Master specialisation. Besides, the Master is structured according to the (module) categories "Complementary Studies" (typically ca. 30 ECTS in Electrical Engineering according to the student's background), "Business studies" (14 ECTS specified in the study handbook), "Advanced Studies in the Major" (40 ECTS, with all Electrical Engineering and Energy Technology modules mandatory to project advanced studies according to industry needs), "Diploma Work/Master's Thesis" (30 ECTS) and lastly "Optional Studies" (in such volume to sum up at least 120 ECTS in the Master). As in the Bachelor's case, the peers deem the curriculum of the Master's programme as principally implementing the defined learning objectives. However, similar to the Bachelor, professional ethics and related personal attitudes are not explicitly stated as a study objective, which in the peers opinion needs to be reconsidered. In addition, the peers' general assessment – as with the Bachelor's programme – applies with the reservation that the University needs to better match the study name with the track-related learning objectives.

Contrary to the Bachelor, the separation of the heterogeneous study specialisations ("Automation and Computer Science", Electrical Engineering", "Energy Technology") is evident in the Master's programme, leaving students with virtually no compulsory (advanced) module set bridging all specialisations and, as a consequence, a much more individually structured PSP and qualifications' profile after the completion of studies. Thus, it appears to be

easier to understand the nature and characteristics of the Bachelor's programme when viewed from the Master's than vice versa. The peers realize and strongly support the Bachelor's design as it aims at laying a strong engineering foundation for different specialisations, which all have relevant applications in the Energy sector. This broad basic knowledge in Physics, Mathematics as well as Engineering Basics can be effectively build on in the Master's programme. Moreover, the foundation also gives students the (formally approved) opportunity to change the Bachelor's specialisation in the course of the Master. Additional Bachelor modules might be required as "Complementary Studies" in order to achieve the intended learning outcomes of the Master's level, but – as peers learnt – nominally at least 70 ECTS (including the Master's Thesis) are required in advanced studies, which in their opinion finally ensure the Master's level of the achieved qualification. In consequence, the peers acknowledge that the curricular structure of the Master's programme leads students to a competence profile equivalent to the exemplary set of the qualifications defined in the relevant SSC for the Master's level.

The curriculum of the newly developed Master Industrial Systems Analytics shows a very similar structure to that of the Energy and Information Technology Master. It consists of "Complementary Studies" (up to 21 ECTS), "Technology Studies" (mainly advanced level modules related to energy systems, product design, and automation technology), "Advanced Major Studies" (30 ECTS; free selection of a combination of two "modules" with 15 ECTS each), "Industrial Project Work" (10 ECTS), "Diploma Work/Master's Thesis" (30 ECTS) and "Optional Studies" (up to 20 ECTS). The peers favourable judge the combination of technological / engineering modules and (product as well as project) management modules. In the panels' view, the curriculum results in an interdisciplinary competence profile of graduates, which is arguably highly demanded in a region with a strong energy sector. Insofar as a certain volume of technological modules is a mandatory part of the curriculum and thus related competences are acquired by all students – irrespective of their optional module choices –, the peers confirm that engineering-specific competences according to the SSC are achieved qualifying the programme also for the award of the EUR-ACE label.[7]

Thus, the peers conclude that the curricula plausibly reflect possible ways to implement the study goals and intended learning objectives. This notwithstanding, they caution that the titles and at least partly the learning outcomes of the Energy and Information Technology programmes appear to be not wholly appropriate (see previous paragraphs and also chap. 1.1, 1.2).

[7] The EUR-ACE label is essentially a Quality Label for engineering programmes requiring that certain Engineering-specific competences in the areas already cited be covered to a significant extent. Although interdisciplinary programmes such as the Master Industrial Systems Analytics may not be fully attributable to one or the other Engineering Technical Committee, they nevertheless may sufficiently serve this aim.

Criterion 1.4 Admission requirements

Evidence:

- Respective Chapter of the SAR
- Degree Regulations of the University of Vaasa, Appendix 24 of the SAR
- Information on the admission rules are available at: https://studyinfo.fi/wp2/en/ (all programmes); https://www.univaasa.fi/master/how-to-apply/admission_criteria/ (Master's programmes) and https://www.univaasa.fi/master/how-to-apply/admission_criteria/programme_specific_criteria/ (Master's programmes) (Download: 18.10.2019)
- Audit discussions

Preliminary assessment and analysis of the peers:

The admission rules for the Bachelor's and the Master's degree programmes have been clearly set and bindingly fixed. They are transparent and easily available for applicants of both academic career paths. Thus, information about the requirements and the application and admission procedure is available on the University of Vaasa websites as well as on the National Admission website (in Finnish and English).

Concerning the Bachelor's programmes, applicants have usually completed the Finnish matriculation examination. Those who have completed a polytechnic higher vocational degree, vocational polytechnic degree or at least a three-year vocational degree may also apply. Additionally, it is possible to apply with certain foreign or international examinations, such as the European or International Baccalaureate or the Reifeprüfung degree. Students can be selected based on their Finnish matriculation examination results alone, their matriculation examination and entrance examination results combined, or only the entrance examination results. The entrance examination is based on the Finnish upper secondary school curriculum in mathematics, physics and chemistry. Prospective students must pass the entrance examination to be selected, even if there are fewer applicants than study places. As the peers acknowledge, this guarantees a minimum knowledge level in science for all selected students and thus contributes to the quality assurance of the Bachelor's programmes. To be selected based on the matriculation examination the prospective student must have at least the grade C in physics or chemistry and passed advanced studies in mathematics, or at least the grade M in advanced mathematics (with grades I, A, B, C, M, E, L from lowest to highest). According to a new method of admission piloted with Vaasan Lyseon Lukio high school, the University organizes a module on Energy and Sustainability,

and students completing the module with a certain grade, combined with GPA mathematics grades, are provided with the possibility to be admitted directly to the Energy and Information Technology Bachelor programme without the entrance exam.

Regarding the Master's degree programmes, the SAR refers to mainly two different recruitment channels: 1) internal students continuing their Master's degree after their bachelor studies at the University and 2) external applicants with an appropriate Bachelor's degree. Concerning the *external* intake for degree programmes with different specialisation tracks such as the Energy and Information Technology Master's programme, the peers understand that Bachelor's degree should be earned in a closely related field of study (Automation and Computer Science, Electrical Engineering, Energy Technology). The peer panel also learnt that a transfer of the specialisation from the Bachelor's to the Masters' programme is possible, but may require additional studies to meet the expected competence profile, which is decided case-by-case.

With respect to the *internal* intake channel, the peers notice that according to the Finnish Universities Act students can apply for both a lower and higher university degree, or to either of these. In practice, this leads to the admittance of all students accepted in a specific Bachelor's programme to the related Master's programme as well, if the application is aimed at both. Only in case of an application for a Master's programme alone, the rule seems to be valid that applicants must have completed a relevant Bachelor's degree beforehand (sec. 37, 3 (1)).

Consequently, an application process and admission criteria are only defined for external applicants and for international degree programmes. Thus, in both Master's programmes under review external applicants need to have completed a Bachelor degree of three or four years at university or polytechnic level and are rated based on their performance in programme-related subjects. Applicants to the international Master's programme Industrial System Analytics additionally have to proof their English language proficiency. Depending on the length of prior studies and the proximity to the core study fields of the programme, a list of bridging courses has been defined for the Master's programmes that may be required to take before the Master programme can be started. The list of which additional courses have to be taken is agreed on with the students in the form of the usual personal study plan (PSP).

Concerning the internal intake, the admission regulations for the Master's programmes do not prevent students, who have applied for both a Bachelor's and a Master's degree, from commencing the Master's study before completing the Bachelor's degree. Representatives of the University and the School stressed that, although being interested in maintaining the

flexible transition from the Bachelor's studies to the Master's studies, students are encouraged to complete their Bachelor's degree before starting their Master's studies. In that sense, § 15 of the Degree Regulations of the University of Vaasa explicitly states: "In accordance with two-cycle degree structure, the student shall first complete a bachelor's degree based on upper secondary education, and after that a master's degree based on the bachelor's degree. The curricula and the faculties' degree regulations determine the general conditions for starting master level studies before completing the bachelor's degree." In spite of this, discussions with the students and the teaching staff clearly suggest that the Master's degree is regarded the relevant degree, while the Bachelor's degree is rather seen as a necessary intermediate step on the way there.

The peers acknowledge the steps the university has taken to ensure that students normally would have completed their Bachelor's degree before commencing a Master's studies. In addition, the attitude of students – as far as can be judged from the audit discussions – shows that many of them follow the university's recommendation regarding the completion of their Bachelor's degree in the standard period of time and, even more important, before beginning their Master's studies. However, the more or less outspoken treatment of the Bachelor's degree as a mere pathway to the master's degree is suspected to contribute to programme-related decisions which, to a certain extent, negatively affect the quality and duration of the Bachelor's studies. In any case, the peers underline that the Bachelor's programme should be considered and treated as an independent programme that needs to be completed entirely before the second step (either taking up a professional career or continuing in a Master's degree) is taken. The panel therefore strongly advices to take further measures to clearly differentiate the Bachelor and the Master level of the education and to support the completion of the Bachelor's degree before starting with a Master's programme.

Nevertheless, the peers consider the admission regulations as overall adequate. From their perspective, they generally reach out to applicants equipped with the knowledge and skills necessary to successfully pursue their chosen Bachelor's or Master's studies. With respect to the Master's programmes particularly, there are also rules in place for applicants who largely but not fully have acquired the knowledge and skills needed for the study programme (sec. 37 No. 4 Universities Act).

Final assessment of the peers after the comment of the Higher Education Institution regarding criterion 1:

The peers consider *not all issues* of the above criterion set *as satisfactorily fulfilled* yet.

Programme Learning Objectives / Curricula [ASIIN 1.1, 1.3]

As they point out in their preliminary assessment, the peers consider an engineering-related work ethics and related attitude of graduates as an indispensable part of any engineering mind-set and qualification profile. Accordingly, professional ethics should be a matter of the stated programme objectives and the related education content (see below, chap. F, A 1.).

Regarding the Bachelor's and Master's programmes in Energy and Information Technology, the peers have thoroughly discussed why the deem it necessary that the intended learning objectives at programme level in this case should also adequately reflect the different specialisation tracks. In order to more clearly document and illustrate the specific competence profile graduates have gained after the completion of their study, the expert panel still holds a requirement to that end necessary (see below, chap. F, A 5.).

The peers thankfully appraise the translated versions of the study plans, of the module descriptions (as far as available yet) and the module-objectives matrices. These documents combine to confirming the impression that the curricula do cover the stated learning objectives adequately.

Curriculum of Bachelor Energy and Information Technology [ASIIN 1.1]

As peers pointed out in their preliminary assessment, the curriculum of the Bachelor Energy and Information Technology in their view may be improved, if students were to acquire additional competences in the fields of engineering fundamentals as well as systems safety and security. Since should be considered in the medium run (see below, chap. F, E 4. and E 5.).

Admission / Completion of Bachelor's programme Energy and Information Technology [ASIIN 1.4]

For reasons outlined above, the peers strongly advice the university to take further actions ensuring that students finish their Bachelor studies before commencing the Master (see below, chap. F, E 6.).

2. The degree programme: structures, methods and implementation

Criterion 2.1 Structure and modules

Evidence:

- Respective chapter of the SAR
- Recommended Study Schedules, Appendix 02B of the SAR
- Curricula of the programmes, translated version submitted on request
- Module Description Examples, Appendix 14 of the SAR
- Student Mobility, Appendix 03 of the SAR
- Student Exchange Agreements, Appendix 04 of the SAR
- Information about recognition of academic achievements acquired at other universities or outside the university available on the internet at: https://www.uni-vaasa.fi/en/for/student/studying/information/compensation/ and https://www.uni-vaasa.fi/en/for/student/studies/internationalisation/exchange/studies/ (Download: 18.10.2019)
- Working Practice, Appendix 05 of the SAR
- Internship Guidelines (Master's programmes), Appendix 36 of the SAR
- Module Pass Rates Cluster B 2015 – 2017, Appendix 07B
- Audit discussions

Preliminary assessment and analysis of the peers:

The degree programmes under review are modularized with the modules/courses forming self-contained teaching and learning units. Coordination and sequence of the modules, from the peers' perspective, are also plausible and generally contribute to achieving the intended learning outcomes of the programmes. This has been confirmed by the students' general assessment of the study programmes' quality. Available examination statistics (module passing rates) at least do not contradict with this finding, as in many cases the numbers seem to present a remarkably high performance standard, in others desired and occasionally significant progress rates, while in fewer instances (mostly courses in Mathematics) constant but expectable lower performance levels occur.

As Bachelor's and Master's students are generally responsible for planning their individual studies, particularly regarding majors, minors and optional studies, it is highly appreciable

and of utmost importance that academic counsellors support them in making up his/her personal study plan (PSP). Peers learnt that by using PSPs, students are encouraged to develop their key skills, select the focus of their studies, plan study schedules, follow their own progression, and to take responsibility of their own personal and professional development. Otherwise, PSPs are subject to submission and (academic) approval. They need to be approved by the responsible study counsellor and any deviations from the curriculum – dependant on the extent of the deviation – require "academic consideration in terms of overall intended learning outcomes and academic level" through different academic advisors (programme coordinator, responsible teacher, programme manager etc.). The peers regard this as a guarantee for reasonable PSPs, particularly in the most flexibly arranged Master's programmes.

The peer panel acknowledges that the students deepen their theoretical knowledge and develop skills and competences in the application of engineering methods in laboratory courses. The laboratory spaces and equipment in the peers' opinion – as far as can be judged from the inspection during the onsite visit (see below chap. 4.3) – highly contributes to this impression. In addition, voluntary internships ("working practice") give students an option to encounter professional engineering tasks and to deal with workplace-related situations. Students of the Bachelor's and the Master's programmes are allowed to include working practices up to 15 ECTS in their studies, whereas two weeks full-time employment with 40 working hours per week translate into 1 ECTS. This in turn means that the attribution of ECTS to the internships actually covers only a part of the workload students have to bear for it (see the following section for further details and an assessment).

The peers note that the industry partners highly esteem the voluntary internships in the degree programmes. They agree that the internships are well suited to introduce students to workplace practices and processes, to prepare thesis works, which are often conducted in cooperation with the companies, and, not least, to establish ties with potential employees. They highlight the importance of industrial placements for engineering students, when issues like employability at large and applicability of engineering knowledge and skills in particular come to the fore. In this connection, it is noteworthy that the Industrial Systems Analytics Master's programme has an obligatory "Industrial Project Work" of 5 to 10 ECTS, while the Energy and Information Technology programmes do not. Furthermore, as peers were told during the discussion, students of these programmes are less inclined to integrate working practices in their studies because they often are already working in respective companies. Nevertheless, the peers recommend encouraging the students of the Energy and Information Technology programmes to include industrial internships ("working practice") in their studies in order to strengthen their engineering practice competences.

The peers appreciate the "Instructions for including practical work training" in degree programmes, although these instructions have not been established yet and are related to the Master's programmes only. From the panels' point of view, they would have to apply for the Bachelor's programmes as well. The instructions detail the requirements for working practices, which must be met. However, the requirements are largely formal. In particular, they do not entail any provision ensuring the meaningful integration of working practices in the curriculum and the University's responsibility for the overall quality of the internships. The onsite-discussions with both students and teaching staff clearly evidenced that the working practices are neither systematically supervised by academic personnel nor thoroughly assessed in the sense that the internship reports deliver a comprehensive and scientifically informed description of the engineering tasks worked on in the company. With regard to the respective accreditation criteria, the peers insist that the university needs to take responsibility in terms of content and structure if the voluntary internships ("working practices") are to be awarded credit points.

There are provisions in place for the recognition of academic achievements acquired at other (Finish or international) universities and also for the recognition of prior learning outside the University of Vaasa, e.g. learning at work. The procedure of recognizing academic achievements and other prior learning is formalized reasonably. Processes for the assessment, the information of students, and the internal documentation and registration are defined and peers have received the impression that these processes are working well. It should be noted that the provisions set for the recognition of academic achievements and prior learning are clearly oriented towards the acquired skills and competences in accordance with the Lisbon Convention.

Principally, the internationalisation strategy of the University is convincingly followed through a multitude of exchange partnerships with other universities aiming at raising student mobility, double degree programmes as well as increasing the number of degree programmes taught in English (particularly Master's programmes). Still, statistical data on international student mobility illustrate that only a small share of students are actually engaged in the international student exchange. Thus, the peers recommend to further support and strengthen student mobility.

Criterion 2.2 Work load and credits

Evidence:

- Relevant Chapter of the SAR
- TEK Graduate Survey 2017, Appendix 32 of the SAR
- Characteristics of the Degree Programmes 2015– 2017, Appendix 01 of the SAR

- Progression Statistics 2015 – 2017 of the Programmes of School of Technology and Innovation, Appendix 06 of the SAR
- 55 ECTS per year
- Audit discussions

Preliminary assessment and analysis of the peers:
The peers see that the University of Vaasa has adopted the ECTS system in order to reasonably design the order and sequence of courses as well as the distribution of student workload per study period, semester and study year. Every semester comprises 30 credits, while each credit is valued 27 working hours. The modules in the Bachelor's programme are awarded 2 to 5 ECTS on average; the modules in the Master's programme 3 to 6 ECTS (apart from the respective Thesis work).

As already pointed out, the award of only 1 ECTS credit point for a two-weeks industrial placement ("working practice") obviously does not reflect the actual workload of students for their work in the company. Given that the working practices at the University of Vaasa are an optional part of the curriculum, whose combined credit weight is limited to 15 ECTS at a maximum, and given also that the students could flexibly arrange the practical training during their studies, the peers would still accept the practice of only partially crediting student workload for an internship. Moreover, since working practices are voluntarily conducted and could be flexibly integrated into the PSP, there is no accreditation requirement urging higher education institutions to fully include the workload in the companies during the student's placement. However, as has been discussed earlier, the conduct and required results of the working practices at the University of Vaasa in the peers' opinion do not yet meet the accreditation criteria satisfactorily (see chap. 2.1).

The peers learnt that by offering many courses on-site as well as online the University creates greater flexibility for working students. In fact, many students appear to have jobs and work besides their studies. Despite this situation however, the School does not regularly assess the student workload in order to review whether the assigned numbers of credits and the included working hours actually meet the students' reality. Otherwise, the students report about few workload evaluations done by individual teachers as well as occasional adaptations either of the awarded number of credit points or the course design in case of significant discrepancies.

However, available statistical data of the study success (e.g. pass rates, study progression, dropout rates, and average duration of study numbers) deliver only poor evidence about the adequacy of the credit point allocation per module, semester and study year. The peers

attribute this essentially to the presented set of aggregated statistical data (mostly per study year), which do not convey meaningful information about individual study cohorts and only scarce module-related information. In the latter instance, at least the pass rate-statistics provide some insights, although the missing module-descriptions make meaningful conclusions hard to achieve.

In the absence of a reliable validation process of the credit point distribution, the peers consider it necessary to introduce a monitoring process for the students' workload and to develop a procedure, how to react if the evaluation reveals noticeable deviances.

Criterion 2.3 Teaching methodology

Evidence:

- Relevant chapter of the SAR
- Recommended Study Plan, Appendix 02 of the SAR
- Programme Management Principles, Appendix 13 of the SAR
- Module Descriptions Examples, Appendix 14 of the SAR
- Audit discussions

Preliminary assessment and analysis of the peers:

From the presented material as well as the discussions on-site, it becomes apparent that the pedagogical skills and teaching methodology are highly valued at the University of Vaasa and in the programmes under review. Evaluation of pedagogical skills and methods are frequently performed and workshops and trainings offered to the teaching staff. As already pointed out, the teaching methodology in the programmes is strongly attached to practical applications of the acquired competences and the students' ability to find adequate jobs after the completion of the programmes. In the opinion of the peers, this hands-on-focused approach seems reasonable given the intended qualification profile and strong connections to the local industry in the Energy sector. Otherwise, it should not be at the expense of the more theoretical and scientific base of the programmes, which are an integral part of the academic education in universities, particularly at the Master's level. This should be considered even more, since the University of Vaasa competes and at the same time closely cooperates with the University of Vaasa of Applied Sciences (VAMK), who provides related study programmes, for instance in the Electrical Engineering and Information Technology field. In their discussions with the programme managers and the lecturers, the peers received the impression that particularly this cooperation is as much welcomed, as it is challenging, but overall works well and to the benefit of both institutions.

Teaching is usually done in the form of lectures, seminars and workshops with many courses comprising theoretical as well as practical elements. In the latter respect, the peers appreciate that many of the teaching staff have previously gained professional experience in companies and thus are able to share these experiences and their contacts with the students. On the other hand, Alumni, students and teaching staff concurrently corroborate the students' participation in appropriate research projects of the school wherever possible.

According to the available information, the programmes are making more and more use of online teaching devices and flipped classroom techniques in order to deal with the changing learning profile of the students. Each module shall use the learning platform Moodle to provide students with course information, video lecturers, online tasks, etc. In summary, the on-site tour and the discussions convey the impression of a vivid desire for teaching innovation, as for example classrooms especially designed to promote interactive ways of teaching and learning convincingly illustrate. This is very much appreciated as it creates an environment of joint development of teaching methodology for and with the students. At the same time, it is well noticed that the University and School are well aware of still existing room for improvement in terms of exploitation of digitalization in teaching. As a result, the teaching methodology is considered up-to-date and adequate in order to convey the contents envisaged by the programmes.

Criterion 2.4 Support and assistance

Evidence:

- Relevant chapter of the SAR
- Audit discussions

Preliminary assessment and analysis of the peers:

The peers get a comprehensive impression of the offers related to support and assistance of the students at the University of Vaasa. The students confirm that an open-door policy is being practised and that the students can always approach all teaching and administrative staff. On the programme level, each one disposes of a programme manager responsible for the programme content and a programme coordinator taking care of the administrative issues of the programme. Additionally, all students are assigned a supervisor with whom they discuss the personal study plan (PSP), their individual specializations and later modifications of the PSP, if required. The peers appreciate that through this kind of support the University creates at least a framework to ensure that the students choose their electives in a coherent way and discuss their individual progress and professional orientation

on a more or less regular basis with an academic supervisor. Information about the modules is provided through the module descriptions and since 2017 through the more detailed course syllabi. These are being distributed at the beginning of the courses and outline in detail the modules' contents, examinations, requirements, etc.

Apart from the pure academic support, the University also disposes of a broad variance of personal support offerings ranging from a Career Centre and Study Council through a Study Psychologist to an International Office and Counselling for International Students.

The auditors conclude that the University of Vaasa and the School of Technology and Innovation make adequate resources available to provide individual assistance, advice and support for all students. The peers highlight that the allocated advice and guidance, in particular the programme managers and individual supervisors, assist the students in achieving the learning outcomes and in completing the course within the scheduled time.

Final assessment of the peers after the comment of the Higher Education Institution regarding criterion 2:

The peers consider *not all aspects* of the above criterion set *as satisfactorily fulfilled yet*.

Internships [ASIIN 2.1]

From the peers' point of view, the University of Vaasa must unmistakably take responsibility for internships or "working practices" in terms of content and structure, if students earn credits for them. Existing guidelines should ensure this and be applicable for all programmes with credited internships (see below, chap. F, A 2.).

With respect to the Bachelor's and Master's programmes in Energy and Information Technology, the peers' recommend encouraging students to include internships in their studies as this will enlarge their engineering practical competences (see below, chap. F, E 7.).

Workload [ASIIN 2.2]

In order to ensure the validity of the credit point allocation the expert panel considers a monitoring mechanism necessary providing reliable information about the underlying workload calculation. Since such a mechanism does not exist yet, they propose a respective requirement (see below, chap. F, A 3.).

Student mobility [ASIIN 2.1]

As noted above, the peer panel also suggests further strengthening the student mobility (see below, chap. F, E 1.).

3. Exams: System, concept and organisation

Criterion 3 Exams: System, concept and organisation

Evidence:

- Respective chapter of the SAR
- Module descriptions Examples, Appendix 14 of the SAR
- Model of Syllabus Document, Appendix 37 of the SAR
- Module pass rates 2015 – 2017, Appendix 07 of the SAR
- Progression statistics, Appendix 06 of the SAR
- Graduation statistics for each programme with grade profiles 2015 – 2017, Appendix 12 of the SAR
- Degree regulations of the University of Vaasa 2017, Appendix 24 of the SAR
- On-site inspection of samples of examinations as well as Bachelor's and Master's theses (Master's thesis for the Master programme Energy and Information Technology only)
- Audit discussions

Preliminary assessment and analysis of the peers:

The examination type for each module/course is defined in the module descriptions. The methods of assessment in use for the degree programmes under review are principally, considered suitable to measure the extent to which students have actually achieved the set learning outcomes. Examination types are selected based on their competence orientation and may include written exams, presentations and project work, either alone or in teams. Oral exams may happen but, as the peers learn, are quite rare in Finnish Higher Education. In general, the programmes are utilizing a wide range of methods not least to monitor the individual learning progress of the students throughout the semesters and the whole study period. This performance steadily contributes to the respective final grade of the courses to a certain degree (at least 50%) thus reducing the impact of one single examination. The continuous assessment is based on learning diaries, self-reflections, role-plays, exams, case analysis, academic essays, forum discussions, digital stories, peer assessments and many more depending on the actual background of the students and the course content. Anyway, regarding the evaluation of courses the School and its teaching staff evidently follow the principle that different evaluation methods suit different learning outcomes.

The results of a sample of examinations inspected during the onsite-visit have been found generally adequate in terms of requirements and qualification level (EQF level 6 and 7 respectively). The inspection of final theses for the Energy and Information Technology degree programmes – the Industrial Analytics Engineering Master has started only recently – also revealed an adequate quality level with respect to the scientific standard and qualification level.

In the SAR, the University presented a comparatively big volume of statistics related to the study progress, module pass rates, graduation rates etc. The peer panel appreciates that very much as it provides a main information source for the assessment of the study success at different stages of the student life cycle. However, the SAR at least lacks a plausible (or even exemplary) description of how these results have been evaluated by the School Management and fed in the further development of the programmes. Surely, the Programme Management Principles (Appendix 13) suggest that systematic monitoring and feedback cycles are in place and observed across the degree programmes. In addition, the "Internal Reporting of the University" scheme (Appendix 27) indicates how and when statistical and survey data are collected and principally available. However, peers were unable to relate the presented data to the curriculum development, neither in general nor exemplary. Regarding this, the panel recommends to document the systematic monitoring of the study progress and the use of the results thereof more comprehensively in order to reasonably decide on and evaluate the follow-up measures.

According to the SAR, exams are usually arranged in general examination days organized by the study administration. Alternatively, the lecturer can arrange the exam at the end of the module. All failed exams may be repeated two times and the administration tries to offer at least one repetition of the exam once per semester, thus reducing the loss of time if a student needs to re-take an exam. Many written exams are also offered in an online version that can be taken by the students individually in prepared computer rooms at the University. Taking eAssessments from home is not possible. However, the online exam option does allow students to plan their exam schedule according to their own timetable, which is considered helpful, since many students are working besides their studies.

Regarding the schedule, conduct and organisation of the assessments at large, transparent rules have been defined, duly published and are obviously working well. Students are informed about the dates and methods of examinations in due time and multiple exam dates allow for the planning of exams and re-sits without overlaps, thus supporting a continuous study progress without undue delay. It is positively taken into account in this connection that Alumni and students concurrently confirmed coordinated and adequate exams, for which they have been/are given sufficient preparation time.

Final assessment of the peers after the comment of the Higher Education Institution regarding criterion 3:

The peer panel considers the above criterion as *completely fulfilled*.

4. Resources

Criterion 4.1 Staff

Evidence:

- Relevant chapter of the SAR
- Technology and Innovations Faculty, Appendix 08 of the SAR
- Quality profile of the Individuals, Appendix 09 of the SAR
- HRM Strategic Action Plan 2018 – 2020, Appendix 22 of the SAR
- Audit discussions

Preliminary assessment and analysis of the peers:

Concerning the teaching personnel, the peers understand from the report and the audit discussions that the degree programmes under review are quite differently resourced. The share of Full-Time Equivalents varies strongly from 4,21 in the Master's programme Energy and Information Technology to 1,56 in the Master's programme Industrial Systems Analytics; and so does the ratio of students to core and adjunct teaching staff ranging from 56 in the Bachelor's programme Energy and Information Technology to 16 in the Master Industrial Systems Analytics. Obviously, the latter Master is the least well equipped in absolute numbers, while on the other hand, the programme has been started only recently and the student numbers are still low resulting in an overall favourable student / teacher ratio thus far. Nevertheless, the teaching load particularly of this Master's programme has to be carried out by a comparatively small teaching staff, which leads the University to the conclusion that the available teaching staff is hardly sufficient for the programme in the long term. Reportedly, there will be 2 to 3 tenure track positions in the School to help the situation. Scarcity of available teaching personnel and a need of possibly more personnel resources for teaching and supervision is inferred for the Master Energy and Information Technology as well, which the School claims to run "with a minimum amount of staff" at present.

Regarding the Bachelor's programme Energy and Information Technology, the cooperation with the local University of Applied Sciences (VAMK) guarantees a somewhat greater flexibility in the use of teaching resources. In addition to core faculty and VAMK staff, the SAR

reports about involving project researchers, regular visitors as well as students in teaching. According to that, project researchers can utilize and bring in their most recent research in teaching and get invaluable teaching experience in return. As peers further learnt, regular visiting teachers from the industry are often post-graduate students or docents of the University. Lastly, students are a flexible resource in this account, and by giving them teaching tasks, the University is trying to engage them as potential post-graduate students. Usually, the School also intends to ensure that at least two teachers can teach each of the courses, provided enough preparation time, and only few bottlenecks seem to exist with respect to this strategy.

In summary however, the actual teaching load of the different categories of teaching staff members (professors, lecturers, and teachers) can hardly be assessed from the available data and information. To judge this, the peers request reliable information about the individual teaching load of all staff members engaged in the teaching of the programmes in relation to the course offerings per study programme. It is promising in this respect, that staff members told the peers about successful School initiatives of recent times to balance the teaching load through additional external personnel or the financing of internal career paths (e.g. tenure track positions).

Further, the peers do not doubt the teaching qualification of the teaching staff. On the contrary, they highly esteem that a considerable share of them, ranging between 69% in the Bachelor's programme and 85% in the Master's programme Industrial Systems Analytics holds a PhD degree. It is also seen principally positive that a considerable number of professors of the highest career level (professors and research directors) do participate in teaching in the different programmes. However, the peer panel cannot identify whether the actual engagement of the individual professor, lecturer or teacher in the course and degree programme accords with the teaching staff members' qualification. Thus, in addition to a meaningful overview over the teaching load of the available teaching staff, the peers ask for a list of academic qualifications of teaching personnel identifying the actual teaching responsibility per staff member and degree programme.

The qualification of the teaching staff for the degree programmes under review and especially for the Master's programmes not least depends on the quality of its research activities. Since the core academic staff members are generally expected to do both teaching and research (the latter to a certain extent at least), it is worthwhile that the School reports about manifold research projects relevant for the degree programmes under review. Although many of them are conducted in cooperation with local companies – who feel very comfortable with that and to a considerable extent provide the physical infrastructure for research purposes (see below chap. 4.3) –, the professors demonstrate that they are well

aware of the crucial role of fundamental basic research normally attributed to the universities. Increasing the number of high-impact publications, which belongs to the outspoken research strategy of the university, is – as professors clearly point out – very much dependent on basic research projects and rather improbable in case of industry-financed application-oriented activities. The related publication statistics (according to the JUFO scale) illustrate an altogether stable number of JUFO level 1 to 3 publications and a slight increase in the highest ranking level 3 most recently. Otherwise, available statistics also clearly indicate that publications are by no means evenly distributed across the teaching staff, but rather spearheaded by a relative stable group of researchers. As the SAR indicates this can largely – though not exclusively – be traced to an imbalance in the teaching load, in particular on the side of younger lecturers and teachers (see following paragraph).

Criterion 4.2 Staff development

Evidence:

- Relevant chapter of the SAR
- Quality profile of the Individuals, Appendix 09 of the SAR
- Programme Management Principles, Appendix 13 of the SAR
- HRM Strategic Action Plan 2018 – 2020, Appendix 22 of the SAR
- Audit discussions

Preliminary assessment and analysis of the peers:

It has been outlined already that the distribution of teaching load among the staff members appears to be imbalanced at times. The peers understand that some staff members are more involved in research than others are, but if a number of staff members, especially younger ones, have a teaching load of 100% of their working time the spare time for research is evidently limited. Discussions with the staff made it very clear, that especially the younger teachers are interested to intensify their research activities, provided they are given more research time. Since it is an overall strategic goal of the University to support and increase the research activities, it should be ensured that all staff members of all different employment levels reaching from teacher to the full professor dispose of a certain guaranteed free time for research. This is even more important in the opinion of the peers, as otherwise a stronger inclusion of scientific research into the modules especially on Master level cannot be achieved.

Concerning the pedagogical and didactical development of the teaching staff, the University provides a large variety of offers and is further developing this aspect. A new system

has been installed allowing staff members to partake in didactical trainings up to an amount of five ECTS credits while reducing their teaching load in the same amount. In the future, it shall be achieved that all staff members complete in the course of their academic promotion at least 25 credits of didactical training. Moreover, the University participates in the government-initiated HELLA programme, that aims at enhancing the teachers' and professors' performance in teaching. HELLA (Higher Education Learning Lab) is a research based and research supported development project on higher education pedagogy that is developing and piloting a new multilingual 60 ECTS study module in higher education for the needs of the universities and the universities of applied sciences. The aim is also to develop operating models for internal use in the institutions of higher education as well as models for cooperation between the institutions, thus enhancing the coordination of education and research in higher education pedagogy and pedagogical forms of activity in administration.

In conclusion, the peers see that the University is providing a lot of support for professional development but still encourage the University to enhance its support system of research activities on all levels of academic careers.

Criterion 4.3 Funds and equipment

Evidence:

- Relevant chapter of the SAR
- Professional Institutions and Corporations, Appendix 10B of the SAR
- On-Site Visit

Preliminary assessment and analysis of the peers:

During the on-site visit, the peers were able to gain a comprehensive impression of the facilities and laboratories at the University of Vaasa. Particularly due to the intensive collaboration with local companies, the laboratory facilities are considered absolutely sufficient, providing students with all possible opportunities to work on their study projects and Thesis works from Bachelor's to PhD Level. The largest technical laboratories are established in the TechnoBothnia complex, where the University and the local University of Applied Sciences have joined their resources largely provided by industry funding to provide the best project and research environment. Besides, the already described innovative classrooms currently being piloted at the University in preparation of planned new constructions are very impressive. In these rooms a range of innovative technical teaching facilities are tested and evaluated with the active participation of the students. The peers positively

note in this connection that students report about very good study and working conditions as well as excellent learning room, classroom and laboratory facilities.

In summary, the peers consider the available equipment more than adequate for the performance of the programmes reviewed.

Final assessment of the peers after the comment of the Higher Education Institution regarding criterion 4:

The peers consider the different dimensions of the above criterion as overall adequately met by the University of Vaasa. They judge the additional lists provided to assess the workload of the teaching staff and its qualifications related to the teaching assignments as helpful.

Teaching capacity and qualification of teaching staff with regard to teaching assignments [ASIIN 4.1]

The peers appreciate the detailed information given in the cover letter to the supplements regarding the working load of the different ranks of teaching and research personnel. Although the assessment of the individual staff workload is still somewhat difficult, because reliable numbers of the actual teaching demand in relation to the available teaching capacity for each programme – taking into account reductions of teaching obligations – are hard to find, the peers receive an altogether meaningful picture of the teaching capacity at the School of Engineering. They find their assumption confirmed that particularly the lower ranks of the teaching staff carry the burden of teaching and supervising students, but also that full professors cover a considerable amount of lectures in the core curriculum. As the given numbers refer to the annual workload of the respective staff members (full, associate, assistant professors, lecturers, teachers, laboratory engineers, research assistants etc.), even the highest rates seem to be bearable (compared to international standards). Nevertheless, precisely because the data reveal the limited time especially (mostly younger) teachers can afford for research, the peers recommend allocating a certain amount of research time to *all different levels* of staff members for further qualification purposes (see below, chap. F, E 2.).

In that respect, the panel welcomes the announcement of the university that a new teaching workload allocation tool shall be introduced in spring 2020 in order to ensure sufficient faculty deployment within and across the programmes.

5. Transparency and documentation

Criterion 5.1 Module descriptions

Evidence:

- Module descriptions Examples, Appendix 14 of the SAR
- Model of Syllabus Document, Appendix 37 of the SAR
- Audit discussions

Preliminary assessment and analysis of the peers:
It has been outlined before that until the site-visit English module/course descriptions were only available for those modules that are generally taught in English language. Before their final assessment, the peers request a full translation of all core modules of the programmes. The descriptions available in English language do provide detailed information about the respective content, learning outcomes, examinations, workload distribution and grading.

Even more detailed and informative in this respect are the course syllabi being provided to students at the beginning of each course.

Criterion 5.2 Diploma and Diploma Supplement

Evidence:

- Relevant chapter of the SAR
- On-site discussions

Preliminary assessment and analysis of the peers:
Diploma and Diploma Supplements of the programmes have not been included in the SAR and are therefore requested in in the further course of the procedure. In the SAR and during the on-site visit it has been confirmed that all students are awarded a Diploma and an adjoining Diploma Supplement at graduation.

Samples of the Diploma Supplement should be provided for each degree programme along with the comment of the university.

Criterion 5.3 Relevant rules

Evidence:

- Relevant Chapter of the SAR
- University of Vaasa Rules of Procedure, Appendix 17 of the SAR
- Degree Regulations of the University of Vaasa, Appendix 24 of the SAR
- Degree Regulations of the University of Vaasa, available on the internet: https://www.univaasa.fi/fi/for/student/studying/rights/regulations/vaasan_ylio-piston_tutkintosaanto_1.3.2019.pdf (not in English; Download:18.10.2019)
- Ethical Guidelines of the University of Vaasa, Appendix 21 of the SAR
- Principles of Programme Management of the University, Appendix 13 of the SAR
- Procedures in Case of Academic Fraud at the University of Vaasa, Appendix 18 of the SAR
- The Universities Act (558/2009), available on the internet: https://www.finlex.fi/en/laki/kaannokset/2009/en20090558_20160644.pdf (Download: 18.10.2019)
- Act Amending the Universities Act (715/2004) / Laki yliopistolain muuttamisesta (715/2004) (Not available in English)
- Government Decree on University Degrees, available on the internet: https://www.finlex.fi/fi/laki/kaannokset/2004/en20040794.pdf (Download: 18.10.2019)
- On-Site discussions

Preliminary assessment and analysis of the peers:

From the documents provided and the discussions during the on-site visit, the peers learned that the University of Vaasa follows a policy of transparent and open rules and regulations. All required rules and regulations are accessible for students at any time online; full syllabi of the course contents are also provided to the students at the beginning of each course. The discussion with the students confirmed that they feel well informed about regulations and comfortable about the access to any information about their degree programmes.

However, it is noted by the peers and supported by student opinion, that the accessibility of information through the University website could be improved. While the access to required information is quite easy through Moodle for students already enrolled, it is difficult to find the relevant information for those external to the programmes. As a part of this

difficulty detailed information about the programmes such as the module/course descriptions are only available on the website in Finnish language, with the only exception of the few international Master's degree programmes. Of course, the peers understand that the other programmes are delivered in Finnish, but for reasons of more transparency and international visibility, it might be advisable to present at least some information about the learning objectives and curriculum of all programmes in English language as well.

Final assessment of the peers after the comment of the Higher Education Institution regarding criterion 5:

The peers consider the above criterion set largely, yet *not fully fulfilled satisfactorily*.

Module descriptions [ASIIN 5.1]

The peers thankfully take note of the translated module descriptions. After having looked through them, they conclude that the descriptions are informative giving comprehensive information about the content of the programmes. In addition, in their view the module descriptions plausibly document how the curricula correspond to the intended learning objectives of the programmes.

Diploma Supplements [ASIIN 5.2]

The peers acknowledge the programme-specific Diploma Supplements provided by the university. These contain information about the structure, study mode and content of the programmes as well as of the individual performance of the graduate. However, the learning outcomes are not included yet and no information could be found about how the graduate's individual performance ranks within his graduation cohort. Both information need to be included according to the resolution of the Paris Declaration of the EHEA minister[8] and in combination with the ECTS User's Guide.[9] The peers therefore propose adding a respective requirement in order to cure these shortcomings (see below, chap. F, A 4.).

[8] Cf. http://www.ehea.info/cid101765/ministerial-conference-paris-2018.html (Download 12.11.2019)
[9] Cf. https://ec.europa.eu/education/ects/users-guide/docs/ects-users-guide_en.pdf (Download 12.11.2019)

6. Quality management: quality assessment and development

Criterion 6 Quality management: quality assessment and development

Evidence:

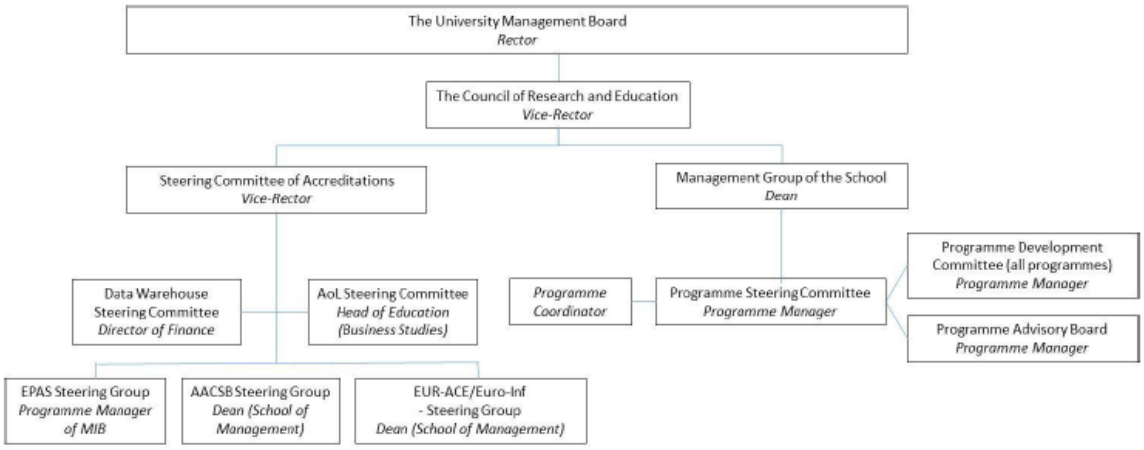
- Relevant chapter of the SAR
- Programme Management Principles, Appendix 13 of the SAR
- Quality Policy at the University of Vaasa (30.11.2012), Appendix 25 of the SAR
- New Programmes Assessment Criteria, Appendix 33 of the SAR
- Feedback Process of the School of Technology and Innovation, Appendix 23 of the SAR
- Internal Reporting of the University, Appendix 27 of the SAR
- Module Level Feedback Form, Appendix 28 of the SAR
- Master's Degree Questionnaire, Appendix 30 of the SAR
- Characteristics of the Degree Programmes, Appendix 01 of the SAR
- Progression Statistics, Appendix 06 of the SAR
- Module pass rates 2015 – 2017, Appendix 07B of the SAR
- Graduation Statistics for Each Programme, Appendix 12 of the SAR
- 55 ECTS per year, Appendix 35 of the SAR
- The Finnish Bachelors Graduate Survey 2018, Appendix 29 of the SAR
- TEK Graduate Survey 2017, Appendix 32 of the SAR
- Audit discussions

Preliminary assessment and analysis of the peers:

The peers acknowledge that the University of Vaasa and the School of Technology and Innovations do have a quality management system in place, whose mechanisms are generally functioning.

Concerning the definition and implementation of quality processes on the one hand, the distribution of responsibilities at university, school and programme level for monitoring, evaluating, changing and adapting existing degree programmes as well as developing new ones on the other, the peers fully agree that the University has established a system-wide quality management system (see the organizational chart below).

Figure 5: University QA organisation chart



The foundations of this QM-system have been laid down in several policy papers (primarily "Quality Policy at the University of Vaasa" (2012) and the more recent "Programme Management Principles"). According to these quality defining papers, the QM strategy of the University of Vaasa has five super-ordinated layers: 1) University as operational environment of education, 2) Design and Development of the programmes, 3) Continuous development of the programmes, 4) Pedagogic and guidance processes and resources and eventually 5) Measurement of performance and results & QA. For each of these pillars, the University has defined clear benchmark criteria as well as developed and established instruments and related procedures for their implementation. Particularly for the continuous monitoring, assessment and further development of the degree programmes, university-level, programme-level, module level and individual level (informal) tools are practiced according the SAR. In theory, the presented management system, its underlying quality culture, benchmark criteria, distribution of responsibilities, processes and tools convey the picture of comprehensive, encompassing and reasonably closed feedback cycles. In the audit discussions, in particular with the students, the peers received the impression that the University in fact to a large extent has been successful – perhaps not so much with a view to every single micro-process of quality management but in terms of the overall benchmark criteria. Thus, the students stress that the QM-system in their view works very well ensuring an open and responsive, learner-friendly programme development.

In spite of this, the peers see room for improvement with a view to the systematic collection, analysis and utilization of study-related evaluation and survey results as well as statistical data. At first glance, the combination of gathering relevant data about study conditions and study progress through surveys and evaluations on a regular basis on the one hand and established structures for the analysis and utilization of the results on the other appears to be in place. Notably, this applies to the course evaluations and their follow-up process, as the students' feedback in the audit discussions clearly suggest. However, regarding the

available statistical database, the peers' raise doubts. Despite an overall impressive volume of statistical data, cohort-wise student statistics enabling a more systematic view on the study success (with indicators like student numbers, average duration of study, dropout rate, graduates in standard period of study, etc.) are not available. The presented performance numbers generally refer to whole study years, thus hindering meaningful findings with respect to the above mentioned success indicators. Other data though, such as the "Progression statistics 2015 – 2017" or the "Module pass rates" (as some of the University's key benchmark figures) have quite interesting numbers, which could/should have prompted a thorough analysis of possible reasons and follow-up measures. However, the peers lack indications of an in-depth appraisal of the aggregated performance statistics and for their deliberate use in a structured follow-up discussion.

Therefore, the peers advise the University to device a quality process ensuring a systemic, programme-related monitoring of the study progress as well as its purposive use for the further development of the degree programmes. In particular, the database of the monitoring process should also include meaningful cohort-wise statistical data.

Final assessment of the peers after the comment of the Higher Edeucation Institution regarding criterion 6:

The peers deem the requirements concerning the quality assurance system *generally fulfilled*. In order to more effectively implement its methods and use its results, they nevertheless recommend further improvements in the medium term (see below, chap. F, E 3.).

D Additional Documents

Before preparing their final assessment, the panel ask that the following missing or unclear information be provided together with the comment of the Higher Education Institution on the previous chapters of this report:

D 1. English translation of module descriptions [ASIIN 5.1]

D 2. Samples of programme-specific Diploma Supplements [ASIIN 5.2]

D 3. List of academic qualifications of teaching personnel identifying the teaching responsibility per staff member and degree programme [ASIIN 4.1]

D 4. Reliable information about the individual teaching capacity in relation to course offerings per study programme [ASIIN 4.1]

E Comment of the Higher Education Institution (06.11.2019)

The institution provided and commented the following additional documents:

- Additional Documentation Cover Letter
- Samples of the programme-specific Diploma Supplements
- Study plans translated into English
- Module-objectives matrices for each programme and specialisation track
- Personnel of the School on different Career Stage Level in the School of Technology and Innovations
- Contact teaching by person of the core faculty of the School
- Sum of contact teaching in different teaching position (including different visiting teacher categories
- Sum of contact teaching in different teaching positions by person (including different visiting teacher categories)
- Sum of contact teaching in different teaching positions by person (including different visiting teacher categories
- Sum of contact teaching in different teaching positions by person and the modules each one teaches (including different visiting teacher categories)
- Sum of contact teaching in different teaching positions by type of contract (including different visiting
- Sum of contact teaching by disciplines, persons and modules teacher categories)
- Sum of contact teaching by disciplines
- Percentage of teaching divided into degree programmes (indicative)
- UVA Career stage eligibility requirements

F Summary: Peer recommendations (19.11.2019)

Taking into account the additional information and the comments given by the HEI, the peers summarize their analysis and **final assessment** for the award of the seals as follows:

Degree Programme	ASIIN-seal	Subject-specific label	Maximum duration of accreditation
Ba Energy and Information Technology	With requirements for one year	EUR-ACE	30.09.2025
Ma Energy and Information Technology	With requirements for one year	EUR-ACE	30.09.2025
Industrial Systems Analytics	With requirements for one year	EUR-ACE	30.09.2025

Requirements

For all degree programmes

A 1. (ASIIN 1.1, 1.3) Ensure that students are committed to professional ethics, responsibilities and norms of engineering practice in a reasonable and transparent manner.

A 2. (ASIIN 2.1) If the "working practices" (internships) shall be awarded credit points, it must be ensured that the university takes responsibility in terms of content and structure. Related instructions for working practices must apply to all degree programmes.

A 3. (ASIIN 2.2) Develop and implement a process to systematically monitor the actual student workload and to adapt either the credit point allocation or the module/course content, if necessary.

A 4. (ASIIN 5.2) Include the programme-specific learning outcomes into the Diploma Supplement. Furthermore, statistical data according to the ECTS-User's guide in addition to the final grade must be provided.

For the Bachelor's and Master's degree programme Energy and Information Technology

A 5. (ASIIN 1.1) Adapt the programme-specific learning outcomes and / or the name of the degree programmes in such manner that they reasonably match with the different study specializations offered in the programmes.

Recommendations

For all degree programmes

E 1. (ASIIN 2.1) It is recommended to further support and strengthen student mobility.

E 2. (ASIIN 4.2) It is recommended to allocate a certain amount of research time to all different levels of staff members for further qualification purposes.

E 3. (ASIIN 6) It is recommended to more comprehensively perform and document the systematic monitoring of the study progress and the use of the results thereof in order to reasonably decide on and evaluate the follow-up process.

For the Bachelor's programme Energy and Information Technology

E 4. (ASIIN 1.3) It is recommended to strengthen the electrical engineering fundamentals (for instance control engineering, analogue and digital circuits).

E 5. (ASIIN 1.3) It is recommended to enlarge the students' knowledge and skills in the field of systems safety and security.

E 6. (ASIIN 1.4) It is recommended to take further steps to focus students on completing the Bachelor's degree before commencing their Master's studies.

For the Bachelor's and Master's degree programmes Energy and Information Technology

E 7. (ASIIN 2.1) It is recommended to encourage the students to include industrial internships ("working practice") in their studies in order to strengthen their engineering practice competences.

G Comment of the Technical Committees

Technical Committee 02 – Electrical Engineering and Information Technology (25.11.2019)

Assessment and analysis for the award of the ASIIN seal

The Technical Committee discusses the procedure and fully agrees with the recommended resolution of the peers.

Assessment and analysis for the award of the EUR-ACE® Label

The Technical Committee deems that the intended learning outcomes of the degree programmes do comply with the engineering specific parts of its Subject-Specific Criteria.

The Technical Committee recommends the award of the seals as follows:

Degree Programme	ASIIN-seal	Subject-specific label	Maximum duration of accreditation
Ba Energy and Information Technology	With requirements for one year	EUR-ACE	30.09.2025
Ma Energy and Information Technology	With requirements for one year	EUR-ACE	30.09.2025
Industrial Systems Analytics	With requirements for one year	EUR-ACE	30.09.2025

Technical Committee 04 – Informatics/Computer Science (19.11.2019)

Assessment and analysis for the award of the ASIIN seal

The Technical Committee agrees with the assessment and recommended resolution of the peers.

The Technical Committee recommends the award of the seals as follows:

Degree Programme	ASIIN-seal	Subject-specific label	Maximum duration of accreditation
Industrial Systems Analytics	With requirements for one year	EUR-ACE	30.09.2025

H Decision of the Accreditation Commission (06.12.2019)

Assessment and analysis for the award of the ASIIN seal:

The Accreditation Commission discusses the procedure. It takes note of the Finnish national statutory regulation allowing students to commence and advance their Master studies before completing their respective Bachelor's degree. In this connection, it is considered crucial that the Master's degree at least cannot be finished before the completion of the Bachelor's degree. That is why the Accreditation Commission deems the respective recommendation 6 to be adequate and sufficient. Overall, the Commission agrees with the recommended resolution by the peers and the Technical Committees without changes.

The Accreditation Commission for Degree Programmes decides to award the following seals:

Degree Programme	ASIIN-seal	Subject-specific label	Maximum duration of accreditation
Ba Energy and Information Technology	With requirements for one year	EUR-ACE	30.09.2025
Ma Energy and Information Technology	With requirements for one year	EUR-ACE	30.09.2025
Industrial Systems Analytics	With requirements for one year	EUR-ACE	30.09.2025

Requirements

For all degree programmes

A 1. (ASIIN 1.1, 1.3) Ensure that students are committed to professional ethics, responsibilities and norms of engineering practice in a reasonable and transparent manner.

A 2. (ASIIN 2.1) If the "working practices" (internships) shall be awarded credit points, it must be ensured that the university takes responsibility in terms of content and structure. Related instructions for working practices must apply to all degree programmes.

A 3. (ASIIN 2.2) Develop and implement a process to systematically monitor the actual student workload and to adapt either the credit point allocation or the module/course content, if necessary.

A 4. (ASIIN 5.2) Include the programme-specific learning outcomes into the Diploma Supplement. Furthermore, statistical data according to the ECTS-User's guide in addition to the final grade must be provided.

For the Bachelor's and Master's degree programme Energy and Information Technology

A 5. (ASIIN 1.1) Adapt the programme-specific learning outcomes and / or the name of the degree programmes in such manner that they reasonably match with the different study specializations offered in the programmes.

Recommendations

For all degree programmes

E 1. (ASIIN 2.1) It is recommended to further support and strengthen student mobility.

E 2. (ASIIN 4.2) It is recommended to allocate a certain amount of research time to all different levels of staff members for further qualification purposes.

E 3. (ASIIN 6) It is recommended to more comprehensively perform and document the systematic monitoring of the study progress and the use of the results thereof in order to reasonably decide on and evaluate the follow-up process.

For the Bachelor's programme Energy and Information Technology

E 4. (ASIIN 1.3) It is recommended to strengthen the electrical engineering fundamentals (for instance control engineering, analogue and digital circuits).

E 5. (ASIIN 1.3) It is recommended to enlarge the students' knowledge and skills in the field of systems safety and security.

E 6. (ASIIN 1.4) It is recommended to take further steps to focus students on completing the Bachelor's degree before commencing their Master's studies.

For the Bachelor's and Master's degree programmes Energy and Information Technology

E 7. (ASIIN 2.1) It is recommended to encourage the students to include industrial internships ("working practice") in their studies in order to strengthen their engineering practice competences.

I Fulfilment of Requirements (03.12.2020)

Analysis of the peers and the Technical Committees (19.11.2020)

Requirements

For all degree programmes

A 1. (ASIIN 1.1, 1.3) Ensure that students are committed to professional ethics, responsibilities and norms of engineering practice in a reasonable and transparent manner.

Initial Treatment	
Peers	Fulfilled Vote: unanimous Justification: A new mandatory course has been included in the curriculum: “Engineering Ethics, Norms and Regulations” (1 ECTS)
TC 02	fulfilled Vote: unanimous Justification: The technical committee follows the decision of the peers.
TC 04	fulfilled Vote: unanimous Justification: The technical committee follows the decision of the peers.

A 2. (ASIIN 2.1) If the “working practices” (internships) shall be awarded credit points, it must be ensured that the university takes responsibility in terms of content and structure. Related instructions for working practices must apply to all degree programmes.

Initial Treatment	
Peers	Fulfilled Vote: unanimous Justification: The teachers of the university are now more closely connected and involved in the project by supervising the report that the students have to write about the internship and also in the initial process of making sure the internships fits well into the overall studies.
TC 02	fulfilled Vote: unanimous Justification: The technical committee follows the decision of the peers.

TC 04	fulfilled Vote: unanimous Justification: The technical committee follows the decision of the peers.

A 3. (ASIIN 2.2) Develop and implement a process to systematically monitor the actual student workload and to adapt either the credit point allocation or the module/course content, if necessary.

Initial Treatment	
Peers	Fulfilled Vote: unanimous Justification: The university is aware of deficiencies regarding this requirement in the past and has described a step-by-step process to implement a thorough calculation of the students‘ workload: „We are now building a systematic, uniform way to take a notice of the feedback concerning workload in the curricula.“
TC 02	fulfilled Vote: unanimous Justification: The technical committee follows the decision of the peers.
TC 04	fulfilled Vote: unanimous Justification: The technical committee follows the decision of the peers.

A 4. (ASIIN 5.2) Include the programme-specific learning outcomes into the Diploma Supplement. Furthermore, statistical data according to the ECTS-User’s guide in addition to the final grade must be provided.

Initial Treatment	
Peers	Not fulfilled Vote: unanimous Justification: The university is still is in the process of updating their Diploma Supplements. A person responsible for the Diploma Supplement has so far not been defined. The peers cannot see any changes being made to the previous Diploma Supplements, which would clarify the different learning outcomes of the different programmes. Apparently, the university needs more time for this, as they are waiting for a new person to be given this responsibility.
TC 02	Not fulfilled Vote: unanimous

	Justification: The technical committee follows the decision of the peers.
TC 04	Not fulfilled Vote: unanimous Justification: The technical committee follows the decision of the peers.

For the Bachelor's and Master's degree programme Energy and Information Technology

A 5. (ASIIN 1.1) Adapt the programme-specific learning outcomes and / or the name of the degree programmes in such manner that they reasonably match with the different study specializations offered in the programmes

Initial Treatment	
Peers	Fulfilled Vote: unanimous Justification: The university's reasons for keeping to certain naming conventions can be followed and understood. Changes made to the descriptions of the programmes now describe them in more detail and precision.
TC 02	fulfilled Vote: unanimous Justification: The technical committee follows the decision of the peers.
TC 04	fulfilled Vote: unanimous Justification: The technical committee follows the decision of the peers.

Decision of the Accreditation Commission (03.12.2020)

The Accreditation Commission discusses the fulfilment of requirements and follows the decision of the peers and technical committees regarding requirement 4 which has not yet been fulfilled.

Degree programme	ASIIN-label	Subject-specific label	Accreditation until max.
Ba Energy and Information Technology	Requirement 4 not fulfilled	EUR-ACE®	6 months prolongation
Ma Energy and Information Technology	Requirement 4 not fulfilled	EUR-ACE®	6 months prolongation
Ma Industrial Systems Analytics	Requirement 4 not fulfilled	EUR-ACE®	6 months prolongation

J Appendix: Programme Learning Outcomes and Curricula

According to SAR, the following **objectives** and **learning outcomes (intended qualifications profile)** shall be achieved through the Bachelor's degree programme Energy and Information Technology:

"After completing this degree programme, students are able to […]:

- analyse and model technology in mathematical and natural science methods,
- describe the physical basics of energy and electricity and the information technology of the [energy related] applications,
- construct and evaluate solutions to practical technical challenges using the scientific method and systematic working,
- express engineering matters lucidly in written form, in the field of specialisation, independently and continuously follow, learn and take into use to advancement of technology and science,
- interpret the societal and economic significance of new technologies, and
- master Finnish and Swedish as required for civil servants by the Finnish law, as well as one foreign language in the practical level.

In addition, after completing the Information technology specialisation option, student are able to:

- specify widely the scientific foundations of computer science, automation, and telecommunication, and
- design and implement software engineering projects to both PC and embedded systems."

Alternatively, the curriculum description provided before the onsite-visit reads as follows:

- knows the scientific basis of information technology, automation technology and telecommunication engineering and has gained a basic professional competence in these fields
- knows the basics of energy technology and the energy sector from the viewpoint of information technology applications

- has the skills to continue to Master's level studies in either the Automation and Computer Science specialisation or in the Master's Programme in Wireless Industrial Automation (communications and systems engineering).")

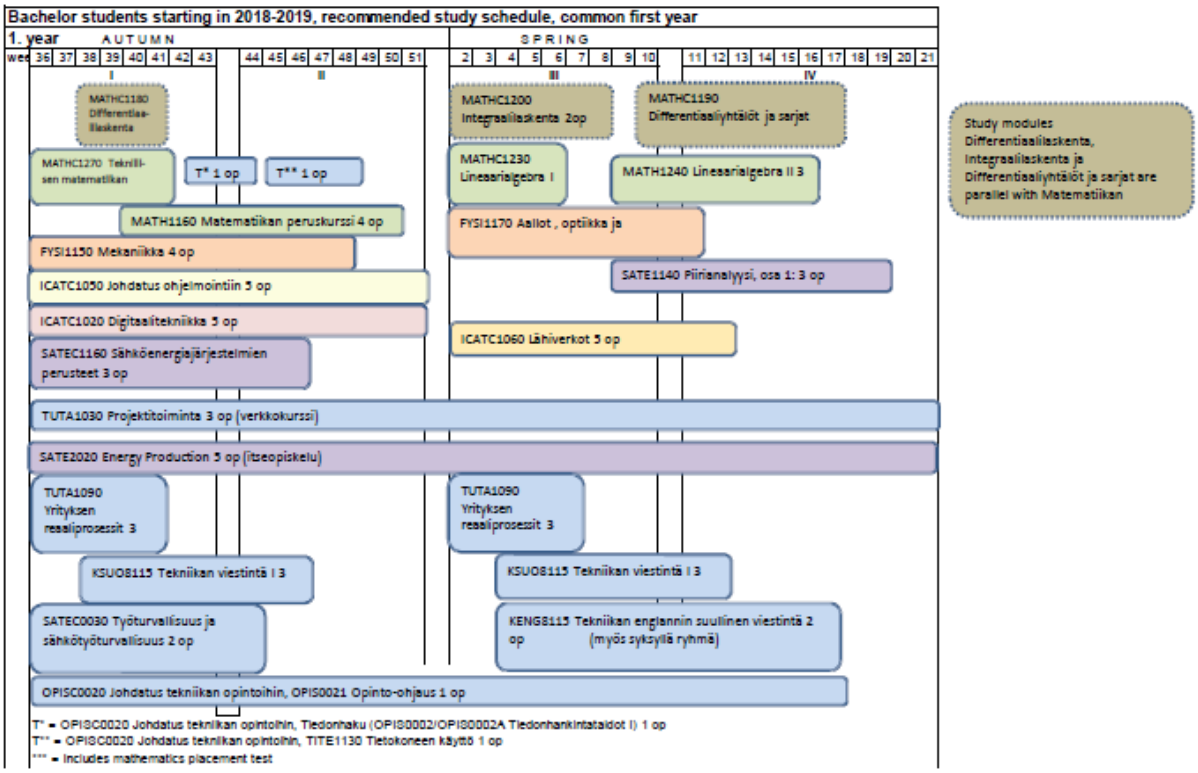
"In addition, after completing the Electrical engineering and energy technology specialisation option, student are able to:

- describe the behaviour of the various parts and components of power systems in different scenarios, and
- analyse power systems by algebra, simulations, and laboratory experiments.

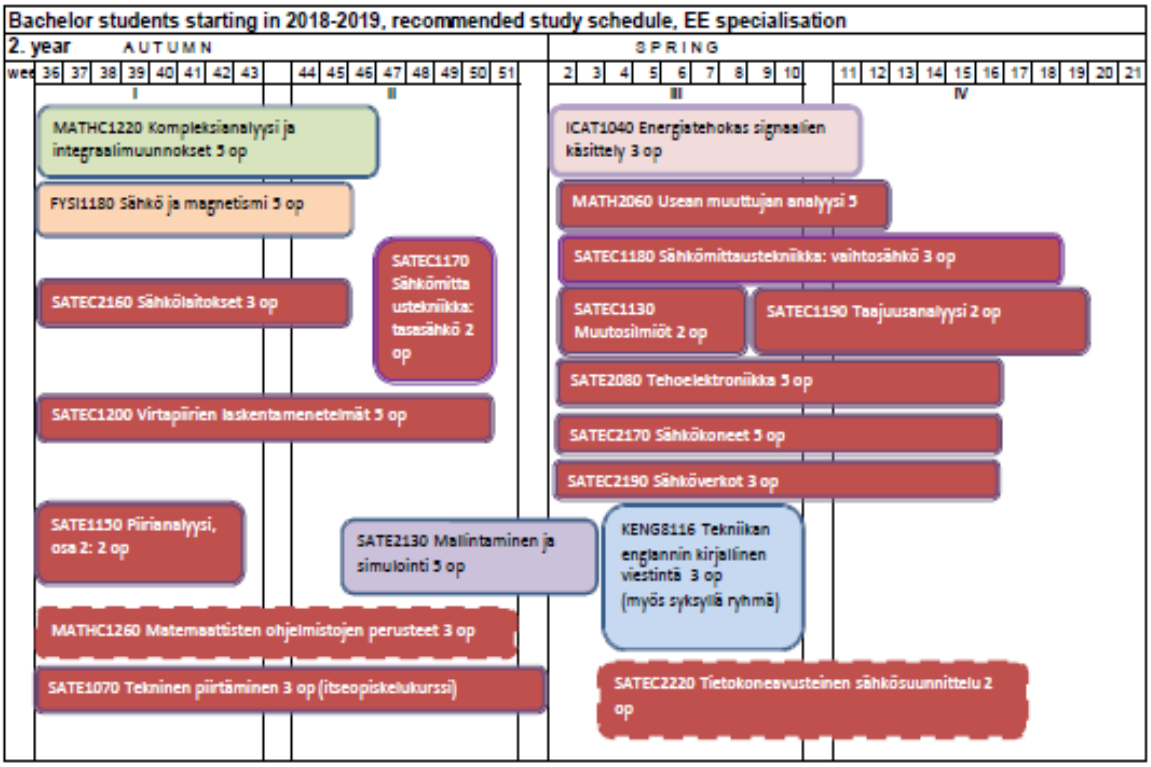
In addition, after completing the Industrial engineering specialisation option, student are able to:

- specify and design production and product development activities with an economic view, and
- analyse the dimensions of sustainability, particularly in the energy field."

The following **curriculum** is presented:[10]



[10] English translations of the curricula were made available to the peers after the onsite visit but have not been included into the annexes of this report.


Bachelor students starting in 2018-2019, recommended study schedule, EE specialisation
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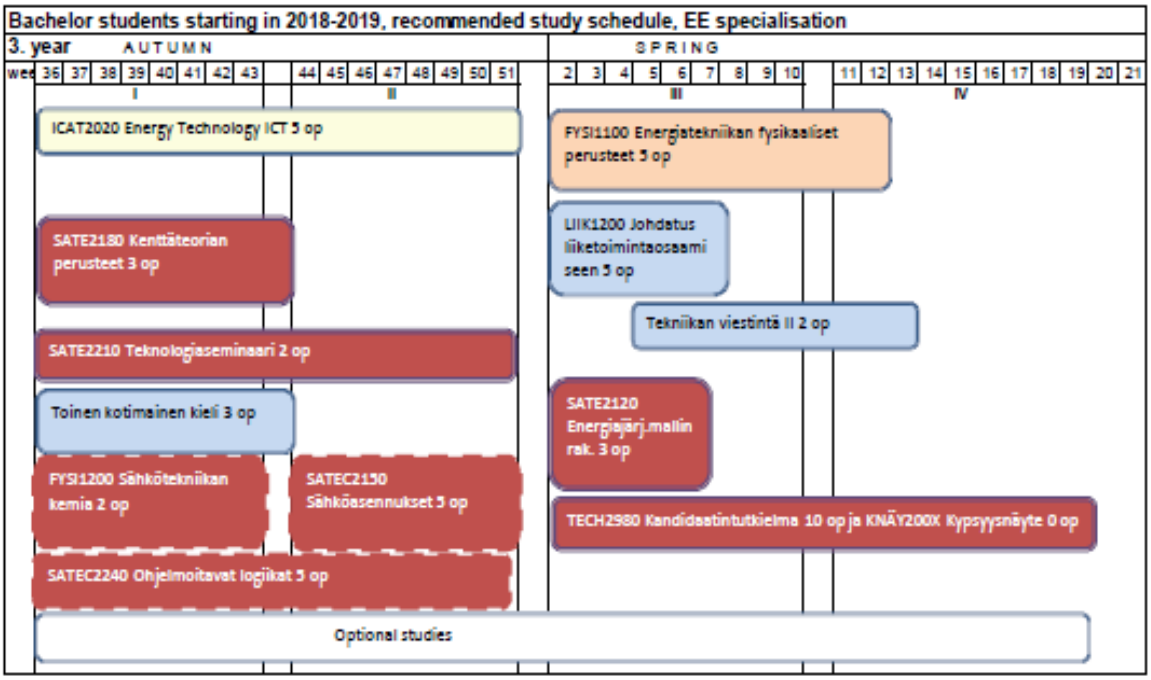
MATHC1220 Kompleksianalyysi ja integraalimuunnokset 5 op
FYSI1180 Sähkö ja magnetismi 5 op
SATEC2160 Sähkölaitokset 3 op
SATEC1170 Sähkömittaustekniikka: tasasähkö 2 op
SATEC1200 Virtapiirien laskentamenetelmät 5 op
SATE1150 Piirianalyysi, osa 2: 2 op
SATE2130 Mallintaminen ja simulointi 5 op
MATHC1260 Matemaattisten ohjelmistojen perusteet 3 op
SATE1070 Tekninen piirtäminen 3 op (itseopiskelukurssi)
ICAT1040 Energiatehokas signaalien käsittely 3 op
MATH2060 Usean muuttujan analyysi 5
SATEC1180 Sähkömittaustekniikka: vaihtosähkö 3 op
SATEC1130 Muutosilmiöt 2 op
SATEC1190 Taajuusanalyysi 2 op
SATE2080 Tehoelektroniikka 5 op
SATEC2170 Sähkökoneet 5 op
SATEC2190 Sähköverkot 3 op
KENG8116 Tekniikan englannin kirjallinen viestintä 3 op (myös syksyllä ryhmä)
SATEC2220 Tietokoneavusteinen sähkösuunnittelu 2 op


Bachelor students starting in 2018-2019, recommended study schedule, EE specialisation
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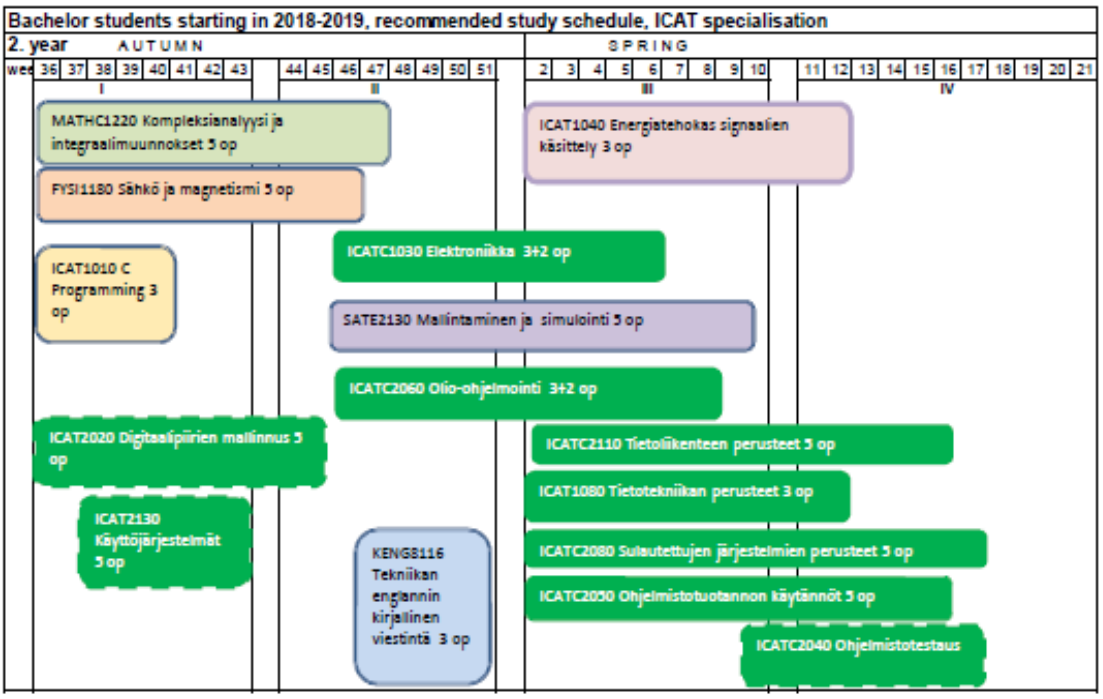
ICAT2020 Energy Technology ICT 5 op
SATE2180 Kenttäteorian perusteet 3 op
SATE2210 Teknologiaseminaari 2 op
Toinen kotimainen kieli 3 op
FYSI1200 Sähkötekniikan kemia 2 op
SATEC2150 Sähköasennukset 5 op
SATEC2240 Ohjelmoitavat logiikat 5 op
Optional studies
FYSI1100 Energiatekniikan fysikaaliset perusteet 5 op
LIIK1200 Johdatus liiketoimintaosaamiseen 5 op
Tekniikan viestintä II 2 op
SATE2120 Energiajärj.mallin rak. 3 op
TECH2980 Kandidaatintutkielma 10 op ja KNÄY200X Kypsyysnäyte 0 op

15.8.2018


Bachelor students starting in 2018-2019, recommended study schedule, ICAT specialisation
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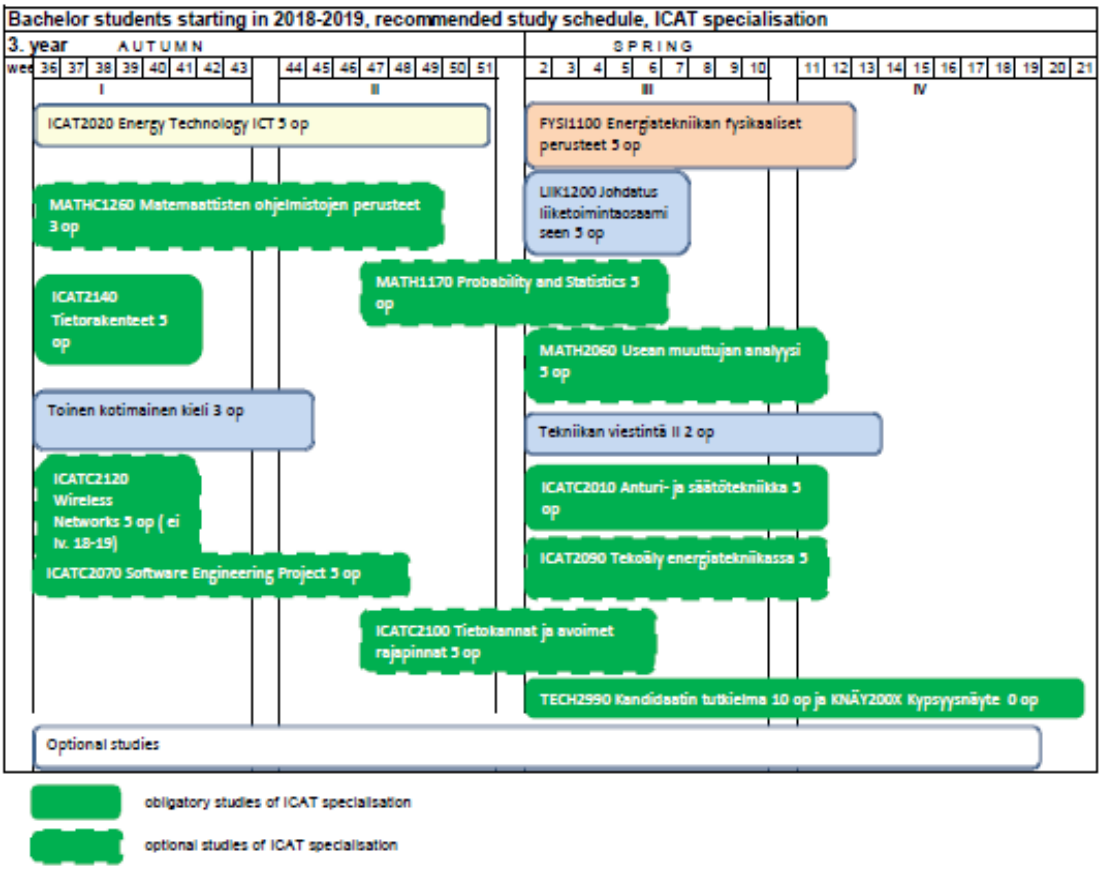
MATHC1220 Kompleksianalyysi ja integraalimuunnokset 5 op
ICAT1040 Energiatehokas signaalien käsittely 3 op
FYSI1180 Sähkö ja magnetismi 5 op
ICATC1030 Elektroniikka 3+2 op
ICAT1010 C Programming 3 op
SATE2130 Mallintaminen ja simulointi 5 op
ICATC2060 Olio-ohjelmointi 3+2 op
ICAT2020 Digitaalipiirien mallinnus 5 op
ICATC2110 Tietoliikenteen perusteet 5 op
ICAT1080 Tietotekniikan perusteet 3 op
ICAT2130 Käyttöjärjestelmät 5 op
KENG8116 Tekniikan englannin kirjallinen viestintä 3 op
ICATC2080 Sulautettujen järjestelmien perusteet 5 op
ICATC2050 Ohjelmistotuotannon käytännöt 5 op
ICATC2040 Ohjelmistotestaus


Bachelor students starting in 2018-2019, recommended study schedule, ICAT specialisation
3. year
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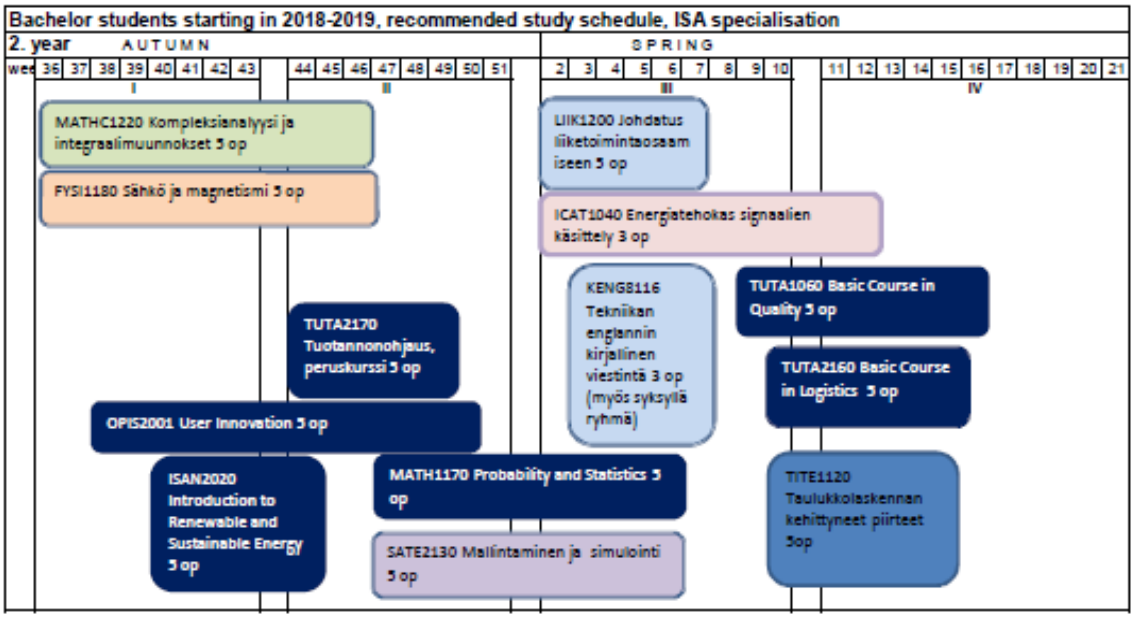
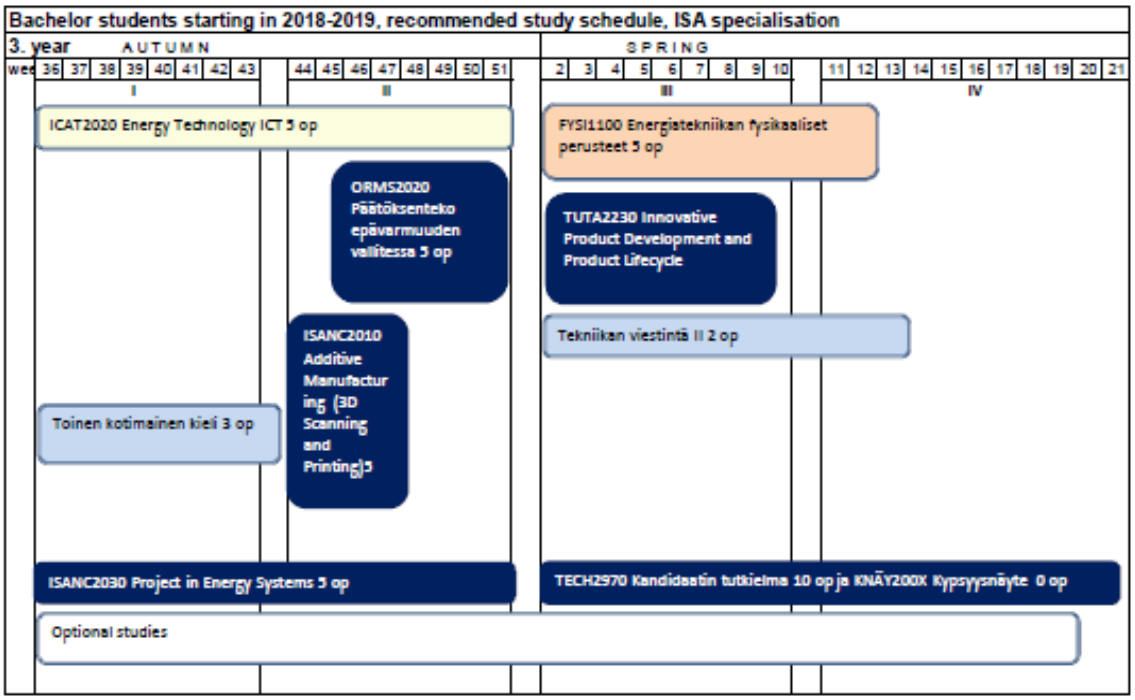
ICAT2020 Energy Technology ICT 5 op
FYSI1100 Energiatekniikan fysikaaliset perusteet 5 op
MATHC1260 Matemaattisten ohjelmistojen perusteet 3 op
LIIK1200 Johdatus liiketoimintaosaamiseen 5 op
MATH1170 Probability and Statistics 5 op
ICAT2140 Tietorakenteet 5 op
MATH2060 Usean muuttujan analyysi 5 op
Toinen kotimainen kieli 3 op
Tekniikan viestintä II 2 op
ICATC2120 Wireless Networks 5 op (ei lv. 18-19)
ICATC2010 Anturi- ja säätötekniikka 5 op
ICAT2090 Tekoäly energiatekniikassa 5
ICATC2070 Software Engineering Project 5 op
ICATC2100 Tietokannat ja avoimet rajapinnat 5 op
TECH2990 Kandidaatin tutkielma 10 op ja KNÄY200X Kypsyysnäyte 0 op
Optional studies
obligatory studies of ICAT specialisation
optional studies of ICAT specialisation





According to SAR, the following **objectives** and **learning outcomes (intended qualifications profile)** shall be achieved through the Master's degree programme Energy and Information Technology:

"After completing this degree programme in the Automation and computer science specialisation option, students are able to […]:

- master the fundamentals of computer science, automation, information technology, and telecommunication, and apply them to the research and product development of energy systems and products,
- utilise digital information and automation technology in all phases of product development – specifications, computer-aided design, implementation, testing, as well as to predictive maintenance, marketing, etc. – by taking into account the economic use of energy and natural resources and the earnings logic,
- model, simulate, and optimise large systems using programming,
- work in multilingual, international teams,
- master the fundamentals of software engineering projects, and participate in those as a technical expert,
- explain in a holistic way how telecommunication systems are integrated to various automation and information systems, as well as the roles of communication in modern devices and distributed systems,
- describe, evaluate, design, test, and apply advanced information and automation technology and scientific methods particularly in applications of energy production, transmission and distribution, utilisation, as well as in system optimisation,
- work in product development, project, specialist, and managerial occupations in the field of information and automation technology,
- develop new innovations, e.g., as for digitalisation and industrial internet,
- independently develop one's professional competence, use information sources critically, and to produce new knowledge to information and automation technology, and
- master the communication, language and interpersonal skills as needed in the occupations, as well as capabilities to participate to the social discussion of energy issues, particularly as for information and automation technology.

After completing this degree programme in the Electrical engineering specialisation option, students are able to […]:

- describe, evaluate, design, test, and apply the methods and scientific thinking of electrical engineering to applications in both industry and other fields,
- manage projects in electrical engineering,
- develop new methods to electrical engineering,
- use literature of technology with critical thinking and produce new knowledge in electrical engineering,
- work in product development, project, specialist, and managerial occupations in the field of electrical engineering,

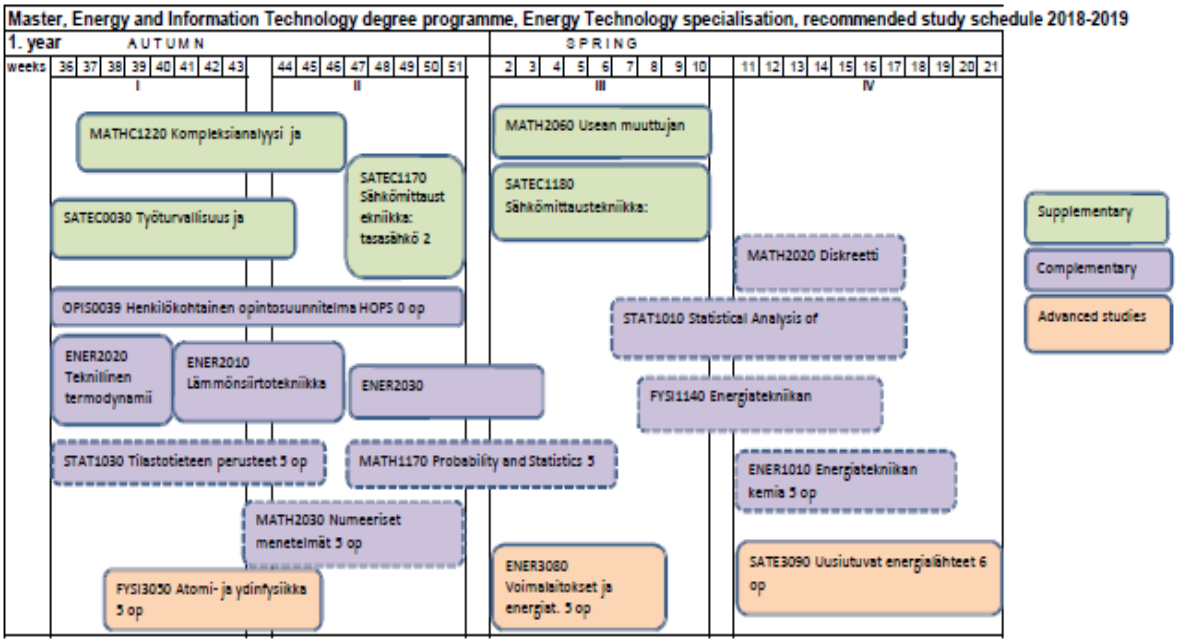
- develop oneself professionally, and
- continue to post-graduate studies (Lic. and PhD).

After completing this degree programme in the Energy technology specialisation option, students are able to […]:

- describe global and local energy management,
- evaluate and compare energy production forms from technology and economic perspectives, and to weigh the alternatives in energy production,
- calculate energy balances and emissions,
- design and study energy technology devices, processes, and systems, including systems to reduce emissions,
- apply energy technology methods to the industry and other applications,
- manage energy technology production, product development, and planning projects,
- develop new methods to energy technology, e.g., computer models and measurement methods,
- use information sources with critical thinking and produce new knowledge in energy technology,
- develop oneself professionally and on the other side in post-graduate studies aiming at lic. and PhD degrees."

The following **curriculum** is presented:

14082018/ EA


Master, Energy and Information Technology degree programme, Energy Technology specialisation, recommended study schedule 2018-2019
1. year
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36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
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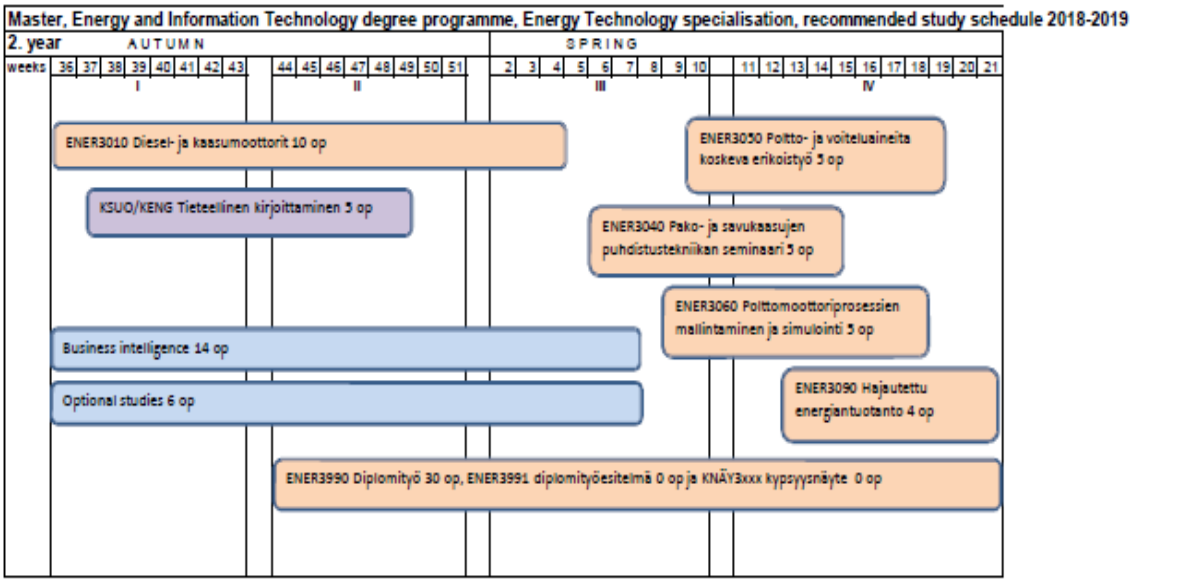
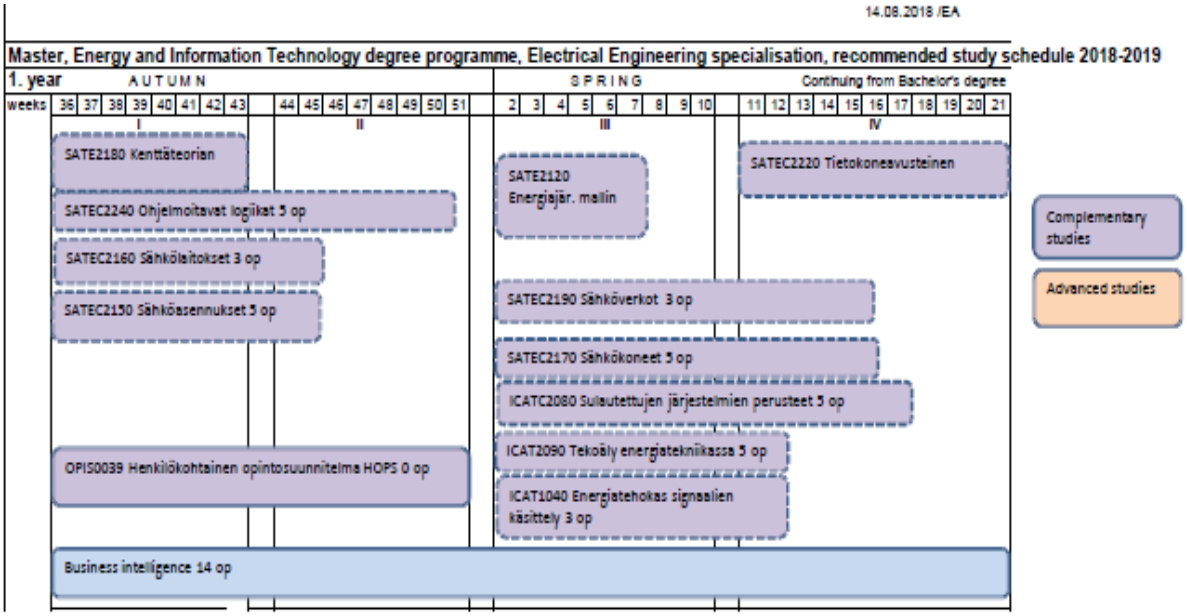
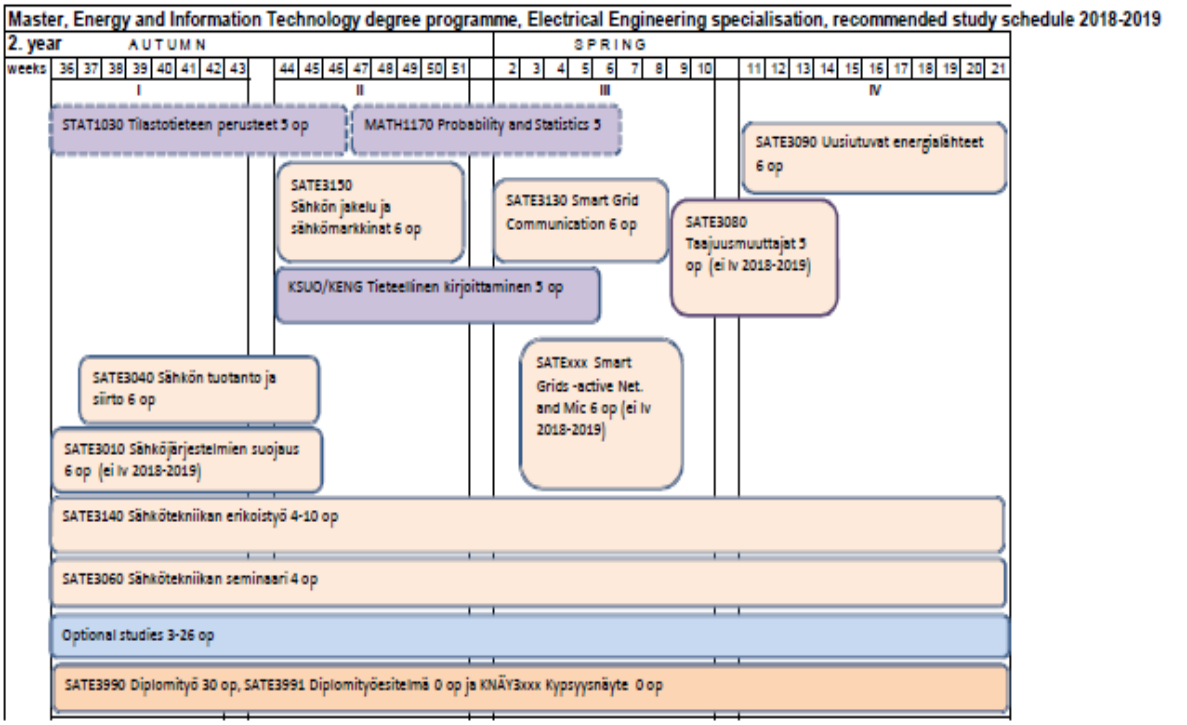
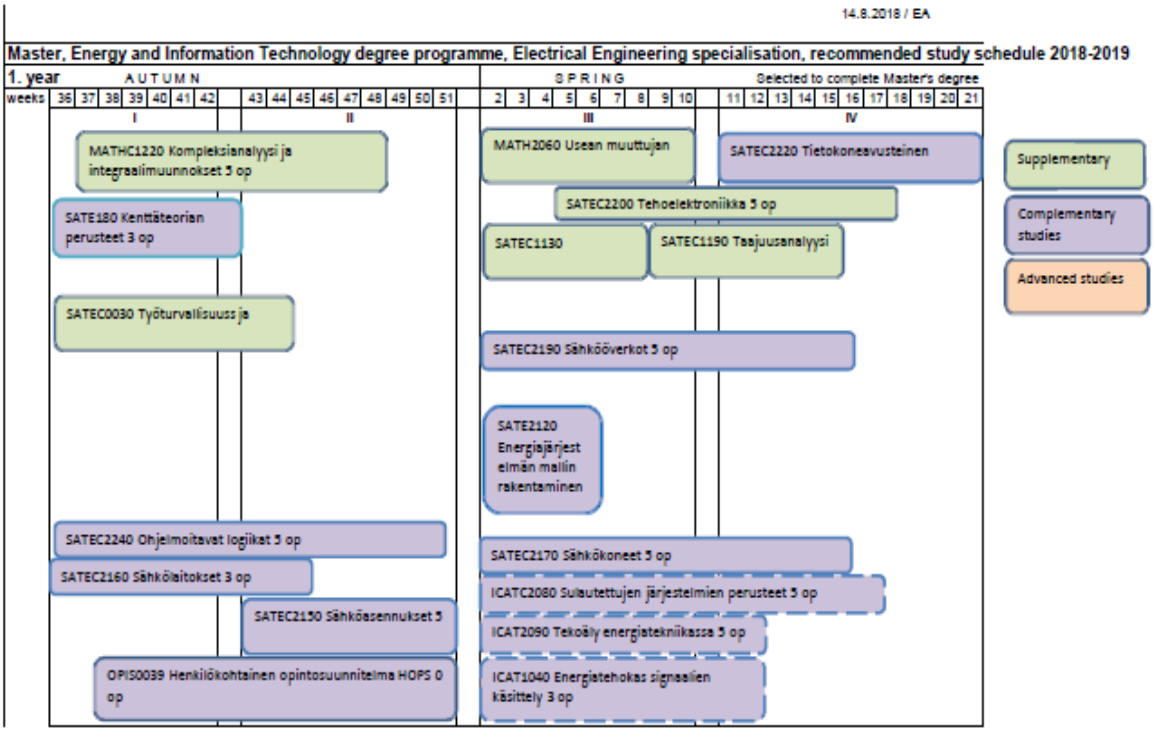
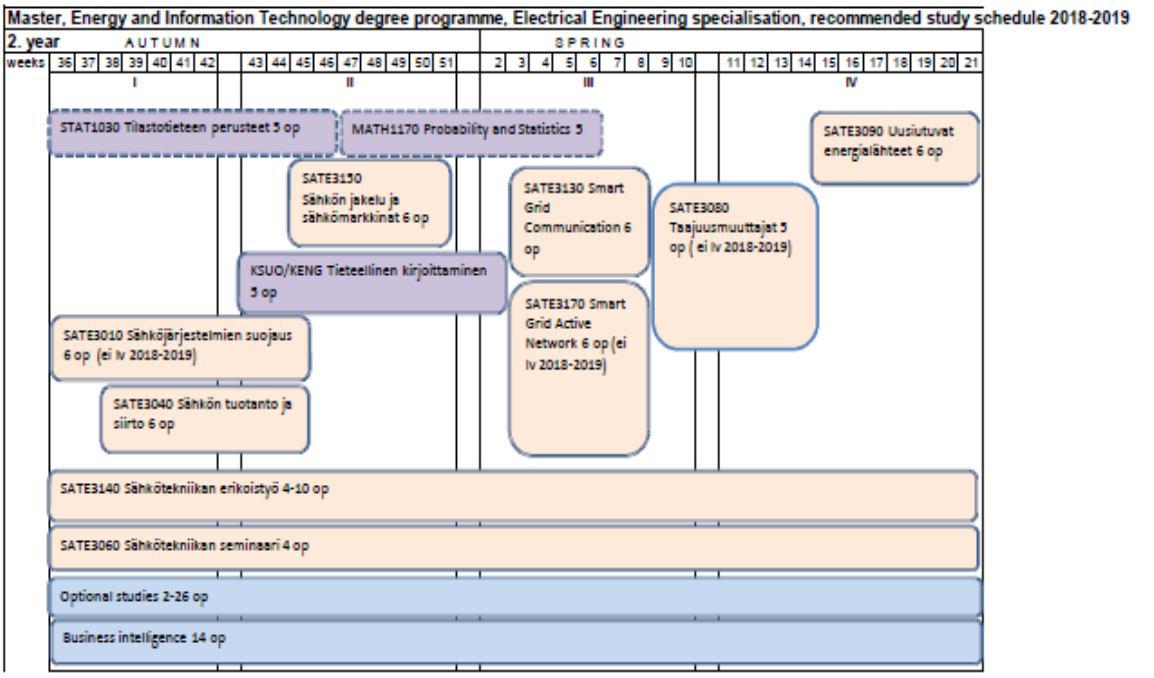
MATHC1220 Kompleksianalyysi ja
SATEC1170 Sähkömittaustekniikka: tasasähkö 2
SATEC0030 Työturvallisuus ja
MATH2060 Usean muuttujan
SATEC1180 Sähkömittaustekniikka:
MATH2020 Diskreetti
OPIS0039 Henkilökohtainen opintosuunnitelma HOPS 0 op
STAT1010 Statistical Analysis of
ENER2020 Teknillinen termodynamii
ENER2010 Lämmönsiirtotekniikka
ENER2030
FYSI1140 Energiatekniikan
STAT1030 Tilastotieteen perusteet 5 op
MATH1170 Probability and Statistics 5
ENER1010 Energiatekniikan kemia 5 op
MATH2030 Numeeriset menetelmät 5 op
FYSI3050 Atomi- ja ydinfysiikka 5 op
ENER3080 Voimalaitokset ja energiat. 5 op
SATE3090 Uusiutuvat energialähteet 6 op
Supplementary
Complementary
Advanced studies

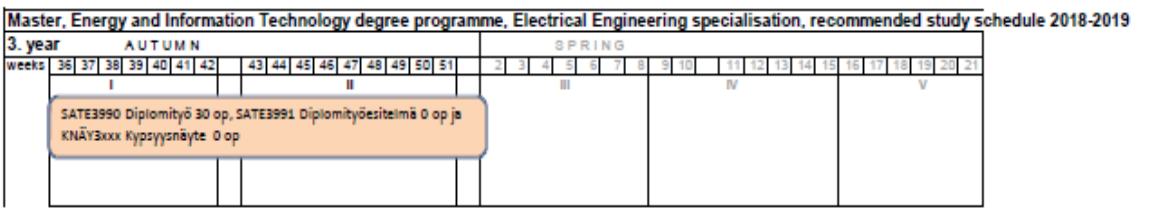

Master, Energy and Information Technology degree programme, Energy Technology specialisation, recommended study schedule 2018-2019
2. year
AUTUMN
SPRING
weeks
36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
I
II
III
IV
ENER3010 Diesel- ja kaasumoottorit 10 op
ENER3050 Poltto- ja voiteluaineita koskeva erikoistyö 5 op
KSUO/KENG Tieteellinen kirjoittaminen 5 op
ENER3040 Pako- ja savukaasujen puhdistustekniikan seminaari 5 op
ENER3060 Polttomoottoriprosessien mallintaminen ja simulointi 5 op
Business intelligence 14 op
Optional studies 6 op
ENER3090 Hajautettu energiantuotanto 4 op
ENER3990 Diplomityö 30 op, ENER3991 diplomityöesitelmä 0 op ja KNÄY3xxx kypsyysnäyte 0 op


14.08.2018 /EA
Master, Energy and Information Technology degree programme, Electrical Engineering specialisation, recommended study schedule 2018-2019
1. year
AUTUMN
SPRING
Continuing from Bachelor's degree
weeks
36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
I
II
III
IV
SATE2180 Kenttäteorian
SATEC2240 Ohjelmoitavat logiikat 5 op
SATEC2160 Sähkölaitokset 3 op
SATEC2150 Sähköasennukset 5 op
OPIS0039 Henkilökohtainen opintosuunnitelma HOPS 0 op
Business inteligence 14 op
SATE2120 Energiajär. mallin
SATEC2190 Sähköverkot 3 op
SATEC2170 Sähkökoneet 5 op
ICATC2080 Sulautettujen järjestelmien perusteet 5 op
ICAT2090 Tekoäly energiatekniikassa 5 op
ICAT1040 Energiatehokas signaalien käsittely 3 op
SATEC2220 Tietokoneavusteinen
Complementary studies
Advanced studies


Master, Energy and Information Technology degree programme, Electrical Engineering specialisation, recommended study schedule 2018-2019
2. year
AUTUMN
SPRING
weeks
36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
I
II
III
IV
STAT1030 Tilastotieteen perusteet 5 op
MATH1170 Probability and Statistics 5
SATE3150 Sähkön jakelu ja sähkömarkkinat 6 op
KSUO/KENG Tieteellinen kirjoittaminen 5 op
SATE3130 Smart Grid Communication 6 op
SATE3080 Taajuusmuuttajat 5 op (ei lv 2018-2019)
SATE3090 Uusiutuvat energialähteet 6 op
SATE3040 Sähkön tuotanto ja siirto 6 op
SATE3010 Sähköjärjestelmien suojaus 6 op (ei lv 2018-2019)
SATExxx Smart Grids -active Net. and Mic 6 op (ei lv 2018-2019)
SATE3140 Sähkötekniikan erikoistyö 4-10 op
SATE3060 Sähkötekniikan seminaari 4 op
Optional studies 3-26 op
SATE3990 Diplomityö 30 op, SATE3991 Diplomityöesitelmä 0 op ja KNÄY3xxx Kypsyysnäyte 0 op


14.8.2018 / EA
Master, Energy and Information Technology degree programme, Electrical Engineering specialisation, recommended study schedule 2018-2019
1. year
AUTUMN
SPRING
Selected to complete Master's degree
weeks
36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
I II III IV
MATHC1220 Kompleksianalyysi ja integraalimuunnokset 5 op
MATH2060 Usean muuttujan
SATEC2220 Tietokoneavusteinen
SATE180 Kenttäteorian perusteet 3 op
SATEC2200 Tehoelektroniikka 5 op
SATEC1130
SATEC1190 Taajuusanalyysi
SATEC0030 Työturvallisuuss ja
SATEC2190 Sähköverkot 5 op
SATE2120 Energiajärjest elmän mallin rakentaminen
SATEC2240 Ohjelmoitavat logiikat 5 op
SATEC2160 Sähkölaitokset 3 op
SATEC2150 Sähköasennukset 5
OPIS0039 Henkilökohtainen opintosuunnitelma HOPS 0 op
SATEC2170 Sähkökoneet 5 op
ICATC2080 Sulautettujen järjestelmien perusteet 5 op
ICAT2090 Tekoäly energiatekniikassa 5 op
ICAT1040 Energiatehokas signaalien käsittely 3 op
Supplementary
Complementary studies
Advanced studies


Master, Energy and Information Technology degree programme, Electrical Engineering specialisation, recommended study schedule 2018-2019
2. year
AUTUMN
SPRING
weeks
36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
I II III IV
STAT1030 Tilastotieteen perusteet 5 op
MATH1170 Probability and Statistics 5
SATE3090 Uusiutuvat energialähteet 6 op
SATE3150 Sähkön jakelu ja sähkömarkkinat 6 op
SATE3130 Smart Grid Communication 6 op
SATE3080 Taajuusmuuttajat 5 op (ei lv 2018-2019)
KSUO/KENG Tieteellinen kirjoittaminen 5 op
SATE3170 Smart Grid Active Network 6 op (ei lv 2018-2019)
SATE3010 Sähköjärjestelmien suojaus 6 op (ei lv 2018-2019)
SATE3040 Sähkön tuotanto ja siirto 6 op
SATE3140 Sähkötekniikan erikoistyö 4-10 op
SATE3060 Sähkötekniikan seminaari 4 op
Optional studies 2-26 op
Business intelligence 14 op


Master, Energy and Information Technology degree programme, Electrical Engineering specialisation, recommended study schedule 2018-2019
3. year
AUTUMN
SPRING
weeks
36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
I II III IV V
SATE3990 Diplomityö 30 op, SATE3991 Diplomityöezitelmä 0 op ja KNÄY3xxx Kypsyysnäyte 0 op

According to SAR, the following **objectives** and **learning outcomes (intended qualifications profile)** shall be achieved through the Master's degree programme Industrial Systems:

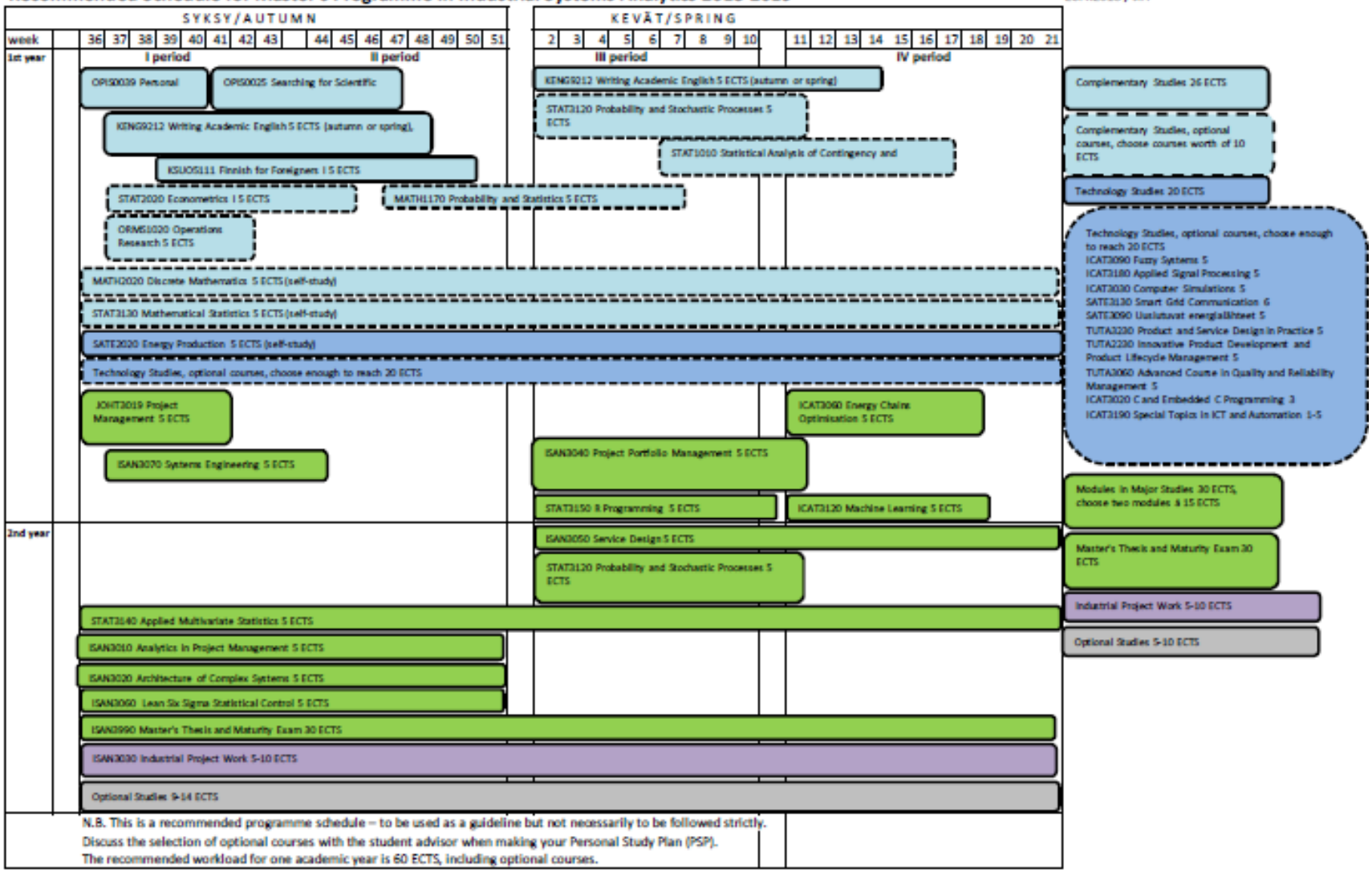
After completing this degree programme, students are able to (as described in the Study handbook):

- - produce knowledge and insights from energy system data,
- - develop and operate high quality standard for energy operations,
- - design and operate successful energy systems,
- - include quantitative and qualitative input streams for decision making, and
- - plan and manage projects within the energy field."

The following **curriculum** is presented:

Recommended Schedule for Master's Programme in Industrial Systems Analytics 2018-2019

26.4.2018 / J.H



N.B. This is a recommended programme schedule – to be used as a guideline but not necessarily to be followed strictly.
Discuss the selection of optional courses with the student advisor when making your Personal Study Plan (PSP).
The recommended workload for one academic year is 60 ECTS, including optional courses.