The Research Council of Norway

Evaluation of Mathematics, ICT and Technology 2023-2024

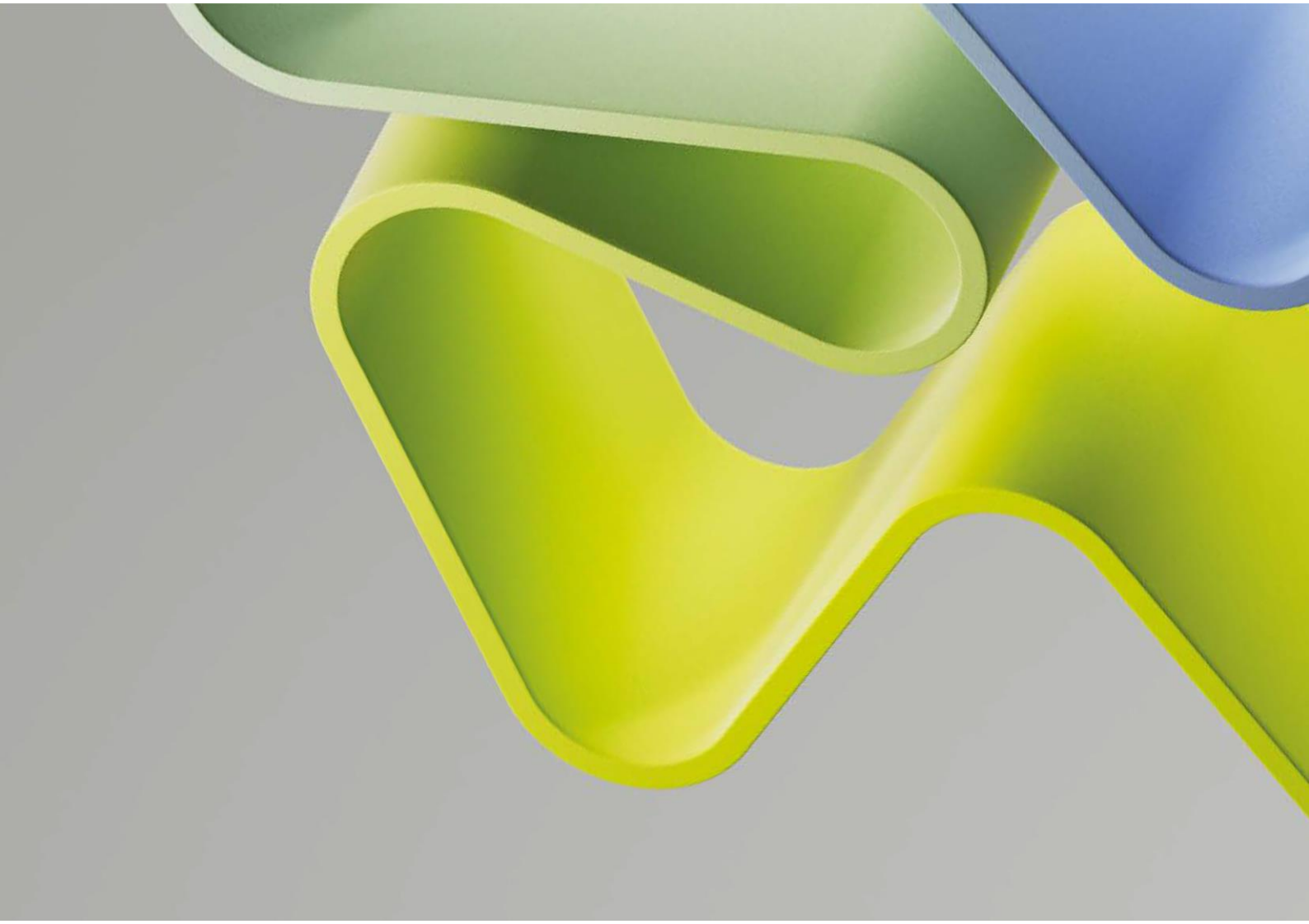
Evaluation Report for Administrative Unit

Administrative Unit: **Department of Electric Energy (IEL)**

Institution: **Norwegian University of Science and Technology (NTNU)**

Evaluation Committee Higher Education Institutions 3

December 2024



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Statement from Evaluation Committee Higher Education Institutions 3

The members of this Evaluation Committee have evaluated the following administrative units at the higher education institutions within Mathematics, ICT and Technology 2023-2024 and has submitted a report for each administrative units:

- Department of Industrial Technology, UiT The Arctic University of Norway
- Department of Electric Energy (IEL), Norwegian University of Science and Technology (NTNU)
- Department of Marine Technology (IMT), Norwegian University of Science and Technology (NTNU)
- Department of Mechanical and Industrial Engineering (MTP), Norwegian University of Science and Technology (NTNU)
- Faculty of Engineering and Natural Sciences (FIN) / Faculty of Technology, Environmental and Social Sciences (FTMS), from 1.1.2025, Western Norway University of Applied Sciences (HVL)
- Department of Mechanical, Electronic and Chemical Engineering, Oslo Metropolitan University (OsloMet)
- Faculty of Computer Science, Engineering and Economics (IIØ), Østfold University College (ØUC)
- Department of Electrical Engineering (IET), UiT The Arctic University of Norway
- Department of Technology and Safety (ITS), UiT The Arctic University of Norway
- Department of Electrical Engineering (IT) and Cybernetics (EIK), University of South-Eastern Norway (USN)
- USN School of Business, University of South-Eastern Norway (USN)
- Department of Microsystems (IMS), University of South-Eastern Norway (USN)

The conclusions and recommendations in this report are based on information from the administrative units (self-assessment), digital meetings with representatives from the administrative units, bibliometric analysis and personnel statistics from the Nordic Institute for Studies of Innovation, Research, and Education (NIFU) and Statistics Norway (SSB), and selected data from the National survey for academic staff in Norwegian higher education and the National student survey (NOKUT). The digital interviews took place in the autumn 2024. The members of the Evaluation Committee are in collective agreement with the assessments, conclusions and recommendations presented in this report. None of the committee members has declared any conflict of interest.

The Evaluation Committee consisted of the following members:

Professor Lina Sarro,
Delft University of Technology (Chair)

Professor Stefania Bruschi,
University of Padova

Professor Khaled Ahmed,
University of Strathclyde

Professor Andreas Müller,
Johannes Kepler University Linz

Professor Maria Teresa Correia de Barros,
University of Lisbon

Professor Kostas J. Spyrou,
National Technical University of Athens

Description of the Administrative Unit

Department of Electric Energy – IEL

Norwegian University of Science and Technology (NTNU)

The administrative unit

IEL aims to do basic and applied research in electric power engineering and develops technology and systems for planning, operating and maintaining efficient, sustainable energy systems. It is inherently interdisciplinary. It has 24 permanent academic positions (14 professors, of whom 2 women, and 10 associate professors) and about 65 temporarily employed junior researchers. Some 21 of the junior researchers are women.

IEL owns and operates the National Smart Grid Laboratory and operates this together with SINTEF Energy.

The research groups of the administrative unit

IEL contains five research groups

- Power electronics – systems and components
- Electric machines and electro-magnetism
- High-voltage technology
- Power markets and energy systems planning
- Power systems – operations and analysis

The unit's work and strategies

IEL's vision is to be at the centre of the green shift in Norway. Its stated strategy is to maintain and strengthen close collaboration on the one hand with the electrical industry, its regulators and stakeholders, and on the other with the Nordic, European and international research community in electric power engineering. Collaboration with industry is essential, and the Unit has collaboration agreements with key industry partners such as Statnett, Statkraft, Equinor, Nexans, Volue, and the Kongsberg Group. It also has a half-time innovation manager.

The unit's work in its sector

IEL is a leader in teaching and research on electrical energy and power engineering in Norway. Its focus areas of research are all related to the generation, transmission, distribution and use of electric energy. The organisation of research in five research groups reflects these focus areas. The research and education cover most disciplines of electric power engineering from power markets, power system analysis, electrical components to high voltage engineering.

The future of the unit

The self-evaluation does not explicitly describe the expected future of the unit, it states:

Our VISION is to be AT THE CENTRE OF THE DIGITAL GREEN SHIFT. The vision aims at building up under the strategy of the IE Faculty to MAKE THE FUTURE SMART, SAFE AND SUSTAINABLE, and NTNU's vision: KNOWLEDGE FOR A BETTER WORLD.

Overall Assessment

The Department of Electric Energy (IEL) embraces the vision of the Norwegian University of Science and Technology “KNOWLEDGE FOR A BETTER WORLD”, its strategy being to “MAKE THE FUTURE SMART, SAFE AND SUSTAINABLE”, this unit envisages being “AT THE CENTRE OF THE DIGITAL GREEN SHIFT”.

This overall evaluation follows the Terms of Reference defined by the administrative unit:

1. *The number and size of research groups and the balance between them in view of the national needs of competence and research in the green transition.* The number of research group is adequate as well as the scientific areas covered. However, some of the research groups seem to be losing their reputation and international links, while the impact of the new areas into which the AU has entered have did not yet become evident.
2. *Whether the department is able to deliver research-based, relevant education for the future needs.* The research covers all relevant areas in power system engineering, and its quality is a guarantee for delivering research-based education. The topics covered are relevant for future sustainable energy systems.
3. *Quality of the research and lab work: internal/Nordic projects, international projects and activities.* IEL conducts high quality research and lab work. However, its impact on society should be better explored.
4. *Development potential of research & Innovation in connection to education (most of master theses are connected to R&D projects)*. IEL incorporates the developed knowledge into the provided education.
5. *Cooperation with industry*. IEL works in close collaboration with industry, involving members of staff and students, but there is potential to increase collaboration that is not being explored.

In general, the evaluation agrees with the Administrative Unit’s identification of its internal strengths and weaknesses. However, the low ratio of PhD students to staff members and the small number of international links in some research areas are also considered weaknesses.

Future prospects were unclear from the material provided to the Committee.

The Terms of Reference for the administrative unit is attached to the report.

Recommendations

Based on the overall assessment of the Department of Electric Energy at the Norwegian University of Science and Technology, the Evaluation Committee recommends the following:

1. Considering the world-leading groups in the different research areas, thoroughly define clear benchmarks, and regularly evaluate activities and outcomes.
2. Rethink the focus areas and composition of the research groups, possibly reorganising some activities, and establish a clear research strategy.
3. Aim to be recognised as word-leading research university in strategically identified areas and increase participation in international projects, in particular as a leading team, and become involved in the work of international professional organisations.
4. Establish a clear strategy for recruitment of permanent staff as well as PhD students and Post-Docs, so to ensure sustainability of established research areas and development of recent and new ones.
5. Increase the number of PhD students.
6. Focus on improving the gender balance.
7. Improve the organisational structure of the group by recruiting medium-level staff

8. Increase collaboration with industry and other stakeholders
9. Improve the user involvement in the developed applications.
10. Be more engaged in knowledge transfer projects with the appropriate stakeholders and industrial partners to enhance research impact.
11. Enhance visibility and societal engagement
12. Document ongoing activities having societal impact.
13. Increase external funding, so as to reduce the dependence on basic funding and increase outreach and visibility.

1. Strategy, Resources, and Organisation of Research

The administrative unit IEL (Department of Electric Energy) envisages being “AT THE CENTRE OF THE DIGITAL GREEN SHIFT” by contributing to fundamental and applied knowledge of electric power systems and developing relevant technologies. This vision underlies the IEL strategy to “MAKE THE FUTURE SMART, SAFE AND SUSTAINABLE” and the university vision “KNOWLEDGE FOR A BETTER WORLD”.

IEL has five research groups that exhibit strong expertise and capacity for research and innovation.

The fundamental and applied research conducted at IEL enables research-based education in electric power engineering, covering generation, transmission, conversion and use of electric energy.

The administrative unit IEL works in close collaboration with industry in a win-win partnership. This collaboration involves members of staff and students.

1.1 Research Strategy

The strategy is well defined in plans currently covering until 2025, clearly defining a framework: vision, values, social mission, key challenges and main objectives. Five core tasks are identified:

- Education and the learning environment.
- Research and organised researcher training.
- Innovation.
- Dissemination and outreach.
- Development of the department and action plans.

There is a concern on ensuring that activities in each of the core tasks are consistent and interrelated.

The administrative unit IEL aims at leading externally funded projects and other large initiatives to a greater extent and being internationally at least in one research area. Together with these research development targets, IEL aims to maintain top-class digital and physical laboratories and increase the progression rate for PhD candidates.

Regarding innovation, the aim is facilitating for society to access and use the outcome of the conducted research activities.

Dissemination and outreach start by collaborating with industry and by incorporating research into teaching. IET is attentive to the quality of the published research work and to invests on visibility through the web and social media.

The administrative unit IET has proved that strategic goals related to institutional strategies and scientific priorities are largely met.

Recommendations:

The administrative unit is encouraged to:

- Expanding collaborations with industry partners, government agencies, and international research institutions, which can enhance the impact and funding potential for research projects.
- Creating a dedicated team or platform to actively seek partnerships and joint funding opportunities, which would help researchers to secure resources more effectively and align projects with real-world applications and industry demands.
- Encouraging greater interdisciplinary collaboration within and beyond the department, which could drive innovation and broaden the scope of research.
- Providing targeted mentorship and resources for early-career researchers and PhD students that would help them build strong research portfolios, increasing overall productivity and quality.
- Boosting the department's profile and attract more talent and partnerships, by implementing strategies to increase the visibility of research outputs.

1.2 Organisation of Research

The administrative unit encompasses five research groups. Collaboration both in teaching and research is promoted.

The interdisciplinary priority areas are identified, following the university strategy: Internationalisation, Interdisciplinary collaboration, Career and skills, Work environment and student welfare, Campus development and Capacity for development.

The administrative unit has a Deputy Head Research position, responsible for the overall research strategy, together with the research group leaders. There is also an Innovation Manager that works close with the area official at the university level. The outreach activities and research training are also coordinated.

The research groups are thematically organised, facilitating these tasks. Collaboration between research groups may cover scientific guidance gaps, if any.

The organisation of research is in line with the institutional strategies and objectives. However, the ratio of PhD students to faculty is about 2:1, lower than usual in research-based universities, where this ratio is about 3. IET considers that a ratio of 2.5 would be good, but it is not a goal on itself.

Recommendations:

The administrative unit is encouraged to:

- Establish a clear research strategy, benchmarking and regularly evaluating activities and outcomes.
- Increase international collaboration in general, particularly as project leaders.
- Adapt the organisation to increase industrial collaboration and public outreach.
- Raise the number of PhD students.

1.3 Research Funding

The administrative unit relies on four funding sources: Ministry of Education and Research, Research Council of Norway, industry and EU - programmes.

The amounts reflect the high level of research quality being produced.

The administrative unit encourages, supports and facilitates researchers and research groups in applying for external funding.

The research groups succeeded in obtaining national and international grants during last five years (2018-2022), KNOK 2 424, average per year from the European Union, and KNOK 319 average per year from other international grants.

Recommendations:

The administrative unit is encouraged to:

- Establish a dedicated grant writing and proposal development team that could assist researchers in all groups in crafting competitive applications, particularly for international funding opportunities.
- Increase partnerships with industry that can help diversify funding sources and create opportunities for co-funded projects.
- Establish an industry advisory board or expanding networking events with industry stakeholders could facilitate stronger, more strategic relationships, leading to more collaborative research proposals and funding prospects.
- Provide small internal grants for preliminary research or pilot studies, which would enable researchers to gather initial data, making their proposals more compelling to external funders. This approach would be particularly beneficial for early-career researchers, helping them establish a track record of research activity and enhancing their ability to secure larger, external grants.
- Enhance support for managing funded projects that could help researchers comply with funding requirements and effectively utilise resources.

1.4 Research Infrastructures

The administrative unit IEL relies on adequate research infrastructures, with well-equipped laboratories, all located at NTNU, including The National Smart Grid Laboratory – NTNU.

The participation in the international infrastructure CERN involves co-supervision of PhD students that spend half/half time and hosting of professors for one year.

Recommendations:

The administrative unit is encouraged to:

- Strengthening access and participating in national and international Infrastructures.
- Enhancing capacity for hosting and coordinating research infrastructures. The unit should plan to host or coordinate major research infrastructures, which can be carried out by investing in building the necessary capacity and expertise to effectively manage these roles.
- Ensuring adherence to FAIR principles in data management. The administrative unit should implement and regularly update policies and practices that ensure full adherence to the FAIR principles for all research data generated within the unit. This includes establishing partnerships with national and international data repositories and

infrastructure providers to ensure that data is managed according to global standards, thereby enhancing the visibility and impact of the unit's research.

1.5 National and international collaboration

The administrative unit IEL has a strong collaboration with both the electric energy industry and the international research community at large, in line with the defined strategy and objectives. These collaborations represent notorious added value to the research quality in the unit.

Examples of cross-sectorial and interdisciplinary collaboration are provided, which bring additional value to research. There is a strong collaboration with industry and stakeholders in the electric energy sector, including official authorities (the energy directorate and the regulatory authority).

Recommendations:

The administrative unit is encouraged to:

- Developing formal agreements with key national and international research institutions and industry partners that can strengthen collaborative efforts.
- Encouraging interdisciplinary projects that involve faculty and researchers from different departments that can create new avenues for collaboration.
- Supporting initiatives that cross traditional academic boundaries, facilitating research that addresses complex, multi-faceted challenges in the energy sector.
- Providing internal funding or resources for joint research proposals, which can motivate faculty and researchers to pursue national and international collaborations.
- Utilising digital tools and platforms that can facilitate communication and collaboration with international partners, especially in the context of remote or hybrid working environments.
- Regularly assessing and documenting the outcomes of collaborative projects can highlight the benefits and impact of partnerships.

1.6 Research staff

There are 103 researchers, of whom 30 hold permanent positions. By category, there are 14 Professors, 10 Associate Professors, 3 Researchers, 5 Lecturers, 2 being temporary positions. Other temporary staff consists of 3 Adjunct Professors (at 20%), 4 Adjunct Associate Professors (at 20%), 54 PhD students and 10 Postdocs.

The Department has a pronounced gender imbalance. Overall, there are 23 women: 2 Professors, 3 Adjunct Associate Professors, 17 PhD students and 1 Postdoc, the overall percentage being 22%. The percentage decreases to 6% if only permanent staff is considered. The Department is tackling the gender imbalance via strategic recruitment of women and search committees have been established. Strategic recruitment means direct hiring without opening a position but based on the principle of qualification. This type of recruitment has become more difficult in recent years due to the economic situation.

Female staff and PhD students play active roles in motivating female engineering students to continue towards an academic career.

Research career opportunities and support to young researchers are well addressed.

The distribution of research time among the staff, including criteria for research leave/sabbaticals (including mobility options), fulfils the goals of the unit. The target is that Professors and Associate Professors have up to 45% research time. PhD students and Postdocs have less than 100% if they have teaching contracts.

Research leaves/sabbaticals are granted, aiming at developing new competence and develop international networks. Applications are processed once per year. There must be five years between consecutive long-term research leaves. One to two persons benefit each year. Shorter visits and stays are also permitted in the framework and financed by research projects.

Recommendations:

The administrative unit is encouraged to:

- Develop and execute a targeted recruitment strategy aimed at attracting underrepresented groups, particularly women, to permanent academic positions.
- Establish comprehensive career development programmes that provide mentorship, training, and networking opportunities for early-stage researchers, including PhD candidates and postdoctoral fellows.
- Periodically assess the unit's recruitment policies and workforce demographics to identify areas for improvement regarding gender balance and age distribution.
- Create initiatives that promote an inclusive culture within the research environment, such as diversity training and awareness programmes for all staff.
- Reassess the criteria and processes for granting research leaves and sabbaticals to ensure they are equitable and support the diverse needs of staff.
- Provide clear guidelines and opportunities for mobility which can enhance research productivity and collaboration while promoting personal and professional growth.
- Promote opportunities for researchers to engage in interdisciplinary projects that can broaden their skill sets and foster collaborations with different departments or external partners.

1.7 Open Science

The university has a Development Plan for Open Science 2023-2025, and the Policy for Open Science is included in the website, with access to the corresponding Guidelines. The established policies and procedures are adequate. Sensitive data resulting from industrial collaboration are protected.

Open access to most publications is enabled. Developed software is made available open-source whenever possible.

Confidentiality agreements are signed when dealing with protected or sensitive data. Data management follows national regulation.

In spite of the general open-source policy, confidentially is guaranteed in specific cases, such as research of a sensitive nature, research includes the use of material protected by copyright and bounds by commercial agreements.

Recommendations:

The administrative unit is encouraged to:

- Providing training that focus on the principles of Open Science, data management, and the FAIR data principles for researchers on how to effectively manage and share their data that can empower them to embrace Open Science practices confidently.
- Creating a system of incentives, such as funding for open access publication fees or recognition in performance evaluations, to encourage researchers to publish their work in open-access journals.
- Ensuring that the data repositories are user-friendly and well-promoted can encourage researchers to share their work more openly.
- Encouraging collaborative research initiatives that involve multiple disciplines, which can lead to innovative approaches and broaden the application of Open Science principles.
- Conducting regular assessments of the unit's Open Science initiatives to measure their effectiveness and identify areas for improvement.
- Actively showcasing successful Open Science projects and initiatives as highlighting achievements can inspire researchers to adopt Open Science practices and demonstrate the positive impact of these efforts on the research community and society as a whole.

2. Research production, quality and integrity

The IEL encompasses five research groups.

- (EME) Electric Machines and Electromagnetism.
- (EMESP) Electricity Markets and Energy Systems Planning.
- (HVT) High Voltage Technology.
- (PESC) Power Electronics – systems and components.
- (PSOA) Power Systems Operation and Analysis.

The EME group research focus is both on electric machines, especially permanent magnet machines, and hydropower generators in various applications and on advanced electromagnetic modelling and analysis of different apparatus and installations.

The EMESP group research focus is on thematic research areas such as electricity markets, system planning, hydropower optimisation, electrification and digitalisation, energy system integration and flexibility, and energy informatics.

The HVT group research focus is on topics within electrotechnical applications of conducting and insulating materials and aims to develop criteria for optimal design of high voltage equipment and secure operation of electricity power networks.

The PESC group research focus is on converter design, digital control of converters and integration of power electronics into power systems, aiming at providing energy conversion technologies to decarbonise the electricity system, the transportation sector and to accelerate integration of on- and off-shore renewables into the power system.

The PSOA group research focus is on analytical and computational methods for power system operation, particularly in the context of digitalisation and sustainability.

There are adequate policy and procedures for research integrity. For difficult and uncertain cases, the “The Research Ethics Committee” was established.

2.1 Research quality and integrity

Research group Power Electronics – systems and components (PESC) overall assessment

The research activities of the group are related to the development, design, optimisation and control of power electronic converters and systems. Application areas include onshore and offshore power systems, marine, oil & gas as well as transportation sectors.” Since 2018 the group size has increased 250 %. Now, it has three professors (one with a 50 % contract), two emeritus professors, one associate professor, one university lecturer with 50 % contract, one researcher, two post docs and 17 PhD students. By developing energy conversion technologies, the group aims at decarbonising the electricity system, the transportation sector and to accelerate integration of on- and off-shore renewables into the power system. Research funding is at a good level, coming from national and international sources. The conducted research is excellent, reaching remarkable international visibility. Societal impact could be increased by working with local industries.

Research group Electric Machines and Electromagnetism (EME) overall assessment

“The main research areas of the group are related to the development, design, optimisation and testing of electric machinery, especially permanent magnet machines and hydropower generators. In addition, research is also focused on advanced electromagnetic modelling and analyses of different power apparatus and installations.” The group has two professors, one emeritus professor, three associate professors, one research scientist, two post docs and six PhD students. Reasons for the somehow reduced number of PhD students should be investigated. The group has not provided a reference benchmark, so the development objectives are unclear. The group has a long and successful tradition of high-quality research and teaching. However, nowadays the international visibility of the group is reduced. There is a need to rethink the focus research areas.

Research group High Voltage Technology (HVT) overall assessment

“The main research activities of the group are related to the design, modelling and operation of electric power components. Research into better insulation materials, both for ac and dc, is being conducted.” The group had an important role on education (around 70 master students and 10 PhD students, between 2018 and 2022). Further to the well-equipped NTNU laboratories with standard testing and measuring equipment, the students use special facilities at SINTEF Energy Research. Today’s group's organisation is not effective, as it lacks medium-level staff and laboratory support personnel. As a consequence, researchers and PhD students are overload with teaching duties and maintenance work on laboratory equipment. Many publications are co-authored by with colleagues from SINTEF Energy Research. This is positive as it shows profitable collaboration, but it is difficult to judge the degree of direct contribution by the individual members of the group. International collaboration is limited.

Research group Electricity Markets and Energy Systems Planning (EMESP) overall assessment

“The main research areas of the group are related to the integration of renewable energy sources, energy storage and consumption in the electricity market, and how to optimise the integration of the power system with other parts of the energy system, e.g. heating and transport.” The group, established in 2018, comprises 29 members including staff members

and researchers. It aims at being recognised as a world leading research group in electricity markets and system planning at regional, national and international levels. Some members of the group already achieved this objective, according to the track record of securing funding and publications. Overall, the group produces very high-quality research. The organisational structure is adequate. For future growth, the group should establish a strategic recruitment plan. Also important is to increase visibility.

Research group Power Systems – operation and analysis (PSOA) overall assessment

“The main research areas of the group are related to the planning, operation, control and analysis of power systems, with applications in smart grids, transmission and distribution grids, microgrids and HVDC systems.” The group, established in 2016, comprises 10 professors and 16 research staff, including 13 PhDs. They contribute to the ENERGY strategic area, particularly in Smart Grids, Wind, and Storage technologies. The group is strong in analytical and computational methods for power system operation. They give important contributions for digitalisation and sustainability. The group has a high potential, but their success in securing funding is limited. Also weak are their international collaborations and their engagement with users of their open-source tools and data repositories. The impact of their research outputs needs clarification.

3. Diversity and equality

There is an action plan for gender equality and diversity, aiming at increasing diversity. A person is in charge of investigating, reporting on, and helping to settle complaints. It is stated that gender equality is considered when recruiting new employees.

4. Relevance to institutional and sectoral purposes

Together with SINTEF, IEL constitutes a very important competence centre. Innovation is a priority and there is a successful history of developing research results into products. Commercialisation, patenting and establishing start-up companies is a reality.

IEL has a long tradition of educating Master and PhDs that play important roles in the Norwegian energy sector.

5. Relevance to society

Three impact cases are presented to show relevance to society, two originating from the research group IEL and one from research group EMESP.

The impact cases in the area of “Electric Machines and Electromagnetics” were originated from research conducted some time ago. One company was established in 1996, and relevant activity was maintained. Another company was established in 2017.

The impact case originated in the area of “Electricity Markets and Energy System Planning” dates from 2017 and results in increasing public awareness about sustainable energy systems.

5.1 Impact cases

Comments to impact case 1: Kongsberg Maritime AS

This case originates from IEL research group “Electric Machines and Electromagnetics” on the topic of Permanent Magnetic (PM) technology in combination with integrated gearless

systems. Results were patented. Kongsberg Maritime AS derives from a company that established in 1996 in Trondheim (SmartMotor AS).

Relevance, importance and strengths of this impact case are evident considering the diversity of applications and clients that were provided along the years. Applications such as wind generators, wheel motors used in wheelchairs and marine applications such as Marine Winches, outboard rim drive propulsion motors and motors for submarines. Clients such as Rolls Royce Marine, Aker Solutions, Statoil, Kongsberg and Siemens.

Comments to impact case 2: Alva Industries AS

This case originates from IEL research group “Electric Machines and Electromagnetics” on the topic of light and highly efficient electric motors. Alva Industries AS was established in 2017 with the university technology transfer support, aiming to contribute to enabling the electrification of several sectors and industries. Three products are available.

So far, the relevance, importance and strengths of this impact case seems more evident at the academic level (BSc, MSc and PhD theses).

Comments to impact case 3: Local sharing of energy and flexibility in distribution grids

This case originates from EMESP research group “Electricity Markets and Energy System Planning”, since 2017, on how to incentive renewable energy development among electricity end-users and how to utilise the flexibility potential of batteries and shiftable electricity demands.

The relevance, importance and strengths of the impact case is linked to dissemination of the results using media to increase public awareness.

Methods and limitations

Methods

The evaluation is based on documentary evidence and online interviews with the representatives of Administrative Unit.

The documentary inputs to the evaluation were:

- Evaluation Protocol that guided the process
- Terms of Reference
- Administrative Unit’s self-assessment report
- Administrative Unit’s impact cases
- Administrative Unit’s research groups evaluation reports
- Bibliometric data
- Personnel and funding data
- Data from Norwegian student and teacher surveys (only for HEI’s)

After the documentary review, the Committee held a meeting and discussed an initial assessment against the assessment criteria and defined questions for the interview with the Administrative Unit. The Committee shared the interview questions with the Administrative Unit at least two weeks before the interview.

Following the documentary review, the Committee interviewed the Administrative Unit in an hour-long virtual meeting to fact-check the Committee’s understanding and refine perceptions. The Administrative Unit presented answers to the Committee's questions and addressed other follow-up questions.

After the online interview, the Committee attended the final meeting to review the initial assessment in light of the interview and make any final adjustments.

A one-page summary of the Administrative Unit was developed based on the information from the self-assessment, the research group’s evaluation reports, and the interview. The Administrative Unit had the opportunity to fact-check this summary. The Administrative Unit approved the summary without substantive adjustments.

Limitations

The Committee judged that the Administrative Unit self-assessment report was insufficient to assess all evaluation criteria fully. However, the interview with the Administrative Unit filled gaps in the Committee's understanding, and the information was sufficient to complete the evaluation.

List of administrative unit's research groups

Institution	Administrative Unit	Research Groups
Norwegian University of Science and Technology (NTNU)	Department of Electric Energy (IEL)	Power Electronics Systems and Components (PESC)
		Electrical Machines and Electromagnetics (EME)
		High Voltage Technology (HVT)
		Electricity Markets and Energy System Planning (EMESP)
		Power System Operation and Analysis (PSOA)

Terms of Reference (ToR) for the administrative unit

The board of the Faculty of Information Technology and Electrical Engineering, NTNU mandates the evaluation committee appointed by the Research Council of Norway (RCN) to assess the Department of Electric Energy (IEL) based on the following Terms of Reference.

Assessment

You are asked to assess the organisation, quality and diversity of research conducted by the Department of Electric Energy as well as its relevance to institutional and sectoral purposes, and to society at large. You should do so by judging the unit's performance based on the following five assessment criteria (a. to e.). Be sure to take current international trends and developments in science and society into account in your analysis.

a) Strategy, resources and organisation

b) Research production, quality and integrity

c) Diversity and equality

d) Relevance to institutional and sectoral purposes

e) Relevance to society

For a description of these criteria, see Chapter 2 of the mathematics, ICT and technology evaluation protocol. Please provide a written assessment for each of the five criteria. Please also provide recommendations for improvement. We ask you to pay special attention to the following 5 aspects in your assessment:

1. The number and size of research groups and the balance between them in view of the national needs of competence and research in the green transition.
2. Whether the department is able to deliver research-based, relevant education for the future needs.
3. Quality of the research and lab work: internal/Nordic projects, international projects and activities.
4. Development potential of research & Innovation in connection to education (most of master thesis are connected to R&D projects).
5. Cooperation with industry.

In addition, we would like your report to provide a qualitative assessment of the Department of Electric Energy as a whole in relation to its strategic targets. The committee assesses the strategy that the administrative unit intends to pursue in the years ahead and the extent to which it will be capable of meeting its targets for research and society during this period based on available resources and competence. The committee is also invited to make recommendations concerning these two subjects.

Documentation

The necessary documentation will be made available by the mathematics, ICT and technology secretariat at Technopolis Group.

The documents will include the following:

- a report on research personnel and publications within mathematics, ICT and technology commissioned by RCN
- a self-assessment based on a template provided by the mathematics, ICT and technology secretariat

Interviews with representatives from the evaluated units

Interviews with the Department of Electric Energy will be organised by the evaluation secretariat. Such interviews can be organised as a site visit, in another specified location in Norway or as a video conference.

Statement on impartiality and confidence

The assessment should be carried out in accordance with the *Regulations on Impartiality and Confidence in the Research Council of Norway*. A statement on the impartiality of the committee members has been recorded by the RCN as a part of the appointment process. The impartiality and confidence of committee and panel members should be confirmed when evaluation data from the Department of Electric Energy are made available to the committee and the panels, and before any assessments are made based on these data. The RCN should be notified if questions concerning impartiality and confidence are raised by committee members during the evaluation process.

Assessment report

We ask you to report your findings in an assessment report drawn up in accordance with a format specified by the mathematics, ICT and technology secretariat. The committee may suggest adjustments to this format at its first meeting. A draft report should be sent to the Department of Electric Energy and RCN. The Department of Electric Energy should be allowed to check the report for factual inaccuracies; if such inaccuracies are found, they should be reported to the mathematics, ICT and technology secretariat within the deadline given by the secretariat. After the committee has made the amendments judged necessary, a corrected version of the assessment report should be sent to the board of the Faculty of Information Technology and Electrical Engineering and the RCN no later than two weeks after all feedback on inaccuracies has been received from the Department of Electric Energy.

Appendices

1. Description of the evaluation of EVALMIT
2. Invitation letter to the administrative unit including address list
3. Evaluation protocol
4. Template of self-assessment for administrative unit (short-version)

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