

# Expert group joint opinion

Evaluation Procedure: Assessment of Study Field

Higher Education Institution: Latvia University of Life Sciences and Technologies

Study field: Power Industry, Electrical Engineering, and Electrical Technologies

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# Summary Assessment of the Study Field

## Summary Assessment of the Study Field

The study direction of Power industry, electrical engineering and electrical technologies implemented at Latvia University of Life Sciences and Technologies (LLU) includes one study programme: professional Bachelor's degree study programme: Applied Energy Engineering. Graduates and students are content with the study programme, the knowledge and skills obtained in university. Education of the students in the two directions both in electrical engineering and heat subjects from power engineering allows them opportunities to find more jobs and to fulfil different roles within "Power Industry, Electrical Engineering, and Electrical Technologies". LLU has established internal quality assurance system and the study field is being developed in coherence with it.

Experts team saw that LLU developed a system to determine the financial resources required for the implementation of the study field. The Energy Institute has training facilities and laboratories with equipment and the necessary technical support. For improvement of study processes, study rooms are regularly improved and modernized, as well as laboratories are equipped with equipment necessary for work however some of them are old and require repair. The academic and research workload of the Teaching Staff of the Institute of Energy is balanced. University has identified the necessary support for students and has established a student support system.

Teaching staff actively inform students about scientific and research achievements. Mechanisms are in place to motivate teaching staff to engage in research through a funding and motivation system. A centralised system for the distribution of public funding has been put in place to ensure a fair and transparent distribution of funding. As innovative solutions in the study process, several activities are used to promote the university and disseminate information to the public, students visit various industrial objects.

Shortcomings include insufficiently incorporated recent trends in energy in the study process, which are closely related to international cooperation and research. Stakeholders are insufficiently involved in the development of the study programme and joint cooperation. Some of the issues covered by future levels of study should be learned at an earlier stage, such as environment issues (gas emissions).

The possibilities of the study field for the performance of scientific activity are considered to be very high and valued as prospects, especially taking into account laboratory equipment and research opportunities for synergies between two energy resources. The study programme is well related to the needs of Latvian rural area and small towns. The content of the programme and traineeship are provided in cooperation with local companies and other institutions. Final theses are supervised and evaluated by representatives of local companies. Therefore, the cooperation with local institution is very good, although could be further improved by proactive measures, like official participation of the employers in the Faculty Board and creation of a study course on strategic development of power engineering, offering the opportunity to leading specialists and managers of local companies to present their lectures to the students. The international cooperation is mostly related with few visiting professors and lecturers.

The number of scientific publications has been significantly increased during the reporting period. The library provides a wide range of information and the most popular scientific databases are available. The training descriptions include the most important sources of information. The teaching staff has significantly elevated qualifications. Activities with the international community have been improved, but not actively enough, given the wide and opportunity-rich study programme. The previously recommendations have been followed and contribution has been made to the development and improvement of the study field.

## 1. Management of the Study Field

### Analysis

1.1. The aims of the study field are clearly defined and attainable. The aims of the study direction and the tasks of the study direction are following LLU strategy to achieve continuous compliance of the content of study courses with specialization field chosen. The study direction and the relevant study programme are in accordance with the strategic development objectives of the higher education institution and suit the national economic and societal development trends. The study direction of Power industry, electrical engineering and electrical technologies implemented at Latvia University of Life Sciences and Technologies (LLU) includes one study programme: the professional Bachelor's degree study programme Applied Energy Engineering. That study programme is unique and differs from all other programmes in Latvia in that it covers knowledge, skills and competences both in electrical power engineering and heat power engineering, thus allowing a graduate engineer to ensure work performance in both fields, as well as in combined energy equipment and systems.

1.2. The management of the study direction and the relevant study programme has a suitable structure. The analysis and assessment of the efficiency thereof, including the assessment of the role of the director of the study direction and the heads of the study programmes, their responsibilities, and the cooperation with other heads of the study programmes provided within the study direction was well described in the self-evaluation report (SER- section II 1. Management of the Study Direction, Ch 1.4) and seems to be efficient. The study direction of Power industry, electrical engineering and electrical technologies includes a single programme "Applied Energy Engineering", therefore the head of the study direction and the director of the study programme is the same person. The main tasks of the director of the study programme are clearly presented (SER section II-1.4). The task of the study direction is to prepare energy engineering specialists competitive in the labour market, with emphasis on the current and prospective requirements of the energy supply systems and their rational use in agricultural and industrial technologies. In the line with aims of the study direction (SER-section II-1.2) is to educate competent engineers in accordance with the needs of the national economy, therefore a large volume of traineeship allows students to gain experience. The management of the university has established internal quality mechanisms, through lecture quality assurance, new staff evaluation, a motivation system, annual evaluation and the students' evaluation of staff, materials and plans for improvement and development of the study field direction. LLU consider that transparency is important to delivering the quality mechanisms (SER, Annex 2.1. Improvement and development plan of study direction). The infrastructure for studies and research has been improved and modernised within the limits of financial possibilities, but this should continue. (SER, Annex 2.1. Improvement and development plan of study direction).

1.3. The higher education institution has established a system and implemented procedures for the admission of students, the recognition of the study period, professional experience, and the previously acquired formal and non-formal education, as well as for the evaluation of the students' achievements and learning outcomes. According to the admission regulations for the professional bachelor's degree programme in Applied Energy Engineering, undergraduate applicants are required to have general secondary education or professional secondary education (SER). Students are admitted on a competitive basis based on the results of their centralized examinations. One of the best outcomes that resulted from implementing the study programme direction is the long traineeship period in companies as part of the study process framework (the total amount is 24 weeks) is to provide students with practical skills and an understanding of the organisation of engineering work. There is a large number of companies where students have access to traineeships, with over 90 companies. The recognition of previously acquired formal education and a previous study period is regulated by the Rector's regulation "On academic recognition procedure at LLU" from 02.11.2016. (Annex: Academic Recognition at LLU.pdf). It is clear that the support

provided by the administrative and technical staff contributes to meet the students' needs in terms of the relevant study programme. All these procedures are logical and efficient. One of the main activities implemented by LLU to increase the number of students is improving and modernising the infrastructure for studies and research and targeting opportunities to receive scholarships funded by patrons. Within the limits of financial possibilities, the renovation of the laboratory infrastructure should continue. The lack of sufficient funding to improve the education system of LLU is highlighted in the discussions with management. Therefore, the management must find solutions to manage the existing sources efficiently and to find other sources of funding (more EU projects and national grants).

1.4. The higher education institution has set out certain academic integrity principles and mechanisms. The academic integrity principles are defined in LLU Senate decision "Regulations for Academic Integrity" (annex: Regulations for Academic Integrity.pdf). The institution uses appropriate and effective plagiarism detection. In 2014, LLU concluded an agreement on the use of an inter-university unified computerised plagiarism detection system (hereinafter referred to as the System) and started the examination of all final theses for plagiarism in both undergraduate and master's degree studies. From 2017/2018 academic year LLU announced that plagiarism checking is compulsory also for doctoral theses. Since the introduction of the unified computerised plagiarism control system, LLU has detected 124 suspicious works in total. 173 theses were checked by the Programme in the study direction Power industry, Electrical Engineering and Electrical Technologies in the time period from 2014 to 2020 and plagiarism was not detected in any of them.

1.5. The information published on the website of the higher education institution regarding the study programme of the study direction complies with the information available in the official registers. A mechanism for the creation and internal approval of the study programmes of the higher education institution, as well as the supervision of their performance and periodic inspection thereof has been developed (Annex 1.1. Main internal legal acts and regulations of LLU). Every year, annual reports are drawn up for all study programmes; the reports are approved by the Senate and published on the LLU website (only in Latvian: <https://www.llu.lv/lv/studiju-virzientu-parskati-un-pasnovertejumazinojumi>). Information about the study directions and study programmes is published on the website of the Latvia University of Life Sciences and Technologies ([www.LLU.lv](http://www.LLU.lv)). However, more detailed information (e.g. descriptions of study programmes) is only available in Latvian in the section: Studijas / Studiju programmas -> <https://www.LLU.lv/lv/studiju-programmas>. The information in English about the study programmes is available in the English version of the university's website. In addition, access to the descriptions of all the study programmes is available via the website of the LLU Faculty of Engineering: <http://www.tf.LLU.lv/en>. The LLU website provides information in Latvian and English required for Erasmus+ academic mobility conditions and procedures in accordance with the Erasmus Charter for Higher Education and its framework guidelines. Such a system is beneficial in providing a broad overview of the issues that need to be addressed and an objective justification for activities within the course framework and study programme, as well as offering mutual exchange of best practice with leaders of other engineering courses, enabling LLU to implement positive experiences into their engineering field. LLU has signed cooperation agreements with 161 partner universities within the framework of the Erasmus+ exchange programme.

## **Conclusions. Strengths and weaknesses**

### Conclusions

The study direction of Power industry, electrical engineering and electrical technologies implemented at Latvia University of Life Sciences and Technologies (LLU) includes one study programme: professional Bachelor's degree study programme: Applied Energy Engineering.

Graduates and students are content with the study programme, the knowledge and skills obtained in university. Graduates are satisfied with the level of their education, which allows them to have successful careers. Education of the students in the two directions both in electrical engineering and heat subjects from power engineering allows them opportunities to find more jobs and to fulfil different roles within "Power Industry, Electrical Engineering, and Electrical Technologies". Employers are also satisfied with the level of graduates' theoretical knowledge. The laboratory equipment has been slowly improved, mainly using funding from approved projects and donations, however this upgrade must continue. Strengths are related to aims of the study direction to educate competent engineers in accordance with the needs of the national economy and obtain theoretical and practical knowledge and are related to the structure of the management of the study field.

#### Strengths

1. The study direction has a practical professional approach; students simultaneously obtain a professional Bachelor's degree and professional qualification.
2. The study direction prepares energy engineering specialists competitive in the labour market, with emphasis on the current and prospective requirements of the energy supply systems and their rational use in agricultural and industrial technologies.
3. One of the best outcomes from implementing the study programme direction is the long traineeship period in companies as part of the study process framework.

#### Weaknesses

1. The lack of sufficient funding to improve the education system of LLU is highlighted in the discussions with management.

## **2. Efficiency of the Internal Quality Assurance System**

### **Analysis**

2.1. LLU has established a quality policy that is available publicly <https://www.llu.lv/sites/default/files/2020-08/Quality%20Assurance%20System.pdf>. It is based on the following principles - leadership and setting ambitious and realistic goals, unity in achieving university goals, stakeholder involvement in the improvement of university products, services and processes, observance of the principles of social responsibility, a positive cooperation approach, an evidence-based approach to decision making. The developed and maintained quality assurance system contributes to the achievement of the aims and learning outcomes of the study field and the relevant study programme - it states clear principles of excellence, LLU vision, mission and values. It also defines clear responsibilities from inner stakeholders so that system can function and achieve aims. Within the system, there are also defined 19 main processes such as "provision of study process", "provision of scientific work" etc. It was noted in the meeting that these processes are not publicly available (from the group responsible for the preparation of SER and the person for QA at the university). It was also indicated that there is a special person responsible for the quality system in LLU.

2.2. LLU gathers feedback from students and graduates. They are reviewed by and available to study programme management, Dean, vice-rectors and Rector. There is no feedback from feedback that is given back to students and graduates (information gathered from meetings). Also, academic staff at the first lecture of a new study course do not give an overview of previous feedback received by students and what actions have been taken to improve a particular study course. From meeting with employers' experts identified that there is no feedback gathered from this group. Also, some members of the group would be willing to share their practical knowledge with students (for

example giving guest lectures or having excursions in the particular workplace).

2.3. LLU collects and analyses different statistics to improve the study field. There is information gathered every month - number of students in study programme as well as the number of students in state-funded places. Once a year there is statistical data about the number of graduates in study programmes and study directions as well as admission results. There is also information gathered about dropouts and reasons for suspending studies. LLU also collects information about performance indicators of the Educational programmes. These statistical data are used to improve the study field and make decisions based on data - for example, what action to take to reduce the dropout rate.

2.4. LLU has identified the standards set forth in Part 1 of the ESG, which require special attention modern updated infrastructure, focus on informing the public (page 35 and 36 in SER). SER states that LLU has various pedagogical methods used based on circumstances in the study field (page 34 in SER). This however could not be fully proven as interviews indicated that the concept of student-centred learning is not fully understood - academic staff could not easily give examples of what methods of student-centred learning are the hardest to implement. Therefore, experts can conclude that this aspect of ESG should be emphasized more. SER also states that there is the procedure for dealing with students' appeals (page 35 in SER), but interviews with students indicated that students do not have an understanding how this could be done.

## **Conclusions. Strengths and weaknesses**

### Conclusions

LLU has established internal quality assurance system and the study field is being developed in coherence with it. Said that experts have indicated some of the weak points of an inner quality system that should be improved (see weaknesses).

### Strengths

1. There is the publicly available quality management system.
2. There is a dedicated person that oversees the quality management system.
3. Broad and regular gathering of statistical data that is used to improve the study process.

### Weaknesses

1. Main processes defined in LLU quality management system are not publicly available. This is important to provide transparency to all stakeholders. Procedure for dealing with students' appeals are not known by students who participated in the interview. This is important as students should know at least where to find such information.
2. There is no feedback provided after the survey (for students and graduates). This means that students and graduates do not know if anything at all has been taken into account from their feedback. Feedback from employers is not received in a systematic way. There are no regular surveys.
3. Student-centred learning is not sufficiently understood by all stakeholders. This was identified in interviews with academic staff.

## **3. Resources and Provision of the Study Field**

### **Analysis**

3.1. Latvia University of Life Sciences and Technologies (LLU) has developed a system to determine the financial resources required for the implementation of the study field and the relevant study programme. The number of state-funded study places are approved in a tripartite agreement among the Ministry of Education and Science, Ministry of Agriculture and LLU. The costs per student in the professional bachelor's degree programme "Applied Energy Engineering" account for 2,746.16 EUR,

according to the information indicated in the self-evaluation report (SER). 80% of the state funding is remuneration costs and 20% other costs. 60% of the paid study funding consists of remuneration costs and 40% other costs, of which 20% are directly at the disposal of the faculty that implements the respective study program. The amount of funding for the science base is calculated and allocated annually from active research activities. 50% funding for the science base is at the direct disposal of the faculty and 50% to cover centralized costs. Research funding consists of funding attracted for the implementation of projects. The funding management system of study field, programme and scientific research is implemented at university and managed centrally. It's effective.

3.2. The Energy Institute has training facilities and laboratories with equipment and the necessary technical support. All lectures are held in classrooms equipped with multimedia equipment. The infrastructure of the Faculty of Engineering, research premises, material and technical support of the Energy Institute are used for the implementation of the study program. Main laboratories: Laboratory of Digital Electronics, Laboratory of the Renewable Energy, Laboratory of Electric Drive and Heat Power Processes, Laboratory of Electric Installation and Maintenance, Laboratory of Computer Modelling, Laboratory of Electrical Engineering, Laboratory of General Electrical Engineering, Automation Laboratory, Laboratory of Alternative Energy and Laboratory of Heat Engineering. Despite the fact that the Energy Institute is located in an old building, the classrooms are regularly improved and modernized, as well as laboratories are equipped with equipment necessary for work. There is no evidence demonstrated that measuring instruments, e.g. thermal cameras, are available in laboratories for laboratory work. The list of available equipment is incomplete. For example, it contains information about 5 multimeters of different models. However, when visiting the Renewable Energy Laboratory at No. 302, it has been found to contain several digital multimeters, Amprobe 34XR-A, but these tools do not appear on the equipment lists. The list does not specify the information in which training rooms, laboratories, specific work equipment is located. As well as there are no complete data on the work equipment necessary and used for the implementation of each course (name of the course, laboratory work, necessary equipment, for what purpose). Students and academic staff are provided with high-quality information technology infrastructure and services. For user identification, LLU has developed an appropriate system that provides each user with their own electronic identity (using LLU IS system, e-studies, LLU emails). The LLU Moodle system is used to ensure a high-quality study process. The Fundamental Library of the LLU serves for information and methodological provision of students. New educational literature is purchased in small copies on demand of teaching staff, rather than analysing the latest trends, needs in the energy sector. Reliable information on the procedure for improvement of material, methodological, informative provision is not provided, as well as there is no clear procedure for how resources are distributed when more laboratory equipment and books are needed.

3.3. 48 teaching staff are involved in the implementation of the study process (including 5 professors, 8 associated professors, 7 assistant professors, 3 guest docents, 11 lecturers and 14 chief lecturers) according to the information indicated in the SER in Section 3.6. The recruitment and employment procedure of the members of academic staff at LLU (announcement of vacancies, hiring process, election procedure to academic position, etc.) is regulated by "LLU Regulation on Academic Positions" approved by the Senate of LLU. The regulations are available on the LLU website: <https://www.llu.lv/sites/default/files/2021-04/Nolikums%2014.04.2021.pdf>. The academic and research workload of the teaching staff of the Institute of Energy is balanced. Professors have the largest share of the research workload, but lecturers have the largest share of academic workload. Professional development of teaching staff is carried out in accordance with the Regulations of the LLU on academic positions (Decision of the Senate No. 10-155 from 14.04.2021) and Cabinet Regulation No. 569 "On the education and professional qualification necessary for teachers and the procedures for improvement of the professional competence of teachers". No aggregated information on the professional development activities of the teaching staff is available. Experts

recommend compiling centrally training activities and other achievements in order to plan, maintain and increase the competitiveness of teaching staff. The lack of sufficient funding to invite highly qualified foreign guest lecturers and to improve the education system of LLU is highlighted in the discussions with management. Therefore, LLU management must find solutions to manage the existing sources efficiently and to find other sources of funding (more projects and national grants) to cover all costs related to local staff and foreign lecturers. The most capable students of the direction are not willing to stay after graduation and work as academic staff members due to the low salaries in higher education, therefore LLU management must find solutions to stimulate candidates. The involvement of highly qualified teaching staff, guest lecturers, and visiting lecturers in the implementation of courses should be extended. The teaching staff participates in both outgoing and incoming mobility; however, the total number and duration of mobility activities are small. The involvement of teaching staff teaching professional subjects in mobility is particularly low, which in turn does not contribute to international cooperation.

3.4. The LLU has identified the necessary support for students and has established a student support system. The main types of support provided for students are scholarships, tuition fee discounts and the possibility to participate in scholarship competitions. LLU provides a wide range of resources to ensure student learning: students have access to the LLU fundamental library, study infrastructure with laboratory equipment, have specialized classrooms and laboratories, as well as developed IT infrastructure, including computer classes, free WIFI network. Students do not have access to the dispute resolution procedure, nor can students follow possible solutions to problems. The reduced number of students is a shortcoming, and it is worth mentioning that the state-funded scholarships for the best students until the beginning of 2021 were only amounting to EUR 99 and because state funding for this is very limited, only a small part of the very good and excellent students receive state scholarships. That's one of the main reasons why a lot of students are working, they often have to combine work with their studies. A curator has been appointed to support students to help solve various uncertainties. For each student course/group, a curator is selected, who also helps to solve uncertain issues for students. The procedure is described in the internal regulations. Psychological support is provided by the directors of study programmes, curators of student groups.

## **Conclusions. Strengths and weaknesses**

### Conclusions

LLU has developed a system to determine the financial resources required for the implementation of the study field. The Energy Institute has training facilities and laboratories with equipment and the necessary technical support. For improvement of study processes, study rooms are regularly improved and modernized, as well as laboratories are equipped with equipment necessary for work. The list of work equipment available is incomplete. The academic and research workload of the teaching staff of the Institute of Energy is balanced. The number of students is gradually declining, which can affect the quality of studies in the future. High-skilled foreign guest lecturers are being approached insufficient due to the small scale of international projects and funding. The transition of generations to the academic and scientific staff has to be improved. The LLU has identified the necessary support for students and has established a student support system.

### Strengths

1. The Energy Institute has training facilities and laboratories with equipment and the necessary technical support.
2. Despite the fact that the Energy Institute is located in an old building, the classrooms are regularly improved and modernised.
3. Students and academic staff are provided with high-quality information technology infrastructure and services.

4. The academic and research workload of the teaching staff is balanced.

5. LLU provides a wide range of resources to ensure student learning.

Weaknesses:

1. The list of work equipment available in laboratories is incomplete. There are no complete data on the work equipment necessary and used for the implementation of the course. Reliable information on the procedure for improvement of material and technical, methodological, informative provision is not provided. There is no evidence that measuring instruments, e.g. thermal cameras, are available in laboratories for laboratory work.

2. The involvement of highly qualified teaching staff, guest lecturers and visiting lecturers in the implementation of courses should be extended. There are a small number of students in groups, so the teaching capacity can be improved by re-planning study courses or increasing the number of students.

3. The LLU management needs to find solutions to attract candidates as academic staff from the most capable students.

#### **4. Scientific Research and Artistic Creation**

##### **Analysis**

4.1. The directions of scientific research in the study field is clearly defined. The research directions defined in the field of study are consistent with the research directions defined at the university. They are appropriate for the study direction and sector, however, there is insufficient integration of the latest trends in the energy sector into the study process, especially, for example, communities, energy synergy, stock exchange, aggregators, etc. In line with the European Union's commitment to achieve climate neutrality in 2050, setting different milestones and targets in each Member State, including Latvia, by adopting the National Energy and Climate Plan 2021-2030 (NEKP 2030), the study field fully complies with them. In order for scientific research to contribute to the objectives, it is necessary to clearly define the specialisation of research and the objectives to be achieved in the next periods. Taking into account the synergy between heat and electricity vectors in the study process, this direction is absolutely in line with national and international energy objectives, however, it is necessary to strengthen both the involvement of students and the link between the energy process and climate neutrality indicators and research in bachelor's studies. Recent trends in the sector are under included, corresponding to the narrow and small number of research projects, their scale. There is a need to focus more on newer trends in order to increase the importance of scientific research and also the possibilities to expand the possibilities for research, especially in rural areas.

4.2. The relation between scientific research in the study field and the study process has been defined and ensured. Scientific research and the outcomes there of are adequate integrated in the study process in the study programme. However, it should be noted that most of the research projects (22, 17 or 16) and mobility of scientific staff carried out were centralised at the university (SAM projects activities) or carried out under the guidance of some scientists in the power engineering field. During the study process, teaching staff inform students about newer research, scientific publications and outcomes. However, the research strategy is not sufficiently clear, especially graduates, stakeholders and especially other scientific institutions are insufficiently involved in the research in order to increase involvement in science. Students are not involved in the implementation of scientific projects, which is considered as a disadvantage, as it does not ensure a full continuity of teaching staff, reduces student-centred training and limits research potential, for example, in projects where there is a condition for mandatory involvement of students. The university has a centralised system of distribution of funding, which includes both academic and scientific funding. Since most of the projects were coordinated centrally or were contract works, the payment of researchers for work in research is carried out through the bonus system. The bonus

system includes scientific publications, project applications, their management and participation in them, as well as other scientific issues. It provides a level playing field for those involved in academic work.

4.3. Within the framework of the study field programme, efforts are ensured to establish international cooperation. Several teachers have participated in various project expertise of the European Commission as evaluators, in the last period a significant number of scientific publications have been achieved, as well as it is planned to develop the infrastructure of the study programme. However, 3 out of 8 examples of self-assessment report expertise are individual examinations with strict confidentiality criteria that do not meet the objective of international cooperation of the study programme. Inaccuracies regarding the existence of the rights of experts of the Latvian Council of Science are also found in the CV of the teaching staff, only one of the lecturers of professional subjects has been granted the relevant rights of an expert. This may be due to the criteria for obtaining the rights of an expert, for which the source of publications is a limiting factor. Of the 124 publications cited, 73 have been published at the university source "Engineering for Rural Development", which promotes neither the recognition, citation or wider networking of publications. The projects implemented during the period are significant and according to the scientific direction and scope of the study programme, however, no project has been implemented in cooperation with foreign partners, for example, H2020. It is not planned to expand the study programme, despite the fact that it is planned to improve the infrastructure by attracting financial resources. In order to increase international recognition, to increase the competences of teaching staff, it is recommended to establish broader cooperation networks with industry and other scientific institutions, publishing research in scientific journals with a high impact factor, actively use the opportunities to submit more project applications in Latvian, Baltic and European project calls. Although the participation of teaching staff in various international commissions and committees is mentioned, their activity is insufficient, especially in the development of mutual cooperation.

4.4. The University has mechanisms in place to motivate teaching staff to engage in research, generally assessed as effective, as they are united throughout the university, which provides uniform and equivalent principles and conditions for any teaching staff. Teaching staff have been provided with financial support for a range of research achievements, such as project management, participation, publications, etc. However, the structural unit and project managers do not have access to funding reports in order to assess the availability of funding and their use, nor is a unified system for the payment system of researchers, including students, in projects in a particular project in accordance with the conditions of the particular project. Depending on the amount of work done for scientific research, there is no possibility of making regular and systematic changes. Thus, the funding may not be distributed in such a way as to make changes according to the amount of work invested.

4.5. At the university, students are involved in research mainly in the implementation or research of practical tasks, such as laboratory development, or research, developing final thesis. Students' involvement in the learning process, support for them is at a high level and is effective. Students of all courses are involved in the learning process and supported. However, students are not involved in the implementation of scientific projects and contract work without providing them with additional funding for their work. The involvement of students directly in research, not only in the provision of the learning process, improves the re-generation of researchers and teaching staff and promotes the prestige of higher education and research. The involvement of students in research would also promote the development opportunities of the study programme, improve networks with industry, as well as the inclusion of the latest trends in the field in the study programme.

4.6. As innovative solutions in the study process, several activities are used to promote the university and spread information in society, students visit various industrial objects. As specialists in their field, teaching staff should make greater use of opportunities to give opinion to the public, to become leaders of opinions in their field. Work with schools should also be improved, for example, in

cooperation with other Latvian higher education institutions, providing an idea of the opportunities provided by the profession. The study process would be more widely implemented in student-centred training methods, such as games, more developmental internal research and promotion.

## **Conclusions. Strengths and weaknesses**

### Conclusions

The field of study is clear about scientific research – energy and heat. Teaching staff actively inform students about scientific and research achievements. Mechanisms are in place to motivate teaching staff to engage in research through a funding and motivation system. A centralised system for the distribution of public funding has been put in place to ensure a fair and transparent distribution of funding. As innovative solutions in the study process, several activities are used to promote the university and disseminate information to the public, students visit various industrial objects. Shortcomings include insufficiently incorporated recent trends in energy in the study process, which are closely related to unsatisfactory international cooperation and research. The number of scientific projects should be increased, especially in cooperation with other scientific institutions and by engaging in international scientific activities, projects and initiatives. The possibilities of the study field for the performance of scientific activity are considered to be high and valued as prospects, especially taking into account laboratory equipment and research opportunities for synergies between two energy resources.

### Strengths

1. The fields of scientific research in the field of study are clearly defined.
2. The field of study corresponds to the latest trends in energy.
3. Teaching staff inform students about the latest research carried out.
4. Active involvement of students in the development of final works, developing the study environment.
5. A predictable system of financial support for funding and achievements in research for teaching staff.

### Weaknesses

1. Insufficient monitoring of the latest trends in the sector and their inclusion in the study and research process.
2. There is no clear definition of the specialization of research and the objectives to be achieved in the coming periods.
3. Insufficient international cooperation and international projects, especially with cooperation with other scientific institutions.

## **5. Cooperation and Internationalisation**

### **Analysis**

5.1. The study programme has established contacts with Latvian employers and professional organizations. The staff of the programme have taken part in internship and training courses at Latvian institutions and foreign universities. The selected partners are related to the power sector and provide valuable expertise in the field. The obtained knowledge has been used to improve the study courses to be in line with current trends in power engineering. Some people from the industry

are attracted to provide practical knowledge. Professional specialists and managers from energy supply companies have been invited to participate to supervise and evaluate students' final theses. It should be mentioned that a few of staff members take part in international internships. There are no contacts with scientific institutions. The members of the Expert Group think that the participation of employers in study programme development is low, which was flagged also in the previous evaluation. There is sufficient proactive cooperation with employers.

5.2. There is a lack of sufficient financing to invite highly qualified foreign guest lecturers. There were only two visiting Professors from Turkey that presented single lectures. The study programme does not include the study courses in English being aimed at the needs of the local market. The number of foreign students was seven. There is an intention to invite a lecturer from the Estonian University of Life Sciences to teach a course on bioenergy. Therefore, the activity under this criterion is rather weak.

5.3. The traineeship programme is well established in accordance with the Regulations on Traineeship. It includes 26 weeks divided into 4 parts: 6 weeks each year in the 1st, 2nd and 3rd study year, and 8 weeks in the 4th study year. Each annual traineeship has a programme that includes the issues to be learned with defined learning outcomes. All the tasks are fully in line with the aims and tasks of the study programme. A large volume of traineeship allows students to gain experience in a relevant position while studying and find their future employment after the graduation. There are no problems with practical training from the industry side. In the period 2013-2020, traineeship agreements have been concluded with more than 90 companies throughout Latvia. The partners for traineeship are evaluated in relation to their ability to provide the trainee with conditions to complete the traineeship programme. The traineeship is supervised by an academic staff member and a company representative. The international internship in the frame of the Erasmus programme can be established, but there is still no activity. Unfortunately, traineeship companies sometimes give the same tasks to trainees during the whole traineeship period, such as dismantling old overhead power lines or replacing old gauges, instead of involving trainees in diverse tasks or work responsibilities.

5.4. Not applicable.

## **Conclusions. Strengths and weaknesses**

### Conclusions

The study programme is well related to the needs of Latvian rural area and small towns. The content of the programme and traineeship are provided in cooperation with local companies and other institutions. Final theses are supervised and evaluated by representatives of local companies. Therefore, the cooperation with local institution is satisfactory, although could be further improved by proactive measures, like official participation of the employers in the Faculty Board and creation of a study course on strategic development of power engineering, offering the opportunity to leading specialists and managers of local companies to present their lectures to the students. The international activity is a weak point. The international cooperation is mainly in form of short visits of the local professors into foreign universities. There were two visiting professors giving single lectures and seven foreign students. The majority of the study courses are not offered in English. An exception is the cooperation with Estonian University of Life Sciences, which has made proposals on improvements in the study programme and offered a guest lecturer for the course on bioenergy.

### Strengths

1. There is a focus on cooperation with local companies and professional organizations, which leads to improvements in the content of study courses.
2. The experience obtained from international internships has been integrated into the study programme courses.

3. Well-established system of traineeship allowing the students to get good practical knowledge and skills.

#### Weaknesses

1. The numbers of foreign visiting professors and students are too low: there were only two visiting professors and seven foreign students in the period 2013-2020.
2. There are only a couple of courses occasionally offered to foreign students in English: Computer Graphics and lectures devoted to mobile robots.

## **6. Implementation of the Recommendations Received During the Previous Assessment Procedures**

### **Analysis**

Recommendation No. 1. During the reporting period, the number of scientific publications has been expanded, lectures have been realised in foreign universities and several visits have taken place. Activities with international cooperation have been partially completed because there are no projects implemented in cooperation with foreign partners, involvement in various working groups or initiatives is also insufficient. The recommendation on budget flexibility, which would facilitate the ability of teaching staff to choose a publicity place, has been partially implemented as teaching staff and project managers are not given access to the financial system to control the relevant expenditure. The training descriptions include more recent international training materials. The library provides access to the most frequently used international databases, however, the Library does not collect statistics on searches in the energy sector in international databases, teaching materials. The statuses of experts and members mentioned in the self-assessment are not found in the CVs of the staff. Overall, the recommendation provided during the previous procedures for the assessment of the study programme has been partially implemented.

Recommendation No 2. During the reporting period, several activities have been carried out to improve the qualification of teaching staff, for example, in SAM project activities, training in English, didactics, IT technologies, etc., have taken place. Teaching staff also regularly visit industrial sites. The recommendation provided during the previous procedures for the assessment of the study programme has been fully implemented.

Recommendation No 3. During the reporting period, 4 agreements have been concluded, where the latest technologies are introduced and recommendations for the development of the industry are provided. However, all contracts have been implemented with one partner and as a result of the visit, other representatives of the industry and stakeholders would also be interested in the development of the study programme and the performance of joint research. This would also require more active involvement of rural stakeholders. Nevertheless, the recommendation provided during the previous procedures for the assessment of the study programme has been fully implemented.

Recommendation No 4. Local industries questionnaires are carried out and the results are summarized. However, the results and actions of the questionnaire are not fully identified, which are implemented after receiving the results. The industry joins the final work in the defence commission and provides feedback on the results achieved. The recommendation provided during the previous procedures for the assessment of the study programme has been fully implemented.

Recommendation No 5. Study laboratories have been modernised during the reporting period, they include the main objectives of the study programme: the acquisition of electrical engineering, heat engineering and power engineering, including renewables. The recommendation provided during the previous procedures for the assessment of the study programme has been fully implemented.

Recommendation No 6. The subjects cover a number of recent industry trends, such as market functioning, tariffs. However, in view of the rapid development of the field, as well as the energy targets, which are part of the climate neutrality objective, a number of newer areas and trends are

not fully covered by the study process. Certain issues, such as the calculation of emissions, the economic assessment that are acquired at future levels of study, should already be covered at this level in order to expand students' knowledge in interdisciplinarity. There is insufficient integration of the latest trends in the energy sector into the study process, especially, for example, communities, energy synergy, stock exchange, aggregators, etc. The recommendation provided during the previous procedures for the assessment of the study programme has been partially implemented.

## **Conclusions. Strengths and weaknesses**

### Conclusions

The number of scientific publications has been significantly increased during the reporting period. The library provides a wide range of information and the most popular scientific databases are available. The training descriptions include the most important sources of information. The teaching staff has significantly elevated qualifications. Recently, several laboratories covering all major fields of study and research have been modernised. Activities with the international community have been improved, but not actively enough, given the wide and opportunity-rich study programme. Stakeholders are insufficiently involved in the development of the study programme and joint cooperation. The latest trends in the sector are insufficiently included, given the rapid development of the sector. Some of the issues covered by future levels of study should be learned at an earlier stage, such as emissions. The recommendations have been followed and contribution has been made to the development and improvement of the study field.

### Strengths

1. Wide availability of resources in the library.
2. Increased qualification and skills of teaching staff.
3. Industry involvement in the evaluation and analysis of the final thesis.
4. High-level training laboratories.
5. A good range of contacts with stakeholders.

### Weaknesses

1. Inadequate cooperation with foreign partners and scientific institutions.
2. The status of experts and members in the scientific and academic commissions, committees, industry associations at the regional and international level shall be improved.

## **7. Assessment of the Requirements for the Study Field**

- 1 R1 - Pursuant to Section 5, Paragraph 21 of the Law on Institutions of Higher Education, the higher education institution/ college shall ensure continuous improvement, development, and efficient performance of the study direction whilst implementing their internal quality assurance systems:

### **Assessment of compliance:** Fully compliant

On the compliance of the internal quality assurance system of the higher education institution LLU with the provisions of Section 5, Paragraph 21 of the Law on Institutions of Higher Education, the SER provides a justification for the given statement (detailed information is provided in Section 1.3 of the report).

The direction of LLU study field provides studies only for the level of bachelors and only in Latvian. The continued improvement and development of the study field are linked to regular teaching staff qualification improvement, industrial involvement, and close cooperation with stakeholders. Bachelors' degree and professional qualification point to meeting market needs, individual treatment of each student, well-established system of the traineeship. The field of

study is corresponding to the latest trends of energy sector development and shows study field effectiveness.

The mentioned shortcomings, such as international cooperation, the expert status of teaching staff, the realization of scientific projects and cooperation with other scientific institutions, as well as the renewal of academic staff, the recruitment of students and industry representatives do not significantly affect the continued development of the study field. Although these are considered to be shortcomings, in all these directions there is an activity to the development of the study field.

- 2 1.1. The higher education institution/ college has established a policy and procedures for assuring the quality of higher education.

**Assessment of compliance:** Fully compliant

The quality management of study processes is part of the overall quality management system of LLU. Since 2016, the quality management system of LLU has been based on the international standards for excellence.

- 3 1.2. A mechanism for the development and internal approval of the study programmes of the higher education institution/ college, as well as the supervision of their performance and periodic inspection thereof has been developed.

**Assessment of compliance:** Fully compliant

A mechanism for the creation and internal approval of the study programmes of the higher education institution, as well as the supervision of their performance and periodic inspection thereof has been developed. Description of the mechanism for the implementation of the quality policy and the procedures for the assurance of the quality of higher education is described in Section 1.3 of the SER).

- 4 1.3. The criteria, conditions, and procedures for the evaluation of students' results, which enable reassurance of the achievement of the intended learning outcomes, have been developed and made public.

**Assessment of compliance:** Fully compliant

The criteria, conditions, and procedures for the evaluation of students' results, which enable reassurance of the achievement of the intended learning outcomes, have been developed and made public. The subjects indicate the skills to be learned. Evaluation criteria are defined at the university. During the internship, feedback is provided on students' knowledge and skills. The defence commission attracts industry representatives who later provide feedback.

- 5 1.4. Internal procedures and mechanisms for assuring the qualifications of the academic staff and the work quality have been developed.

**Assessment of compliance:** Fully compliant

LLU has developed procedures and regulations (approved by the Senate) to guarantee the qualifications and work quality of academic staff (Annex in chapter 3.5): The LLU Regulations on Academic Positions, [LLU\\_Regulations\\_on\\_Academic\\_positions\\_EN.pdf](#), The Regulation regarding the Calculation of Academic Workload, [Regulation\\_on\\_Calculation\\_of\\_Academic\\_Workload.pdf](#), The Motivation System for LLU Academic Staff (pg. 14 SER).

- 6 1.5. The higher education institution/ college ensures the collection and analysis of the information on the study achievements of the students, employment of the graduates, satisfaction of the students with the study programme, efficiency of the work of the academic staff, the study funds available and the disbursements thereof, as well as the key performance indicators of the higher education institution/ college.

**Assessment of compliance:** Fully compliant

The higher education institution ensures the collection and analysis of the information on the study achievements of the students, employment of the graduates, satisfaction of the students with the study programme, efficiency of the work of the academic staff, the study funds available and the disbursements thereof, as well as the key performance indicators of the higher education institution. Regular questionnaires are carried out and the results of questionnaires are compiled to assess the positive and improvement areas. The results of the questionnaire can be seen by the teaching staff or administrative management concerned.

- 7 1.6. The higher education institution/ college shall ensure continuous improvement, development, and efficient performance of the study direction whilst implementing their quality assurance systems.

**Assessment of compliance:** Fully compliant

The higher education institution ensures continuous improvement, development, and efficient performance of the study direction whilst implementing their quality assurance systems. The quality assurance system allows for the improvement of communication between teachers and students. The collection of feedback and opinions provides an opportunity to improve study courses and implement the necessary changes therein. The close interlinkage of teaching staff and students is a key tool for maintaining quality.

- 8 R2 - The cooperation with different organisations from Latvia and abroad implemented within the study direction ensures the achievement of the aims of the study direction.

**Assessment of compliance:** Partially compliant

The cooperation with local institutions is well established. The needs of the companies and recommendations from professional organizations and companies are reflected in the study courses. The representatives of the local companies supervise and evaluate final theses. The traineeship system is well organized. The system of attraction foreign lecturers and students from abroad is missing. There is very low number of visiting professors, lecturers and students.

- 9 R3 - Compliance of scientific research and artistic creation with the development level thereof (if applicable).

**Assessment of compliance:** Fully compliant

Taking into account a two-way study programme, which includes electricity and heat energy vectors, scientific research corresponds to the level of scientific development. It is necessary to follow innovations more actively, to implement them in the study and research process. However, scientific activity has increased significantly over the last period and the volume of scientific publications has been significantly increased.

- 10 R4 - Elimination of the shortcomings and deficiencies identified during the previous assessment of the study direction, if it has been conducted, or the implementation of the provided recommendations.

**Assessment of compliance:** Fully compliant

The recommendations have been taken into account and a great contribution has been made to the promotion of both the study environment and research and cooperation. The qualifications of the teaching staff have been increased. Although the follow-up to innovations and research results are not entirely satisfactory, recommendations have been taken into account and growth is observed.

## 8. Recommendations for the Study Field

## Short-term recommendations

Make publicly available LLU quality management system described processes so that all stakeholders and students can see their part in achieving aims. Special attention should be drawn to procedure for dealing with students' appeals - all students should be informed how quality management procedure is executed. Include key performance indicators (KPI's) and their explanations so employers, students and graduates can see particular process performance.

Develop a procedure for improvement of material, methodological, informative provision. It is necessary to complement the list of work equipment available in laboratories by including the list of all the instruments available and indicating in the list information about the locations of the specific work equipment, and for implementation of what courses they are intended.

It is necessary to clearly define the specialisation of research and the objectives to be achieved by setting measurable criteria for research that promote visibility, opportunities for cooperation, publicity and development.

The study courses in English taught by foreign professors and lecturers could be offered to foreign students, for example as elective courses.

Keep up with the latest trends in energy and include them in study courses, especially about rural areas.

## Long-term recommendations

The management must find solutions to manage the existing sources efficiently (preplanning courses or other ways) and to find other sources of funding to cover all costs related to local staff and foreign lecturers.

The most capable students of the direction are not willing to stay after graduation and work as academic staff members due to the low salaries in higher education, therefore LLU management must find solutions to stimulate candidates.

Improve feedback giving and receiving in LLU: make sure that survey results are available to students, give feedback to students and graduates after a certain period of time after initial feedback is received. This is necessary to show that feedback provides value and those who give the feedback also know that LLU acts upon it. Create a feedback process for employers. This could be surveys and/or meetings. Afterwards, also give feedback back to employers so they know what has happened with the information obtained. At the first lecture of a study course, academic staff should show previous results of surveys and explain what action has been taken to improve study course thus showing students that surveys are a valuable asset in quality management system and also improving the particular study course.

To boost academic excellence and improve study process more emphasis should be put towards student-centred learning. This should be done in the following ways: regularly inform students that different pedagogical methods are used based on circumstances and evaluate a possibility to student groups choose pedagogical methods used in some study courses. Provide training to academic staff about student-centred learning. Supplement study course descriptions with a chapter "Student-centred learning methods" that describes what methods are used in particular study course. As well as what outcome is expected from the method used.

Expand the involvement of highly qualified teaching staff, guest lecturers and guest lecturers in the implementation of courses.

Expand in scientific research projects, including application preparation and scientific cooperation with industry and scientific institutions.

The international study might be popularized among local students by meeting with students who finished their study abroad, offering them short-term group visits to the foreign universities to test international learning opportunities.

The academic staff might find the courses in foreign universities, which meet the requirements of their study programme, to recommend them to the local students.

It is essential to extend participation in international associations, commissions and committees, working groups and initiatives.

## **II. "Applied Energy Engineering" ASSESSMENT**

### **II. "Applied Energy Engineering" ASSESSMENT**

#### **1. Indicators Describing the Study Programme**

##### **Analysis**

1.1. In the study programme "Applied Energy Engineering", professional bachelor studies to be acquired Professional Bachelor Degree in Energy Engineering, qualification - Engineer of Energy Systems as well as the aims, objectives, learning outcomes and admission requirements, are interrelated, as practical knowledge acquired during the internship, a large amount of practical work, knowledge of the electricity and heat industry. This comes also from the fact that the study programme fully complies with standard for "Engineer of Energy Systems" as well as with requirements set for a professional bachelor's degree. This was also proven during an on-site visit with interviews - both from graduates and employers. Although not all learning outcomes have been mapped to the learning outcomes to study programme even though this information was asked in the meeting with study programme management and additional information was sent. From 243 either knowledge, skills or competence that should or could be acquired during the study programme 8 of them are still not mapped to the corresponding results of the study programme. Admission requirements are relevant to the study programme - secondary education, Latvian language, foreign language, mathematics and additional points for the physics exam.

#### **Conclusions by specifying the strengths and weaknesses**

The study programme "Applied energy engineering" has been created in an interrelated way.

##### Strengths

1. Appropriate admission requirements to achieve learning outcomes of the study programme.

##### Weaknesses

1. Not all study course learning outcomes are mapped to study programme's learning outcomes.

#### **2. The Content of Studies and Implementation Thereof**

##### **Analysis**

2.1. There is a precise procedure at LLU for the development of study programmes and their

approval. The content and volume of the professional bachelor's study programme "Applied Energy Engineering" complies with the requirements of the 2nd level professional higher education state standard, which is determined by the Cabinet of Ministers regulations no. 512 "Regulations regarding the second level professional higher education state standard" issued on 26.08.2014. The qualification awarded after the completion of the programme "Applied Energy Engineering" is determined and described in accordance to the professional standard "Engineer of Energy Systems" which corresponds to the 6th level of higher education in the national qualifications framework, therefore it is also applicable to the corresponding level of the European Higher Education Area qualifications framework. The development of new study programmes is regulated by the decision No 10-5 of the Senate from March 13, 2019 and its supplement "Regulations on development, approval and changes in the study courses at LLU" (see annex Regulations on Study Programme Development.pdf). According to the regulation, the new programme is discussed and analysed during the meetings of Methodology Commission, the Board of a faculty and LLU Board of Studies before its approval by the Senate. The volume of the programme meets the minimum requirement of 160 CP imposed by regulations no. 512. The number of contact hours has minimum level of 40%, which is the case for the considered program. The choice of study courses, the amount and content of study courses, as well as the content of practice are in accordance with the professional standard "Engineer of Energy systems". A detailed comparison of the professional standard requirements and the study programme is provided in Annex 3.2, but some common features are outlined below. All the required amounts of programme parts correspond to the minimal requirements imposed by the regulations no. 512: general, humanitarian and social study courses of 20 CP; theoretical basics and IT courses of 36 CP; branch professional specialization courses of 60 CP; free choice courses of 6 CP; practice of 20 CP; state examination together with the defence of a bachelor's or diploma thesis of 12 CP. The exception is the number of the study papers: there are nine of those in the programme instead of required minimum number of three papers. The courses are chosen in accordance with knowledge requirements for the performance of basic tasks of professional activity imposed by the state education standard. The regulations no. 512 requires the compliance with the requirements of the Environmental Protection Law and the Civil Protection and Disaster Management Law. These requirements are met by the study courses Ecology and Environmental Protection since the work with energy installations has an impact on the environment and Labour and Civil Protection that helps to prepare specialists who can manage people. General study courses include knowledge, skills and competences that are necessary for an engineer and a manager, as well as for doing business. In accordance with Cabinet Regulation no. 512, Paragraph 11.1., the study programme includes study courses for the development of business professional competence (innovations, organization and establishment of enterprises, management methods, basics of business economics, project development and management, record-keeping and financial accounting system, knowledge of labour relations regulation, including social dialogue in society, as well as knowledge of other innovations in running a business or institution). They are: Basics of Management 2 CP, Entrepreneurship 2 CP, Basics of Law 1 CP, Psychology of Engineering 2 CP. The volume of them is greater than minimum requirement of 6 CP. There is also Professional English / German. Field study courses and IT courses provide the overall theoretical foundation for professional specialization courses and therefore they are included in the study plan prior to professional specialization courses. Those include Computer Science, Physics, Mathematics, Technology of Structural Materials, Computer Graphics in Energy. Achieved learning outcomes in Mathematics are used in the required calculations in further study courses, the learning outcomes of computer graphics can be used to draw electrical circuits. Computer Science is necessary for practically any further study course, including the analysis and processing of course information. The field electrical basic courses include such important courses for energy engineering as Applied Electrical Engineering, Theoretical Electrical Engineering, which are the basis for further professional specialization courses as Electrical Vehicles and Electric Drive, Lighting and Electrical Technology, Basics of Automation, Power Supply

Technologies, Electric Power Plants and Networks etc. The detailed compliance between the knowledge requirement by the professional standard and the study programme is given in Appendix 3.3. All the study courses in the curriculum are arranged according to their relation to other study courses following a logical sequence. Assessment criteria and methods, as well as grading criteria, are publicly available, they are determined in the Regulations of Studies: [www.llu.lv/sites/default/files/2021-05/Study\\_regulation\\_2021\\_EN.pdf](http://www.llu.lv/sites/default/files/2021-05/Study_regulation_2021_EN.pdf), the assessment evaluates the achieved results of the learning outcomes. The final stage is the development and defence of a bachelor thesis. LLU Regulation of Procedures for Thesis Writing and Final Examination set the plagiarism detection system for all the theses. In accordance with the regulations no. 512, a graduate is awarded a professional bachelor's degree and the fifth level professional qualification of Engineer of Energy System; the bachelor's degree gives the right to continue education in the academic master's study programme or master's program. In the frame of the ongoing project "Improvement of LLU academic staff" supported by the European Social Fund, there is a plan to hire a guest lecturer from Estonian University of Life Sciences to teach the entire study course in bioenergy. In common, the descriptions of the study courses meet requirements of the Law on HEIs: 1) define the prior knowledge; 2) determine the aims of the study course and the planned learning outcomes; 3) outline the content of the study course in combination with the course calendar, provides mandatory and supplementary literature, indicate other sources of information; 4) describe the organisation and tasks for the independent work of students; 5) determine the evaluation criteria of learning outcomes. Nevertheless, the Expert Group has discovered some shortages in the descriptions of study courses. In the study course "Electrical Measurements ETeh2005", the main literature does not indicate such important literature sources such as Cabinet Regulation No. 238 "fire safety regulations", Latvian Electrical Commission (LEK) standard "LEK 038 "Norms and volumes of thermographic examination of electrical installations". In the study course "Introduction in the Profession of Energetic ETehP002", old versions of standards are indicated at the basic literature. LEK 002 and LEK 025. In the study course "Organization of Engineering in Energetic EnerP009", old versions of standards are indicated in the basic literature. LEK 002. The study course "Introduction in the Profession of Energetic ETehP002", does not specify what prior knowledge is required. The study course "Electric Power Stations and Networks Ener4036", does not specify what prior knowledge is required. The study course "Electrotechnical materials ETeh4052", does not specify what prior knowledge is required. In the description of the study course "Organization of Engineering in Energetic EnerP009" the internet address, which does not work, is indicated in the literature. (<https://www.theiet.org/oncomms/sector/power/magazine.cfm>). The course descriptions do not specify the work equipment (resources) necessary for the implementation of the courses, such as equipment, laboratories used. Study courses do not include thermographic measurement, which is an important tool in energy audits as regards heat losses, as well as diagnostics of electric and heat power equipment. There is also a need to reflect in study courses such high voltage equipment as 110 - 330 kV cables and overhead lines. Those are the basis for the Latvian energy system and are of great importance in understanding its operation.

2.2. The existing study programme is reviewed each study year and an annual report of the study direction is created. The reports are analysed in the meetings of Boards of faculties, the Studies Centre, and the Board of Studies and approved by the Senate. In the time period, 2018 - 2021 study programme was analysed and evaluated by outer experts from Latvia Association of Electric Power Engineers and Energy Installation Builders (for example, the topic on decentralized frequency control in power networks was included in study courses on the recommendation by this professional organization), Estonian University of Life Sciences and consulting firm Dynamic University: the improvement plan was worked out. In 2020 the descriptions, format and content of all study courses were updated; thus, students are offered more detailed and user-friendly explanations of requirements, assessment criteria, content, number of hours corresponding to topics, etc. to ensure high-quality study process. This administration system is designed by its users

and is specially adapted to facilitate the pedagogical and study processes. Moodle is actively used via providing on-line and video lectures, on-line consultations, lecture notes and presentations, assignments, tests, and quizzes. The e-Moodle system provides an opportunity to implement the learning process in more flexible way - both online and using blended learning approach by combining traditional teaching methods that take place in classrooms with the possibilities offered by the Internet tools. The learning material posted online by teaching staff provides students with an opportunity to get acquainted with lecture materials in advance, thus having more time for discussions and exercises during contact lessons therefore it is possible to encourage in-depth understanding of the topic. When students expressed a wish to have more video lectures to improve the understanding of the courses taught, this requirement was satisfied. The availability of teaching materials online provides access to materials for students and teaching staff at the desired time and place, thus it is not necessary to prepare and distribute copies of handouts and resources to students. Student-centred learning takes into account the students' needs by creating relevant learning pathways: Bloom's taxonomy is applied in the development of study course programmes; students' willingness to study independently is facilitated, at the same time the guidance and support of the teaching staff are ensured, for example, out of every 40 working hours, which correspond to 1 CP (1.5 ETC), 24 hours are provided for students' individual work; students work on course projects and do homework independently, they receive consultations from the academic staff; relationship building is based on mutual respect between students and members of academic staff; there are appropriate procedures for dealing with student complaints. To tackle the problem of insufficient applicants' knowledge, the number of contact lessons has been increased in Physics and Mathematics to fill in the gaps of knowledge obtained at previous stages of education. The content of the Mathematics and Physics study courses were adjusted to the requirements of the energy sector. The contact hours of these courses will be increased to provide individual work with students. Professional courses have been designed to create a step-by-step approach. The electrical engineering study is divided into three parts providing a flexible way to obtain knowledge starting from basics and ending with complex concepts. For example, the first part course "Applied Electrical Engineering" includes a topic describing the fundamentals of electric machines, which is then further developed in the study course "Electric Machines and Electric Drive". The protection methods are first taught in "Applied Electrical Engineering" to understand the basics; then the selection and calculations for specific applications are analysed in the next semester. There is also big attention towards supporting students' wish to complete their study and do debt through additional opportunities like life-long learning.

2.3. The students' opinions on passed courses are collected each half-year. The survey results of students, graduates and employers are analysed and used in a reasonable manner. For example, the wish of students to get better knowledge of professional software and more video lectures was satisfied. Nevertheless, the wish of graduates and employers to get more practical skills instead of theoretical was reasonably rejected as ruining the balance in the study process. The visit to LLU has demonstrated high satisfaction of students, graduates and employers with the current comprehensive approach to the study process.

2.4. There is still very low international activity of students, which have doubts about their English language level, relevance of international courses to their study programme and social-cultural obstacles in foreign countries. Only 10 students visited foreign educational institutions and energy enterprises in period 2013-2020. It would be recommended to find a way for students to practice their conversational English by participating in short visits into foreign universities and enterprises. The international study might be popularized between students by meeting with students finished their study abroad, offering them short-term group visits to the foreign universities to test international learning opportunities. The academic staff might find the courses in foreign universities, which meet the requirements of their study programme.

## Conclusions by specifying the strengths and weaknesses

### Conclusions

The study programme basically meets all the governmental and university enactments and aims of the study. It is properly structured to provide all necessary engineering and managing skills and knowledge. The programme and courses are annually evaluated, the external experts are attracted to provide a better quality of the study. The student-oriented education is facilitated by Moodle platform, high attention to physical and mathematical knowledge, gradual approach to the teaching of specialized courses starting from simple things and ending with complex concepts. This is a very innovative way to overcome current difficulties with the declining level of secondary schools' graduates. The individual approach is implemented to support students' wish to continue study and hand over debts. The results of students', graduates' and employers are used to improve study programme if they are reasonable. The response of students, graduates and employers are mainly positive. The low international mobility of students is the main drawback. Although the students are aware of mobility possibilities, some additional measures are required to increase their interest in this way of education. In the opinion of the Expert Group, the content of the courses needs to be improved in some parts. Review and update descriptions of all courses, indicate the necessary prior knowledge, update the literature lists, as well as make sure that all specified literature online works.

### Strengths

1. The programme provides good engineering and managing skills and knowledge is regularly reviewed and evaluated by local and foreign experts.
2. The study programme has been modified in relation to problems in secondary education providing high attention to the real level of mathematical and physical knowledge of first-year students.
3. Moodle system is well developed and actively used remarkably facilitating the study process.
4. Individual supporting approach is used towards students' needs.

### Weaknesses

1. Low international mobility of the students: there were only 10 students who visited foreign educational institutions and energy enterprises in period 2013-2020.
2. There are some drawbacks in study courses descriptions that have to be eliminated.
3. Thermographic measurements and high voltage equipment should be better reflected in the study programme.
4. Study courses are reviewed in accordance with practical experience obtained from the local power utilities, however the content of the courses needs to be improved and more information should be added. Some courses are not detailed enough, the course descriptions lack some information about the necessary prior knowledge required.

## 3. Resources and Provision of the Study Programme

### Analysis

3.1. 48 teaching staff are involved in the provision of the study programme (including 5 professors, 8 associated professors, 7 assistant professors, 3 guest docents, 11 lecturers and 14 chief lecturers). For the implementation of the study programme and achievement of results, the infrastructure of the LLU, material and laboratory base is used: Digital Electronics Laboratory, Renewable Energy Laboratory, Electric Drive and Thermal Process Laboratory, Wiring Laboratory and Maintenance, Computer Modelling Laboratory, Electrical Engineering Laboratory, Artificial Intelligence Laboratory, General Electrical Engineering Laboratory, Electrical Measurement Laboratory, Automation Laboratory, Alternative Energy Laboratory and Heat Engineering Laboratory. There is no evidence that measuring instruments, e.g. thermal cameras, for laboratory work are available in laboratories,

and there is no evidence that thermography is taught in study courses. Experts recommend to continue supplementing laboratory equipment with newer technological solutions in the energy sector. In general, the material and technical base of studies is sufficient and corresponds to the specifics of the study programme. The informative and methodological materials base is provided by the fundamental library of LLU. The library provides a wide range of information, the most popular scientific databases are available. (Science Direct, Scopus, Web of Science, IEEE etc.). The financial basis necessary for ensuring study processes is formed from the State budget, study fees of local students and infrastructure development projects.

3.2. not applicable

## **Conclusions by specifying the strengths and weaknesses**

### Conclusions

The infrastructure, material and technical and laboratory base of the LLU are used for the implementation of the study programme. The material and technical base is sufficient and corresponds to the specifics of the study programme. Experts recommend to continue supplementing laboratory equipment with newer technological solutions in the energy sector.

### Strengths

1. The library provides a wide range of information and access to the most popular scientific databases.
2. LLU has a sufficient financial basis for the implementation of the study programme.
3. A wide laboratory base is available for the implementation of the study programme.

### Weaknesses:

1. Thermal cameras are not used in training and laboratories.

## **4. Teaching Staff**

### **Analysis**

4.1. Overall, the distribution of teaching staff and academic positions over the years remains approximately the same. Consequently, changes in the composition of the academic staff during the reference period did not significantly affect the quality of studies. As a result of the changes in the composition of the teaching staff, the higher education institution undertakes measures in a target-oriented manner to avoid negative effects on the quality of implementation of the study programme and the compliance of the study programme with the requirements set forth in the regulatory enactments. As can be seen from the Self Evaluation report SER, the number of teachers in general has increased during the reporting period. The number of lecturers has increased the most, mainly related to the involvement of new lecturers as well as attracting several external lecturers who work in the branch. Therefore, it is difficult to say if the changes in the composition of academic staff had a positive or negative impact. It is a natural process that should be well managed by the management of the study program.

4.2. All the requirements of the relevant regulatory enactments regarding the compliance of qualifications of the teaching staff relative to the positions are observed. The regulation is available in the Annex "LLU\_Regulations\_on\_Academic\_positions\_EN". According to the Law on Institutions of Higher Education and the above mentioned LLU regulation, candidates may be elected to the positions of Professors, Associate Professors and Assistant Professors if they have a doctoral degree or candidates may be elected to the position of Associate Professors in a professional programme also if they have at least 10 years of work experience in the field. The compliance of candidates for

each position is clearly regulated and proves their relevant qualification, which undoubtedly serves to ensure high quality of studies. Academic staff members in these positions have certain requirements for research activities, therefore their results are used in the study process, providing students with the latest developments and research findings in the field. In this regard, the aim of the Study Programme is to regularly improve the qualifications of academic staff and to raise the qualification of each lecturer of the Energy Institute at the Latvia University of Life Sciences and Technologies at least once every 6 years in professional events of the field as well as in the academic qualification improvement and other types of courses.

4.3. not applicable

4.4. During the reference period the academic staff of the study programme was involved in research activities in the fields corresponding to the content of the study programme: projects and contract research activities in total were implemented. The activity is presented in Annex 2.6. "Projects implemented in the reporting period (2013-2020) that are thematically related to the field of study" and it is adequate for this study field. Research projects and contract research projects as well as more detailed description of research activities are given in the Annex "Research and projects" and in Section 4.1. of Part 2 "Description of the Study Direction". In addition to the above mentioned, the academic staff of the study programme participated in international cooperation to conduct research activities, Section 4.3 "International cooperation in scientific research and/or artistic performance" of Part 2 "Description of the Study Direction". The application of gained information is reflected in the content of the study courses (Annex "Study courses"). The gained information and knowledge were used in the following study courses: "Bioenergy" and "Alternative Energy and Energy Economics" (the research results on the use of biomass for energy production), "Heat Supply Sources" (research on microclimate, emission reduction), "Transition Processes and Relay Protection" and "Power Plants and Networks" (contract research activities with "Latvenergo AS"), "Applied Electronics and Communication Equipment" (research in robotics).

4.5. A mechanism for mutual collaboration between the teaching staff members is in place, which contributes to the improvement of the study courses/ modules and their correlation. The cooperation between academic staff members takes place through coordination of the study courses content and its adaptation to the specific features of the corresponding study programme. For example, the content of the Mathematics and Physics study courses for the "Applied Energy Engineering" study programme was adjusted to the requirements of the energy sector, including topics that the programme director and other teaching staff members of the Institute of Energetics considered relevant to this programme. Also, it was agreed that the number of contact hours for these courses should be increased in order to be able to work with students individually, thus helping students to acquire the study material for the courses. Professional specialization courses have been designed in coordination with other courses so that knowledge of basic theory regarding the subject is acquired prior to the more specialized knowledge which is acquired in the following study courses. For example, the study course "Applied Electrical Engineering" includes a topic describing operation principles, parameters and the general structure of electric machines, which is then further developed in the study course "Electric Machines and Electric Drive" dealing with the selection of a vehicle, its application, analysis of parameters, operating modes, etc.

The sequence of topics and their compatibility were discussed between the respective teaching staff members in order to avoid overlapping between the content of different study courses. It should be noted that each topic can be viewed from a different perspective depending on the application of the objects, conditions, environment, etc. Therefore, if appropriate, the same topic could be studied in different study courses. However, the CVs of some teaching staff highlight a disproportionate allocation of courses delivered (CV\_ENG 23 sept.zip). Academic workload should be distributed evenly between teaching staff or a mechanism should be provided to stimulate scientific, research activities and participation in projects. Also, some of the academic or scientific staff should improve their knowledge of English.

## Conclusions by specifying the strengths and weaknesses

### Conclusions

Academic staff regularly improve their qualifications and undertake internships in companies. Methodological commissions are set up in faculties, to create a platform where academic staff members can discuss the programmes of the study courses and recommend improvements if necessary; some courses need to be improved according to the requirements of the labour market.

### Strengths

1. As a result of the changes in the composition of the teaching staff the higher education institution LLU undertakes measures in an oriented manner to avoid negative effects on the quality of the implementation of the study programme and the compliance of the study programme with the requirements set forth in the regulatory enactments.
2. The qualification of the teaching staff members involved in the implementation of the study programme complies with the requirements for the implementation of the study programme and the requirements set forth in the regulatory enactments.
3. The academic staff is involved in scientific research in the fields related to the content of the study programme both at the national and international level.

### Weaknesses

1. The big number of courses assigned to some teaching staff doesn't afford them enough time for publications and research.

## 5. Assessment of the Compliance of the Study Programme "Applied Energy Engineering"

### Requirements

1. The sample of the diploma to be issued for the acquisition of the study programme complies with the procedure by which state-recognised documents of higher education are issued.

#### **Assessment of compliance:** Fully compliant

The sample of the diploma to be issued for the acquisition of the study programme complies with the procedure by which state-recognised documents of higher education are issued. Annex "Sample of the diploma to be issued for the acquisition of the study programme" and file name "Diploma and supplement.zip" fully complies with Republic of Latvia Cabinet Regulation No. 202.

2. Documents confirming that the higher education institution/ college will provide the students with the options to continue the acquisition of education in another study programme or at another higher education institution/ college (a contract with another accredited higher education institution/ college), in case the implementation of the study programme is discontinued.

#### **Assessment of compliance:** Fully compliant

See annex "Document confirming that the higher education institution/ college will provide the students with the options to continue the acquisition of education in another study programme or at another higher education institution/ college (a contract with another accredited higher education institution/ college), in case the implementation of the study programme is discontinued" File name "Agreement\_LLU and RTU\_Energy Engineering\_EN.docx" with Riga Technical university in the study programme "Power and Electrical Engineering", "Smart Power Systems" and others.

3. Document confirming that the higher education institution/ college guarantees to the students a compensation for losses if the study programme is not accredited or the licence of the study programme is revoked due to the actions of the higher education institution/ college (actions or failure to act) and the student does not wish to continue the studies in another study programme.

**Assessment of compliance:** Fully compliant

See annex "Document confirming that the higher education institution/ college guarantees to the students a compensation for losses if the study programme is not accredited or the licence of the study programme is revoked due to the actions of the higher education institution/ college (actions or failure to act) and the student does not wish to continue the studies in another study programme" File name "LLU\_apliecinajumi\_Energetika\_EN.docx".

- 4 4. The teaching staff members involved in the implementation of the study programme are proficient in the official language in accordance with the regulations on the level of the official language knowledge and the procedures for testing official language proficiency for performing professional duties and office duties.

**Assessment of compliance:** Fully compliant

All of the teaching staff have received higher education in Latvian. This has been described in annex "Basic information on the teaching staff involved in the implementation of the study direction". As well as an annex with file name "LLU\_apliecinajumi\_Energetika\_EN.docx" confirms that the official language proficiency of the teaching staff involved in the implementation of the relevant study programme Applied Energy Engineering of the study direction complies with the regulations on the level of the official language knowledge and the procedures for testing official language proficiency for performing professional duties and office duties and is signed by LLU Rector.

- 5 5. The teaching staff members to be involved in the implementation of the study programme have at least B2-level knowledge of a related foreign language, if the study programme or any part thereof is to be implemented in a foreign language.

**Assessment of compliance:** Not relevant

- 6 6. At least five teaching staff members with a doctoral degree are among the academic staff of an academic doctoral study programme, at least three of which are experts approved by the Latvian Science Council in the respective field of science. At least five teaching staff members with a doctoral degree are among the academic staff of a professional doctoral study programme in arts.

**Assessment of compliance:** Not relevant

- 7 7. The academic staff of the academic study programme complies with the requirements set forth in Section 55, Paragraph one, Clause 3 of the Law on Institutions of Higher Education.

**Assessment of compliance:** Not relevant

- 8 8. The sample of the study agreement complies with the mandatory provisions to be included in the study agreement.

**Assessment of compliance:** Fully compliant

Annex "Sample (or samples) of the study agreement" (file name "Study\_Agreement\_LV\_EN\_2021.pdf") fully complies with Republic of Latvia Cabinet of Minister Regulation No 70. "Studiju līgumā obligāti ietveramie noteikumi".

- 9 9. The descriptions of the study courses and the study materials have been prepared in all languages in which the study programme is implemented, and they comply with the requirements set forth in Section 56.1, Paragraph two and Section 56.2, Paragraph two of the Law on Institutions of Higher Education.

**Assessment of compliance:** Fully compliant

Annex "Descriptions of the study courses/ modules" (file name "Studiju kursi.zip") complies with the set requirements of Section 56.1, Paragraph two and Section 56.2, Paragraph two of the Law on Institutions of Higher Education. Some of the course descriptions can be revised. In general, the course descriptions meet the requirements and the skills and knowledge to be acquired by students.

- 10 10. The study programme complies with the valid professional standard or the requirements for the professional qualification (if there is no professional standard required for the relevant occupation) provided that the completion of the study programme leads to a professional qualification.

**Assessment of compliance:** Fully compliant

Annex with file name "3\_3\_annex\_Compliance with the professional standard.docx" proves that the study programme complies with the valid professional standard "Engineer of Energy Systems" (Available: <https://registri.visc.gov.lv/profizglitiba/dokumenti/standarti/2017/PS-175.pdf>). This can be concluded as each criteria set by the standard are being taught in study courses.

- 11 11. Academic study programmes provided for less than 250 full-time students may be implemented and less than five professors and associated professors of the higher education institution may be involved in the implementation of the mandatory and limited elective part of these study programmes provided that the relevant opinion of the Council for Higher Education has been received in accordance with Section 55, Paragraph two of the Law on Institutions of Higher Education.

**Assessment of compliance:** Not relevant

- 12 12. The study programme complies with the State Academic Education Standard or the Professional Higher Education Standard.

**Assessment of compliance:** Fully compliant

Annex with file name "3\_2\_annex\_Compliance with the national education standard.docx" confirms that study programme complies with the requirements of the 2nd level professional higher education state standard, which is determined by the Cabinet of Ministers on 26.08.2014. regulations no. 512 "Regulations regarding the second level professional higher education state standard".

- 13 13. The joint study programmes comply with the requirements prescribed in Section 551, Paragraphs one, two, and seven of the Law on Institutions of Higher Education (if applicable).

**Assessment of compliance:** Not relevant

- 14 14. Each member of the academic staff has either publications published in reviewed editions within the last six years, including international editions (if they have worked for a shorter period of time, the number of publications shall be in proportion to the work period), or artistic creation achievements (for instance, exhibitions, films, theatre performances, and concert activity), or a five-year practical work experience (except for the experience in the implementation of the study programme) in accordance with the Law on Institutions of Higher Education.

**Assessment of compliance:** Fully compliant

The qualification of the teaching staff members involved in the implementation of the study programme complies with the requirements for the implementation of the study programme and the requirements set forth in the regulatory enactments (see Dissention options of the experts).

## 15 R5 - Overall rating

### **Assessment of compliance:** Fully compliant

The qualification of the teaching staff members involved in the implementation of the study programme complies with the requirements for the implementation of the study programme and the requirements set forth in the regulatory enactments. Study programme complies with the requirements of the 2nd level professional higher education state standard. Study programme complies with the valid professional standard "Engineer of Energy Systems".

## **Requirements (R6-R8)**

- 1 R6 - The compliance of the study provision, scientific support (if applicable), informative provision (including libraries), material and technical provision, and financial provision with the conditions for the implementation of the study programme and ensuring the achievement of the learning outcomes.

### **Assessment of compliance:** Fully compliant

The compliance of the study provision, scientific support, informative provision, material and technical provision and financial provision with the conditions for the implementation of the study programme and ensuring the achievement of the learning outcomes is compliant. Study courses are reviewed in accordance with practical experience obtained from the local power utilities, however the content of the courses needs to be improved and more information should be added. Some courses are not detailed enough, the course descriptions lack some information about the necessary prior knowledge required. From compliance point of view, it is enough to achieve the learning outcomes, at the same time experts evaluate the fact that this factor should be improved to raise the quality of study programme. These aspects are more described in previous parts of assessment.

- 2 R7 - The compliance of the qualification of the academic staff members, visiting professors, visiting associate professors, visiting docents, visiting lecturers, and visiting assistants with the conditions for the implementation of the study programme and the provisions set out in the respective regulatory enactments.

### **Assessment of compliance:** Fully compliant

The qualification of the teaching staff members (academic staff members, visiting professors, visiting associate professors, visiting docents, visiting lecturers, and visiting assistants) involved in the implementation of the study programme is fully compliant with the requirements for the implementation of the study programme and the requirements set forth in the regulatory enactments. The regulation is available in the Annex "LLU\_Regulations\_on\_Academic\_positions\_EN".

- 3 R8 - The study programme leading to the master or doctoral degree is based on the advances and findings in the relevant field of science or artistic creation.

### **Assessment of compliance:** Not relevant

## **Conclusions by specifying the strengths and weaknesses**

### Conclusions

The study programme "Applied energy engineering" has been created in an interrelated way. The study programme basically meets all the governmental and university enactments and aims of the study. It is properly structured to provide all necessary engineering and managing skills and knowledge. The programme and courses are annually evaluated, the external experts are attracted

to provide a better quality of the study. The student-oriented education is facilitated by Moodle platform, high attention to physical and mathematical knowledge, gradual approach to the teaching of specialized courses starting from simple things and ending with complex concepts. This is a very innovative way to overcome current difficulties with the declining level of secondary schools' graduates. The individual approach is implemented to support students' wish to continue study and hand over debts. The results of students', graduates' and employers are used to improve study programme if they are reasonable. The low international mobility of students is the main drawback. Although the students are aware of mobility possibilities, some additional measures are required to increase their interest in this way of education. In the opinion of the Expert Group, the content of the courses needs to be improved in some parts.

The infrastructure, material and technical and laboratory base of the LLU are used for the implementation of the study programme. The material and technical base is sufficient and corresponds to the specifics of the study programme. Experts recommend to continue supplementing laboratory equipment with newer technological solutions in the energy sector. Academic staff regularly improve their qualifications and undertake internships in companies. Methodological commissions are set up in faculties, to create a platform where academic staff members can discuss the programmes of the study courses and recommend improvements if necessary; some courses need to be improved according to the requirements of the labour market.

#### Strengths

1. Appropriate admission requirements to achieve learning outcomes of the study programme.
2. The programme provides good engineering and managing skills and knowledge is regularly reviewed and evaluated by local and foreign experts.
3. The study programme has been modified in relation to problems in secondary education providing high attention to the real level of mathematical and physical knowledge of first-year students.
4. Moodle system is well developed and actively used remarkably facilitating the study process.
5. Individual supporting approach is used towards students' needs.
6. The library provides a wide range of information and access to the most popular scientific databases.
7. LLU has a sufficient financial basis for the implementation of the study programme. A wide laboratory base is available for the implementation of the study programme.
8. As a result of the changes in the composition of the teaching staff the higher education institution LLU undertakes measures in an oriented manner to avoid negative effects on the quality of the implementation of the study programme and the compliance of the study programme with the requirements set forth in the regulatory enactments.
9. The qualification of the teaching staff members involved in the implementation of the study programme complies with the requirements for the implementation of the study programme and the requirements set forth in the regulatory enactments.
10. The academic staff is involved in scientific research in the fields related to the content of the study programme both at the national and international level.

#### Weaknesses

1. Not all study course learning outcomes are mapped to study programme's learning outcomes.
2. Low international mobility of the students: there were only 10 students who visited foreign educational institutions and energy enterprises in period 2013-2020.
3. There are some drawbacks in study courses descriptions that have to be eliminated.
4. Thermographic measurements and high voltage equipment should be better reflected in the study programme.
5. Study courses are reviewed in accordance with practical experience obtained from the local power utilities, however the content of the courses needs to be improved and more information should be added. Some courses are not detailed enough, the course descriptions lack some

information about the necessary prior knowledge required.

6. Thermal cameras are not used in training and laboratories.

7. The big number of courses assigned to some teaching staff doesn't afford them enough time for publications and research.

### **Evaluation of the study programme "Applied Energy Engineering"**

Evaluation of the study programme:

Good

### **6. Recommendations for the Study Programme "Applied Energy Engineering"**

#### **Short-term recommendations**

Provide a full mapping of study course learning outcomes to results of the study programme. So that each knowledge, skill or competence acquired in study courses help to achieve results of the study programme. Afterwards set in control mechanisms to stimulate positive link from and to study courses as well as a way to make sure that they don't overlap. Review and update descriptions of all courses, indicate the necessary prior knowledge, update the literature lists, as well as make sure that all specified literature online works

Study courses are reviewed in accordance with practical experience obtained from the local power utilities, however the content of the courses needs to be improved and more information should be added. Some courses are not detailed enough, the course descriptions lack some information about the necessary prior knowledge required

To supplement study courses with study topics on thermographic measurements and 110 -330 kV cable and overhead lines

Distribute academic workload more evenly in order to increase scientific research for teaching staff, especially professors and associate professors.

#### **Long-term recommendations**

The international study might be popularized among local students by meeting with students who finished their study abroad, offering them short-term group visits to the foreign universities to test international learning opportunities. The academic staff might find the courses in foreign universities, which meet the requirements of their study programme, to recommend them to the local students.

Continue supplementing laboratory equipment with newer technological solutions in the energy sector.

It would be recommended to find a way for students to practice their conversational English by participating in short visits into foreign universities and enterprises.

## **III. Assessment of the Requirements for the Study Field and the Relevant Study Programmes**

### **III. Assessment of the Requirements for the Study Field and the Relevant Study Programmes**

## Assessment of the Requirements for the Study Field

Requirements	Requirement Evaluation		Comment
<p>R1 - Pursuant to Section 5, Paragraph 21 of the Law on Institutions of Higher Education, the higher education institution/ college shall ensure continuous improvement, development, and efficient performance of the study direction whilst implementing their internal quality assurance systems:</p>	Fully compliant		<p>On the compliance of the internal quality assurance system of the higher education institution LLU with the provisions of Section 5, Paragraph 21 of the Law on Institutions of Higher Education, the SER provides a justification for the given statement (detailed information is provided in Section 1.3 of the report).</p> <p>The direction of LLU study field provides studies only for the level of bachelors and only in Latvian. The continued improvement and development of the study field are linked to regular teaching staff qualification improvement, industrial involvement, and close cooperation with stakeholders. Bachelors' degree and professional qualification point to meeting market needs, individual treatment of each student, well-established system of the traineeship. The field of study is corresponding to the latest trends of energy sector development and shows study field effectiveness.</p> <p>The mentioned shortcomings, such as international cooperation, the expert status of teaching staff, the realization of scientific projects and cooperation with other scientific institutions, as well as the renewal of academic staff, the recruitment of students and industry representatives do not significantly affect the continued development of the study field. Although these are considered to be shortcomings, in all these directions there is an activity to the development of the study field.</p>

<b>Requirements</b>	<b>Requirement Evaluation</b>		<b>Comment</b>
R2 - The cooperation with different organisations from Latvia and abroad implemented within the study direction ensures the achievement of the aims of the study direction.		Partially compliant	The cooperation with local institutions is well established. The needs of the companies and recommendations from professional organizations and companies are reflected in the study courses. The representatives of the local companies supervise and evaluate final theses. The traineeship system is well organized. The system of attraction foreign lecturers and students from abroad is missing. There is very low number of visiting professors, lecturers and students.
R3 - Compliance of scientific research and artistic creation with the development level thereof (if applicable).	Fully compliant		Taking into account a two-way study programme, which includes electricity and heat energy vectors, scientific research corresponds to the level of scientific development. It is necessary to follow innovations more actively, to implement them in the study and research process. However, scientific activity has increased significantly over the last period and the volume of scientific publications has been significantly increased.
R4 - Elimination of the shortcomings and deficiencies identified during the previous assessment of the study direction, if it has been conducted, or the implementation of the provided recommendations.	Fully compliant		The recommendations have been taken into account and a great contribution has been made to the promotion of both the study environment and research and cooperation. The qualifications of the teaching staff have been increased. Although the follow-up to innovations and research results are not entirely satisfactory, recommendations have been taken into account and growth is observed.

### **Assessment of the Requirements for the Relevant Study Programmes of the Study Field**

No.	Study programme	R5	R6	R7	R8	Evaluation of the study programme (excellent, good, average, poor)
1	Applied Energy Engineering (42522)	Fully compliant	Fully compliant	Fully compliant	Not relevant	Good

### The Dissenting Opinions of the Experts

14. Each member of the academic staff has either publications published in reviewed editions within the last six years, including international editions (if they have worked for a shorter period of time, the number of publications shall be in proportion to the work period), or artistic creation achievements (for instance, exhibitions, films, theatre performances, and concert activity), or a five year practical work experience (except for the experience in the implementation of the study programme) in accordance with the Law on Institutions of Higher Education.

In compliance points experts have different options:

Davis Freidenfelds: Not all academic staff fulfil the requirements (for example academic staff for Sports and Informatics). This was concluded by evaluating academic staff CV (for the first time and additionally sent in). "CV PDF Eng.zip" and "CV\_ENG 23 sept.zip". The specific requirements set in criteria 14 of assessment of compliance of the study programme "Applied Energy Engineering" state that each member has to have either publications within last six years (including international editions) or a five-year practical work experience (except for the experience in the implementation of the study programme). Therefore, the criteria could be evaluated as partially compliant.

Other experts: The qualification of the teaching staff members involved in the implementation of the study programme complies with the requirements for the implementation of the study programme and the requirements set forth in the regulatory enactments. All teaching staff have a degree, relevant publications or practical experience according to LLU\_Regulations\_on\_Academic\_positions\_EN.pdf. Moreover, all professional teaching staff have the appropriate activities and have undergone further training during the last period.