Evaluation report

Evaluated point	Grade	Comments
Scientific impact of research	Good	EMÜ focuses on sustainability of natural resources. Applied research is dominant, agriculture and forestry in particular, but engineering is also included. EMÜ carries out interdisciplinary research and inter-university collaboration, thus avoiding the risk of being subcritical. Environmental science is significant, with no overlap with other Estonian universities. Institute of Technology (IT) and Institute of Forestry and Rural Engineering do research in Engineering and Technology. Strengths of the Institutes are their publication record and international cooperation. PhD participation within the different research fields is strong. IT has developed a strong research group in bio-fuels the last 5 years, producing cutting edge research in bio-fuel production from agricultural material, cellulose, hemi-cellulose, lignin and waste. Chemical free pretreatment is being developed. This research is strengthened by close connection to EMÜ´s research in agriculture and forestry. An experimental photo-reactor was designed and implemented for using algae for biofuel production. The Engine lab is testing biofuels in internal combustion engines (otto and diesel). 100% bio-fuel, mixtures with petroleum based fuels, and the possible need for additives are investigated. Effects of biofuels on engine efficiency, lubrication, component wear and life are studied. The Measuring lab does leading research in GDAT using coordinate measuring machines and 3D laser scanning. Metallographic analysis and measuring of mechanical properties of materials are carried out. The Laboratory of Wood Physical and Mechanical Properties tests mechanical and electrical properties. Climate chambers and equipment for non-destructive testing are also used. The Laboratory of building structures, can apply load cycles of high force. Building construction in timber is being developed in Estonia. Pure wood specimens and value-added refined wood are being tested. The ICT-based processing technology laboratory for renewable energy was impressive, with microgrid solutions combining solar, wind and heat storage. Data acquisition and real time computer control are combined to realize near zero-energy buildings. Optimization of power electronics is carried out in cooperation with TTÜ. The Laboratory of experimental mechanics of residual stresses does theoretical and experimental study of residual

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		stress in PVD coatings. Applications are tools for machining, electronics and PCBs. The Geodesy and photogrammetry laboratory is well equipped for high precision field measurements, surveying, and development of digital terrain models. The Laboratory of building physics focuses on study of thermal conductivity of insulation materials, primarily those based on local natural materials. The hydraulics laboratory for water management represents a unique national competence for study of hydraulic properties in soils and landfills. The academic output in terms of publications is good.
Sustainability and potential of research	Very good	A generous input from EU structural funds has enabled significant upgrading of the buildings and laboratories so they are currently of high standard. Supplemented by investment by the University, these funds have also enabled purchase and construction of modern, state of the art equipment. There will be a continuing need for upgrades, refurbishment, and maintenance and replacement of equipment. However the level of expenditure should be less in the coming years and the department is confident that the high standards can be maintained in spite of the decline in EU funding for these purposes. Most of the current research areas are on problems of key importance in society for example water management, biofuels, management of small scale renewable energy, efficient combustion, and land management. These fields pose fundamental and challenging problems, which will continue to provide important and stimulating research. The academic staff are of high quality with valuable expertise. The current research students are well supervised and committed to their research. There is a perceived threat to the sustainability of research in that the Institute would welcome more PhD students but they are aware of the need to recruit actively. Also the nature of the fields under study are attractive to young socially aware students.
Societal importance of research	Very good	The Institute benefits from the university's unique position, supporting services inside the institution and the different labs, collaboration with Tallinn Technical University through their distinct areas of expertise, complementing skills and services in Estonia, contract work, predominantly for SMEs, and research collaboration with institutions abroad. We exemplify the relevant impact of work below. Geodesy and photogrammetry supports a range of projects and enterprises for high precision (HP) measurement. The

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		staff have developed the Estonian official HP geoid model, the HP land uplift model and HP height connections to Estonian islands. The building physics lab tests the thermal properties of natural materials, building envelopes, and does air tightness tests. It is an important resource for developers of natural materials and potential refurbishment activities. Although a non-accredited lab, the recent national survey for materials network could enhance their prominence. Alternatively, the host institution could invest in certification and accreditation of the lab, to place the group in a stronger position, as development of insulation materials is a state initiative. The lab also collaborates with the nZEB Centre of Excellence at TTÜ. The building structures lab is unique in the country, loading structures up to 12 m span of beams and panels, along with research on foundations. It has enabled collaboration with factories producing timber buildings and prefabricated panels, which then export the components to Norway, etc. The biofuels lab has grown in the last 5 years to an international lab, cooperating with Tartu University, as well as India, Austria, Finland and SMEs, and holds two patents. The metrology lab, part of the Estonian Roadmap, enables collaboration between different labs. Focusing on the use of biofuels it has benefited from collaborations with companies developing engines and patents for their work. Additionally, they have worked with Estonian Energy providing oil shale, and have been involved with developing legislation on biofuel use in the country. The state-of-the-art hardware in the metrology lab supports regular contract work, with some large-scale partners, e.g. an aluminium company that is supplier to automotive industry internationally. The unique expertise developed on GDAT further supports their activities. The renewable energies lab, collecting real-time data for a microgrid, provides information for installation in a rural setting and enables collaboration with rural buildings department as well as groups outside the university; e.g. Wind Energy Cluster, nZEB Centre of excellence in TTÜ. The other significant beneficial impact on society is in the training of well qualified scientists. Of the graduated PhDs, a large proportion go to industry, particularly those with a focus on application, e.g. biofuels and renewables energies, about 50% of these graduates move to industry.

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Scientific basis in the field is sufficient to conduct doctoral studies. (This question should be answered only if: a) institution being evaluated is conducting doctoral studies and; b) The field being evaluated is proposed to grant positive evaluation. If these conditions are met then: a) If the level of scientific basis is sufficient for conducting doctoral studies in every structural unit being evaluated, then the answer should be „yes“; b) If the scientific basis is not sufficient in some structural units, then those units should be listed.)		Yes. The problems tackled in doctoral studies in engineering and technology have a sound scientific basis.

Summary assessment

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Areas of special note as appropriate (Where necessary indicate sub-fields, assessment criteria, and/or structural units which, in the committee's opinion, were of a notably high level.)		The commitment of the Institutions to solutions of environmental problems was impressive.
Areas in need of improvement as appropriate (Where necessary indicate sub-fields of the field being evaluated, assessment criteria, and/or structural units which, in the committee's opinion, revealed significant shortcomings.)		Care should be taken to ensure that the majority of PhDs should be completed within four years.
Assessment proposal to the Minister of Education and Research	To grant positive evaluation	Based on our assessment of research impact, sustainability of research and societal impact as reported above, we recommend the Minister of Education and Research to grant positive evaluation.

Feedback

Evaluated point	Comments
Feedback for institution (This question should be answered only if the institution asked for feedback from the evaluation committee in the self-report (about up to three specific areas of R&D which it finds to be currently important, e.g., related to its development plan).)	No questions were posed by the institution.
Suggestions for unit, institution, state etc. (As appropriate, committee can give additional feedback for the structural unit, the institution, or the State (please specify whom feedback is directed to) according to the directive assessment criteria for regular evaluation (article 7).	Suggestions for the state: There appears to be a disjoint between the research areas that are determined as critical by the state, such a water management and biofuels, and the state's actions in promoting them. Suggestions for the Institution: Some concerns were expressed by both faculty and students that insufficient recognition is given to scientific articles where the natural journal for publication is indexed by SCOPUS but not by Web of Science. This affects base line funding and the requirements for award of a doctorate. A note for the University: In the context of diversity and inclusivity and the European Disability Strategy priorities, accessibility requirements for wheelchair access may need to be revisited and the buildings adapted accordingly. It is commendable that the University provides ramps and appropriate lifts to enable wheelchair navigation on the ground floor and in between different floors. However, along some of the floors, access to wheelchairs appears more difficult through door frames which with have stepped access, e.g. in some labs and offices. The development of a focus group to review provision in the light of appropriate standards and best practice guidelines could be considered.