UNSW Engineering

Education Specification

1. Program Overview

Program Title: Bachelor of Engineering (Honours)

Award Title: Bachelor of Engineering (Honours) (Renewable Energy Engineering)

Engineering Discipline: Renewable Energy Engineering

The SOLABH Bachelor of Engineering (Honours) in Renewable Energy (RE) is a four-year, full-time degree. It is offered by SPREE as a specialisation of the UNSW 3707 Bachelor of Engineering (Honours) program. It is an AQF Level 8 qualification and provides graduates with advanced knowledge and skills for professional and/ or further learning. This document illustrates how the SOLABH specialisation fosters the Engineers Australia (EA) Stage 1 Competencies for Professional Engineers in its students. In the following sections aims and specialisation learning outcomes (SLOs) are presented. This is followed by the curriculum mapping that relates the course learning outcomes (CLOs) of individual courses to SLOs, and SLOs to EA Competencies.

The specific objective of the Renewable Energy program is to educate engineers for the needs of the renewable energy and related industries to support the energy transition. Areas of study include renewable and distributed energy system design and operation, energy efficiency and sustainability, and electricity industry integration and policy. A unique feature of this program is that from Year 2, students can select a set of ‘Strand elective’ courses in one of three areas to develop depth and focus to their education in Renewable Energy. These courses are available in Humanitarian and Sustainability, Low Energy Systems, and Renewable Energy Systems.

2. Career Alignment

Careers in renewable energy engineering are expanding rapidly as the energy transition accelerates. This creates a strong demand for engineers who can design, integrate and operate renewable energy systems while meeting sustainability, safety, reliability and regulatory expectations. This specialisation prepares graduates for roles across the renewable energy value chain by building skills and competencies in renewable technologies, power systems integration, techno-economic analysis, project development, and professional communication and teamwork.

Graduates of this degree can work in a wide range of companies including developers, owner-operators, consultancies, network service providers, equipment manufacturers, retailers, aggregators, regulators and government. Typical roles include renewable energy systems engineer, PV/wind engineer, grid integration or DER engineer, energy storage engineer, asset performance/operation and maintenance engineer, energy market analyst, project development engineer, and energy efficiency/building services engineer.

To support the broad and interdisciplinary nature of the job market, three “strands” have been introduced which allows students to further specialise in Humanitarian Engineering, Renewable Energy Systems and

Low Energy Building, while maintaining a consistent engineering emerging areas, including customer-side energy resources (rooftop PV, batteries, EV integration, virtual power plants and demand response), advanced wind system design, and data-enabled asset management, are being strengthened through new electives and ongoing integration of data science skills across the curriculum.

3. Specialisation Framework

On successful completion of this specialisation, graduates will be able to:

1. Show proficiency in the enabling sciences that underpin Renewable Energy (physics, mathematics and computer science), sustainability and climate change, quantify the impact of human activities on environmental systems and propose engineering solutions.
2. Demonstrate proficiency of Renewable Energy specialist technical knowledge including quantifying the magnitude, variability and uncertainty of the resources underpinning renewable energy and energy systems, analysing the impact on system design, operation, performance and integration within the broader energy system.
3. Critically evaluate and apply current research to the solution of problems faced in a real world context, in Renewable Energy engineering, by considering technical, economic, social and environmental implications.
4. Use appropriate analytical and computational tools to analyse complex problems in renewable energy and solve by applying critical thinking and engaging with real world context.
5. Design renewable energy systems using knowledge of the functionality and operating principles of systems components, enabling technologies and relevant standards.
6. Use plant and electricity industry data to analyse the operation and impacts of renewable and distributed energy systems and design and implement solutions to improve their performance and integration into electricity systems.
7. Lead and manage renewable energy projects, individually or as part of a team, in a systematic and professional manner.
8. Demonstrate a high level of personal autonomy, perseverance, ethical conduct and professional accountability when working as an individual and within diverse multi-cultural and multi-disciplinary team environments.
9. Communicate professionally and effectively within and outside of renewable energy engineering and effectively incorporate feedback

4. Continuous Improvement

The SPREE Program Committee monitors the programs and courses. The Committee meets once per month. The committee gathers feedback from the stakeholders including industry, Course Convenors, School and Faculty committees, students and professional bodies. In addition, the School conducts routine course reviews and comprehensive course and program reviews as discussed in Section 5.2. Course convenors also propose revisions based on course review, student feedback and/ or industry requirements. Revision and/or new course/program proposals are presented to the SPREE Learning and

Teaching Committee (LTC) for further discussion and endorsement. The approved proposals are presented to the Faculty Academic Committee.

5. Review Process

5.1. Faculty-led Review

UNSW's Academic Offering Review and Monitoring Procedure outlines a structured approach to maintaining the quality and relevance of academic programs and courses. It includes both program-level and course-level review processes, with defined responsibilities and timelines.

Program Monitoring is conducted annually for all programs and specialisations. A comprehensive program review must occur at least once every five years for accredited programs, and every seven years for others. These reviews include a self-evaluation report (SER), review panel, review event, and a formal response with an implementation plan. Oversight is provided by the Academic Board and University Academic Quality Committee (UAQC), with input from Faculty Education Committees and Deans.

Course Review within UNSW Engineering is managed through a two-tiered process: Routine Course Review and Comprehensive Course Review. Routine reviews are conducted at the end of each term by Schools, using data such as enrolment, assessment outcomes, academic integrity issues, WAM differences, and student feedback (myExperience). Courses flagged through this process are added to the Comprehensive Course Review roster.

Comprehensive Course Reviews are detailed evaluations led by the Course Convenor in collaboration with a Faculty Educational Developer, Nexus Fellow, or Senior Academic. These reviews assess course design, pedagogy, alignment with learning outcomes, and feedback mechanisms. Outcomes are documented in a Course Development Plan and an Evaluation Report following the next course delivery. Schools must review at least 10% of their courses annually.

Stakeholder involvement spans multiple levels, including the Academic Board, UAQC, Faculty and School committees, Course Convenors, and external contributors such as students and professional bodies.

Frequency of updates includes termly course reviews, annual program monitoring, and five-yearly comprehensive reviews for accredited programs.

6. Curriculum Mapping

Curriculum mapping was undertaken following the methodology established by the Faculty. The mapping was conducted as a two-step process. The assessments in an individual course were mapped with the CLOs, CLOs were mapped with SLOs and SLOs were mapped with relevant Engineers Australian Stage 1 Competency Standards for Professional Engineers (PLOs). Both core and elective courses in the specialisation were considered for the mapping. These mapping are shown in Tables 1, 2 and 3.

Mapping of the assessments to CLOs and CLOs to SLOs were done in consultation with the course convenors, and the mapping of SLOs to PLO was performed in consultation with the program leader.

Curriculum mapping shows that the specialisation provides good coverage of all the Engineers Australia Stage 1 Competencies for Professional Engineers. It is particularly strong in in-depth technical knowledge, application of engineering methods, engineering design, and creative, innovative and pro-active demeanour. The SPREE IAC is satisfied that the SLOs and the mapping of competencies appropriately address the needs of the renewable energy industry. Although "Professional and personal attributes" competencies are embedded in the specialisation, some elements of this such as ethics could be better distributed across the specialisation which is an aim of the on-going program review.

Table 1. Mapping of the specialisation learning outcomes to the Engineers Australia Stage 1 Competencies.

SLO/PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	PLO13	PLO14	PLO15	PLO16
1. Show proficiency in the enabling sciences that underpin Photovoltaic and Solar Energy (PVSE) Engineering (physics, mathematics and computer science).	X	X														
2. Demonstrate proficiency of PVSE Energy specialist technical knowledge such as operation, design and manufacturing of solar cells and modules, energy efficiency and photovoltaic systems design.		X	X		X	X	X	X								
3. Critically evaluate and apply current research to the solution of problems faced in a real world context, in PVSE Energy engineering, by considering technical, economic, social and environmental implications.				X		X					X		X	X		
4. Use appropriate analytical and computational tools to analyse complex problems in PVSE and solve by applying critical thinking and engaging with real world context.					X	X	X	X	X							
5. Design PVSE systems using knowledge of the functionality and operating principles of systems components, enabling technologies and relevant standards					X	X	X	X	X	X						
6. Lead and manage PVSE projects, individually or as part of a team, in a systematic and professional manner.										X						X
7. Demonstrate a high level of personal autonomy, perseverance, ethical conduct and professional accountability when working as an individual and within diverse multi-cultural and multi-disciplinary team environments.											X		X		X	X
8. Communicate professionally and effectively within and outside of PVSE engineering and effectively incorporate feedback.												X		X		

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Table 2. Mapping of courses to the specialisation learning outcomes

Course code	1. Show proficiency in the enabling sciences that underpin Renewable Energy (physics, mathematics and computer science), sustainability and climate change, quantify the impact of human activities on environmental systems and propose engineering solutions.	2. Demonstrate proficiency of Renewable Energy specialist technical knowledge including quantifying the magnitude, variability and uncertainty of the resources underpinning renewable energy and energy systems, analysing the impact on system design, operat	3. Critically evaluate and apply current research to the solution of problems faced in a real world context, in Renewable Energy engineering, by considering technical, economic, social and environmental implications.	4. Use appropriate analytical and computational tools to analyse complex problems in renewable energy and solve by applying critical thinking and engaging with real world context.	5. Design renewable energy systems using knowledge of the functionality and operating principles of systems components, enabling technologies and relevant standards.	6. Use plant and electricity industry data to analyse the operation and impacts of renewable and distributed energy systems and design and implement solutions to improve their performance and integration into electricity systems.	7. Lead and manage renewable energy projects, individually or as part of a team, in a systematic and professional manner.	8. Demonstrate a high level of personal autonomy, perseverance, ethical conduct and professional accountability when working as an individual and within diverse multi-cultural and multi-disciplinary team environments.	9. Communicate professionally and effectively within and outside of renewable energy engineering and effectively incorporate feedback.
Level 1 Core Courses									
COMP1511 Programming Fundamentals	Introduced								
COMP1911 Computing 1A	Introduced								
DESN1000 Introduction to Engineering Design and Innovation		Introduced		Introduced	Introduced		Introduced	Introduced	Introduced
ELEC1111 Electrical Circuit Fundamentals	Introduced	Introduced		Introduced			Introduced		
ENGG1811 Computing for Engineers	Introduced			Introduced					
MATH1131 Mathematics 1A	Introduced								Introduced
MATH1141 Higher Mathematics 1A	Introduced								Introduced
MATH1231 Mathematics 1B	Introduced								Introduced
MATH1241 Higher Mathematics 1B	Introduced								Introduced
PHYS1121 Physics 1A	Introduced								Introduced
PHYS1131 Higher Physics 1A	Introduced								Introduced

PHYS1221 Physics 1B	Introduced								Introduced
PHYS1231 Higher Physics 1B	Introduced								Introduced
SOLA1070 Sustainable Energy	Introduced	Introduced	Introduced	Introduced	Introduced	Introduced		Introduced	Introduced
Level 2 Core Courses									
DESN2000 Engineering Design and Professional Practice		Introduced		Introduced	Developed		Developed	Introduced	Developed
MATH2018 Engineering Mathematics 2D	Developed			Introduced					
MATH2019 Engineering Mathematics 2E	Developed			Introduced					
MATH2089 Numerical Methods and Statistics	Proficient	Developed							
MMAN2700 Thermodynamics	Developed	Developed							
SOLA2051 Project in Photovoltaics and Renewable Energy	Developed	Developed		Developed	Developed		Introduced	Developed	Developed
SOLA2060 Introduction to Electronic Devices	Developed	Developed		Developed	Introduced				
SOLA2540 Applied Photovoltaics	Developed	Developed		Introduced	Proficient	Introduced	Introduced	Introduced	Developed
Level 3 Core Courses									
ELEC2911 Power Engineering for Renewable Energy		Developed		Developed					
SOLA5050 Renewable Energy Industry and Policy		Developed	Proficient	Proficient		Developed		Developed	Developed
SOLA5053 Wind Energy Converters	Developed	Proficient	Introduced	Proficient	Proficient	Developed	Developed	Developed	Proficient
SOLA5057 Energy Efficiency	Developed	Developed		Developed		Introduced	Introduced	Developed	Developed
Level 4 Core Courses									
ELEC4122 Strategic Leadership and Ethics							Developed	Developed	Developed
SOLA4012 Photovoltaic Systems Design	Proficient	Proficient	Introduced	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient
SOLA4951 Research Thesis A	Proficient	Developed	Developed	Developed	Developed	Developed	Developed	Developed	Developed
SOLA4952 Research Thesis B	Proficient	Proficient	Developed	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient
SOLA4953 Research Thesis C	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient	Proficient
Strand Electives									

ELEC2134 Circuits and Signals	Proficient			Proficient					
ENGG2500 Fluid Mechanics for Engineers	Developed	Developed		Developed					
ENGG3001 Fundamentals of Humanitarian Engineering			Developed					Developed	Developed
ENGG4102 Humanitarian Engineering Project			Proficient	Developed			Proficient	Proficient	Developed
MECH3610 Advanced Thermofluids	Proficient	Developed							
SOLA2060 Introduction to Electronic Devices	Developed	Developed		Developed	Developed				
SOLA3010 Low Energy Buildings and Photovoltaics	Developed	Developed	Developed	Proficient	Proficient			Developed	Developed
SOLA5056 Sustainable Energy for Developing Countries			Proficient	Developed	Introduced	Developed	Proficient	Proficient	Developed
Discipline (Depth) Electives									
ENGG4111 Energy Storage	Developed	Developed	Proficient		Developed	Developed			
MECH9720 Solar Thermal Energy Design		Developed	Developed	Developed	Developed				Proficient
SOLA5051 Life Cycle Assessment	Proficient	Developed	Proficient	Proficient	Developed		Developed	Developed	Proficient
SOLA5052 Bioenergy and Renewable Fuels	Developed	Developed	Developed	Developed	Developed				
SOLA9103 Renewable Energy System Modelling and Analysis	Proficient	Proficient	Proficient	Proficient	Proficient	Developed	Developed	Developed	Proficient
SOLA9104 Hybrid Renewable Energy Systems		Proficient	Developed	Proficient	Proficient	Proficient	Developed		Developed

7. Assessments

At SPREE, we use a mix of assessment type to balance assurance of learning and authenticity. Our assessment design is guided by three simple principles: we want students to show what they know (technical competence and understandings), show what they can do (apply, design, analyse, investigate, communicate... all in a context close to a professional context) and improve as they go (through formative assessment, staged tasks and timely feedback). This philosophy leads us to combine invigilated assessments where appropriate (to provide robust evidence of individual attainment) with practical and project-based assessments (to develop higher-order capabilities such as problem framing, iteration, experimentation, modelling, design and teamwork). Assessment choices are made to align with the course learning outcomes and the development of the student within the program. This ensure that the student has a coherent progression through the program with competencies being scaffolded.

The School has reviewed the alignment of assessment types across the specialisation, with fewer than 30% of courses retaining a final exam, and many replacing it with problem- or project-based assessment. In courses involving design and report writing, assessment is often staged so students receive feedback as the course progresses. Presentations, posters and oral exams are also used to build communication skills and support academic integrity. Overall, this assessment design prioritises authenticity while ensuring students develop AI literacy and self-regulation as part of professional practice (i.e., preparing them for the world “out there”).

In team-based assessments, individual team members are peer-assessed. We are also increasingly implementing viva-style oral examination in team-based assessment as well as in project-based assessments. Viva-style components also support assessment integrity in an environment where generative AI can otherwise obscure individual contribution and disciplinary reasoning.

SPREE’s approach to use of generative AI and assessment integrity

The School has implemented many processes to ensure that academic integrity is maintained:

- All exam papers are reviewed by another academic. New questions are written for each exam.
- Online exams use as much randomisation as practically possible. This includes use of question banks and use of STACK questions which allows randomised questions, were developed for numerical questions. In most courses open ended questions are used in exams to assess students’ comprehension. Exams also start at a set time so that student need to focus on their exams which reduces collusion.
- Viva-style oral exam are used in several courses and are often linked to preceding take-home tasks, helping to ensure take-home tasks are used primarily for learning rather than being treated as end-point assessment or completed using generative AI.
- Assignments are submitted in electronic format and are submitted through TurnItIn, which detects plagiarism, collusion and use of AI.
- Thesis literature review and final thesis have two markers to ensure consistency. If there is a mark difference of greater than 10, a third marker is used.
- Several courses (stage-gate courses in-terms of competency development at the program level) have hurdles where student much achieve certain performance level to pass the course.

In addition, the School is shifting from “policing” AI to redesigning tasks so that AI use is explicit and supports learning rather than completion. In particular, we (i) design tasks so the assessable product is clearly tied to disciplinary process (drafting, iteration, justification, and reflection), (ii) use vivas/oral checks and staged submissions to validate authorship, reasoning, and individual contribution, and (iii) make AI use transparent and pedagogically purposeful, for example, through in-house course-context chatbots that promote “AI for learning”, such as the Scout bot used in SOLA2540.

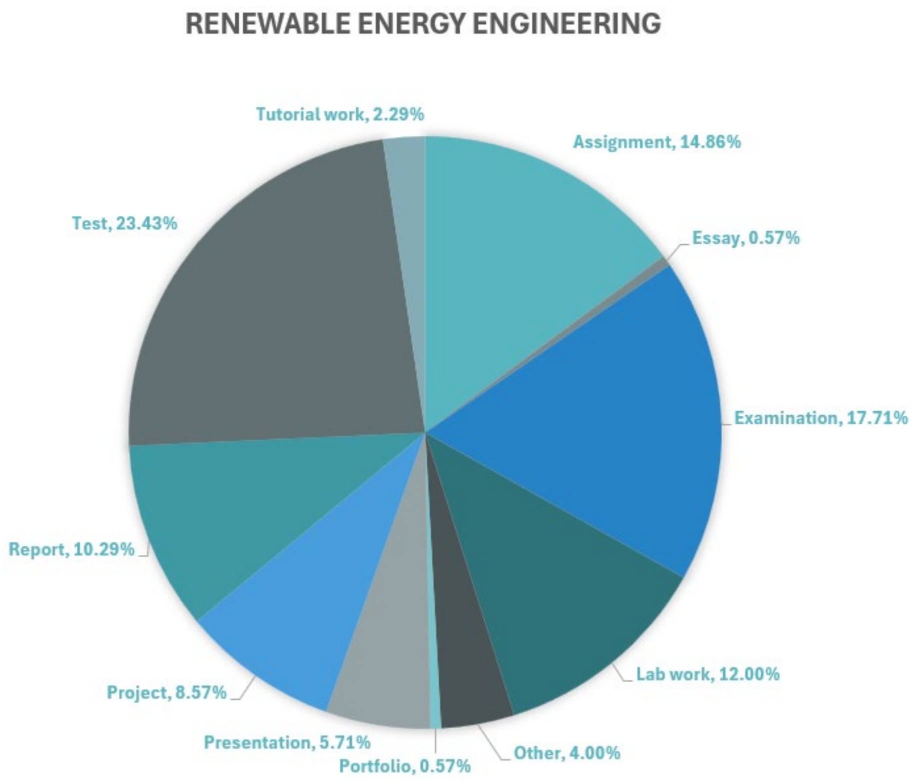

Figure 1. Percentage of assessment types used within the specialisation.

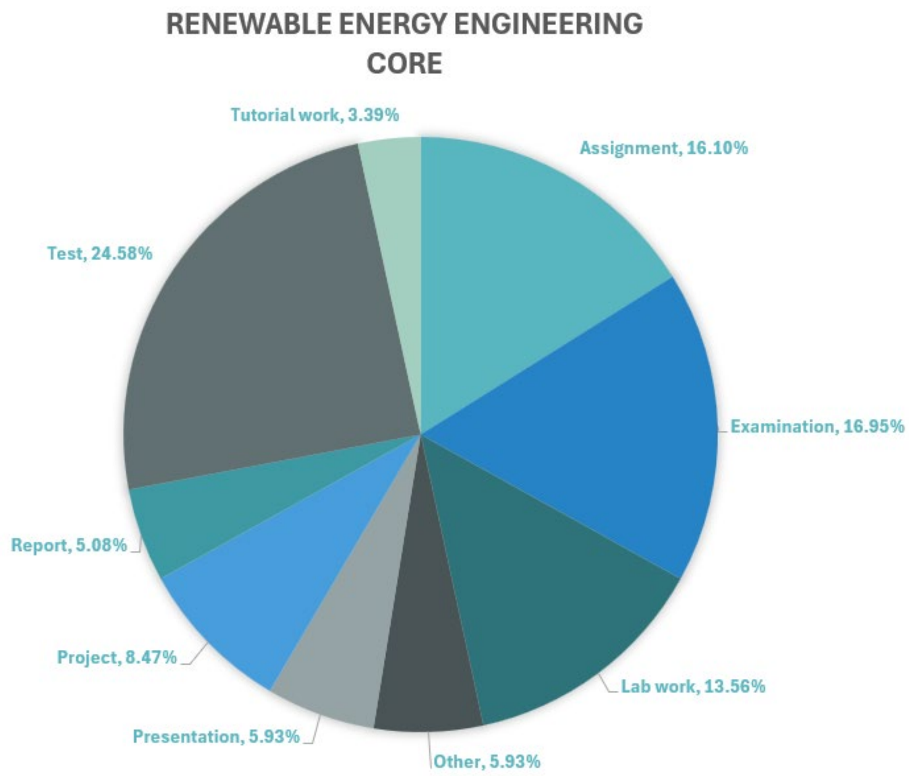

Figure 2. Percentage of assessment types used within the core of the specialisation.

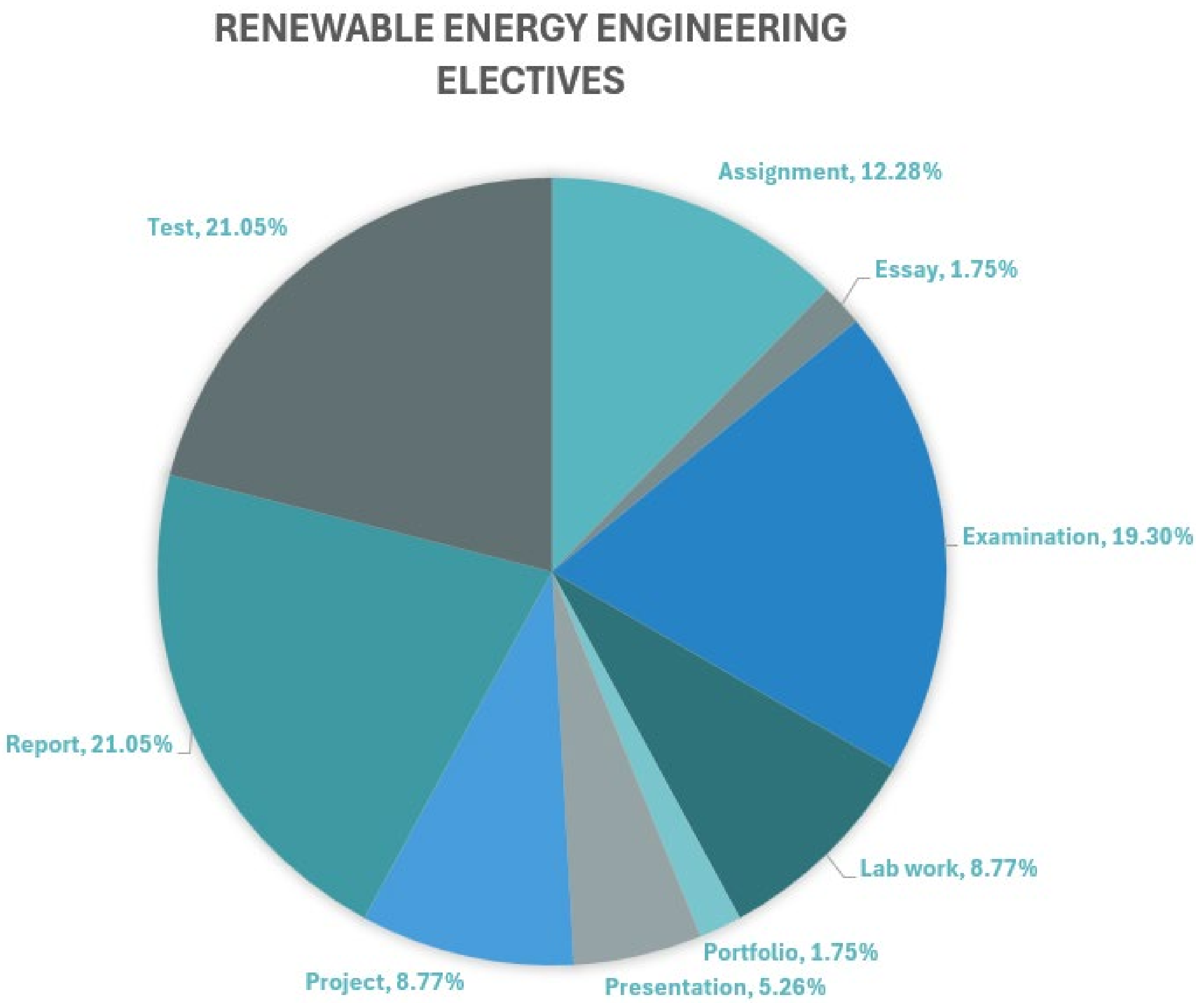

Figure 3. Percentage of assessment types used within the electives of the specialisation.

8. Specialisation Progression Plan

Students can track their progression through the "myPlan" checker tool.
[myPlan | Current Students - UNSW Sydney]

A progression checklist and/or study plan is also available for students for the single degree and the double degree offerings.

[Progression checksheets & study plans | Engineering - UNSW Sydney]