**SOLA 5051**

**Life Cycle AssessmentContents**

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# Staff contact details

## Contact details and consultation times for course convener

Name: Dr Jose Bilbao

Office location: Room 317, TETB

Tel: (02) 9385 4284

Email: j.bilbao@unsw.edu.au

**Consultation time:** Tuesdays from 16:00 to 18:00 via Microsoft Teams Video Chat (“open door”, no appointment needed). For all enquiries about the course please contact the course convener. For all other questions or enquiries, you are encouraged to ask the lecturer during lectures and post your question on MS Teams.

**Keeping Informed**: All course material and announcements will be posted in MS Teams. Please note that it is your responsibility to check the site regularly for any updates and that you should take careful note of all announcements.

## Contact details for tutors

Tutor: Dr Marina Lunardi, m.monteirolunardi@unsw.edu.au

# Important links

* [Microsoft Teams](https://student.unsw.edu.au/teams-students)
* [Moodle](https://moodle.telt.unsw.edu.au/login/index.php)
* [Health and Safety](https://www.engineering.unsw.edu.au/energy-engineering/student-resources/workplace-health-and-safety)
* [Student Resources](https://www.engineering.unsw.edu.au/energy-engineering/student-resources)
* [UNSW Timetable](http://timetable.unsw.edu.au/current/subjectSearch.html)
* [UNSW Handbook](https://www.handbook.unsw.edu.au/)
* [Engineering Student Support Services Centre](https://www.engineering.unsw.edu.au/study-with-us/current-students/student-resources/engineering-student-support-services)
* [UNSW Photovoltaic and Renewable Energy Engineering](https://www.engineering.unsw.edu.au/energy-engineering)

# Course details

## Credit points

This is a 6 unit-of-credit (UoC) course with a total workload equivalent to 150 hours for the term, including all contact hours, learning activities and assessments. Hence, you should aim to spend around 15 h/w on this course. This course involves around four hours per week (h/w) of scheduled online or face to face contact. The additional time should be spent in making sure that you understand the lecture material, completing the set assignments, further reading, and revising for any examinations.

## Contact hours

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Day** | **Weeks** | **Time** | **Delivery Mode** |
| **Lectures**  | Wed. | Weeks 1-5 and 7-10 | 14:00 - 16:00 | Online |
| **Tutorials** | Wed. | Weeks 1-5 and 7-10 | 16:00 - 18:00  | Online |
| Thu. | Weeks 1-5 and 7-10 | 09:00 - 11:00 | Face to face, TETB G16 |

## Pre-requisites and Assumed Knowledge

To engage with the aspects of the course related to photovoltaic and renewable energy systems, students should have a basic understanding of the components, design and operation of such systems.

## Summary and Aims of the course

Life Cycle Assessment, or LCA, is a “cradle-to-cradle” approach for assessing products, processes or systems. This course will deal with the application of LCA on energy systems and its relevance. The broad aim of this course is to provide students with knowledge on the fundamentals of LCA, and an understanding of its relevance to the disciplines of PV and RE Engineering. More specifically the course aims to:

* Develop within students a solid understanding of the methodology and applications of LCA;
* Expose students to a range of examples and LCA case studies to demonstrate the process;
* Teach students to use available tools and techniques to conduct simple LCAs.

## Student learning outcomes

This course is designed to address the learning outcomes below and the corresponding Engineers Australia Stage 1 Competency Standards for Professional Engineers. The full list of Stage 1 Competency Standards may be found in Appendix A. After successfully completing this course, you should be able to:

|  |  |  |
| --- | --- | --- |
| **Learning Domain** | **Learning Outcomes** | **EA Stage 1 competencies** |
| Understanding | 1. Interpret and make use of completed LCAs
 | PE1.3 |
| Applying  | 1. Determine whether it is worthwhile to commission an LCA for different scenarios
 | PE1.3 |
| Analysing | 1. Recognise the breadth of LCA applications and the role of LCA in the overall process of environmental management.
 | PE1.6 |
| Evaluating | 1. Assess renewable energy technologies and systems using LCA theory.
 | PE1.6 |
| Creating | 1. Undertake simple LCAs of renewable energy systems, compliant with international norms.
 | PE2.3, PE3.2 |

# Teaching strategies

The teaching strategy for this course comprises a series of lectures and tutorial activities. The lecture series will present theory related to the methodology and applications of LCA, including various case studies throughout the course. Within each lecture, it is intended that a range of teaching formats will be employed. These will include regular non-assessable quizzes on previous lecture content, class brainstorming sessions, and small-group and large group discussions. Students will be encouraged to actively engage with the topics via these lecture activities. It is expected that three to four topics will be covered by guest lecturers.

A set of tutorial questions or activities will be made available every week and students will be expected to work through the assigned activities in the tutorial session as directed by the tutor, sometimes working in small groups. In some cases, preparation such as reading prior to the tutorial class will be required. Students can also use their allocated tutorial session to ask tutors any questions they may have about the material taught in lectures.

Students are strongly encouraged to use the discussion group to assist their learning. Tutors will monitor the discussions and help answer posted questions.

The course contains a component of self-learning through the experience gained via using the life cycle assessment software OpenLCA. The software will be used in tutorial sessions. Undergraduate and postgraduate students will attend the same lectures and tutorial sessions.

# Course schedule

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Week** | **Lectures** | **Tutorial** | **Delivering mode** | **Suggested Readings** |
| 1 | LCA M1 – Intro, Goal & Scope | Goal, scope & FU | Online & face to face | Book Ch 6 to Ch 8 |
| 2 | LCA M2 – Inventory Analysis | Life cycle inventory | Online & face to face | Book Ch 9 |
| 3 | LCA M3 – Impact Assessment | LCA for a cup of tea | Online & face to face | Book Ch 10 |
| 4 | LCA M3 – Uncertainty Analysis | OpenLCA Bottles | Online & face to face | Book Ch 11 |
| 5 | LCA M4 – Interpretation  | OpenLCA PV | Online & face to face | Book Ch 12 |
| 6 | Flexibility week |  |  |
| 7 | LCA A1 – RE Systems | LCA of energy systems, normalisation and weighting | Online & face to face | Book Ch 26 |
| 8 | LCA A2 – Buildings | EPBT and energy yield  | Online & face to face | Book Ch 28 |
| 9 | LCA A3 – Transport | LCA of transport  | Online & face to face | Book Ch 27 |
| 10 | LCA A4 – LCSA | Project meetings | Online & face to face | Book Ch 14 |

# Assessment

## Assessment overview

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Assessment** | **Group Project?** (group size) | **Length** | **Weight** | **Learning outcomes assessed** | **Assessment criteria** | **Due date and submission requirements** | **Deadline for absolute fail** | **Marks returned** |
| Online quizzes (x7) and video interview (x1) | No | Quizzes: 10 questions Interviews: 10 minutes | 20% | 1, 2, and 3 | Lecture material from weeks 2 to 9. | Quizzes: Tuesdays 10 pm of the following weekInterview: week 10  | N/A | Quizzes: One hour after the quiz due date |
| Deliverable 1 – Article peer review | No | 4-page report including drawings | 20% | 1 and 2 | Laboratory activity in week 3 | Saturday week 3 | One week after due date | Two weeks after submission |
| Deliverable 2.1 – Method and Planning Video (M1-M2)  | Yes (4) | 5 min video | 10% | 2 and 3 | Lecture material and studio activities from weeks 1 to 7 | Monday week 7 | One week after due date | Two weeks after submission |
| Deliverable 2.2 – LCA report (M1-M3) | Yes (4) | 10-page report plus attachments | 20% | 1 to 5 | All course content from weeks 1-10 inclusive. | Friday Week 10 | One week after due date | Upon release of final results |
| Deliverable 2.3 – Interpretation report (M4) | No | 4-page report plus attachments | 30% | 1, 4 and 5 | All course content from weeks 1-10 inclusive. | Friday Week 11 (Exam Period) | One week after due date | Upon release of final results |

## Assignments

*Online quizzes (Total 20%)*

You will have to complete seven online quizzes, from weeks 2 to 5 and weeks 7 to 9. The quizzes will test your learning from the course content. The quizzes are strictly individual and can be done online at any time after the lecture. The online quiz of a respective week will be open until Tuesday 10 pm of the following week, **after this time the quiz cannot be attempted**.

I addition one video interview will be carried out in week 10. This interview is strictly individual between the student and the course coordinator or tutor. The interviews will check that you have learned the content of the course as demonstrated by the results in the online quizzes. **The mark obtained in the interview will be used to adjust your final quiz mark.**

*Deliverable 1 – Article Peer Review (Individual - 20%)*

This assignment is to be completed individually and will involve peer reviewing and analysing a published LCA article on an energy system. This task includes answering questions related to the methodology followed by the article under review.

*Deliverable 2 – LCA Project (Team and individual - 60%)*

This project involves completing an LCA in a specific renewable energy system, according to ISO standards. The project will run through the whole term, and the first deliverable is a video presentation of the LCA methodology proposed by the team. The final report is divided in two sections: team and individual. The team section must contain the main body of the LCA study, excluding for the interpretation section, which will be individual and submitted separately.

### Presentation

All submissions are expected to be neat and clearly set out. Your results are the pinnacle of all your hard work and should be treated with due respect. Presenting results clearly gives the marker the best chance of understanding your work and the method you have used; even if the numerical results are incorrect.

### Submission

Work submitted late without an approved extension by the course coordinator or delegated authority is subject to a late penalty of 30 percent (30%) of the maximum mark possible for the assessment item submitted after the due date, plus 10 percent (10%) of the maximum mark possible per 24 hour period after the due date (including weekends and public holidays). These penalties are applied to the mark received for the assessed item.

The late penalty is applied per calendar day (including weekends and public holidays) that the assessment is overdue. There is no pro-rata of the late penalty for submissions made part way through a day. Work submitted after the ‘deadline for absolute fail’ is not accepted and a mark of zero will be awarded for that assessed item.

For some assessment items, a late penalty may not be appropriate. These are clearly indicated in the course outline, and such assessments receive a mark of zero if not completed by the specified date. Examples include:

1. Weekly online tests or laboratory work worth a small proportion of the subject mark, or
2. Online quizzes where answers are released to students on completion, or
3. Professional assessment tasks, where the intention is to create an authentic assessment that has an absolute submission date, or
4. Pass/Fail assessment tasks.

### Marking

Marking guidelines (i.e. rubrics) for assignment submissions will be provided at the same time as assignment details to assist with meeting assessable requirements. Submissions will be marked according to the marking guidelines provided.

## Examinations

You must be available for all quizzes and the video interview. There will be no final examination for this course.

## Special consideration and supplementary assessment

If you have experienced an illness or misadventure beyond your control that will interfere with your assessment performance, you are eligible to apply for Special Consideration prior to submitting an assessment or sitting an exam.

**Please note** that UNSW now has a [Fit to Sit / Submit rule](https://student.unsw.edu.au/sites/all/files/uploads/group271/fit-to-sit-guide.pdf), which means that if you attempt an exam or submit a piece of assessment, you are declaring yourself fit enough to do so and cannot later apply for Special Consideration.

For details of applying for Special Consideration and conditions for the award of supplementary assessment, please visit UNSW’s [Special Consideration page](https://student.unsw.edu.au/special-consideration).

## Workload

It is recommended you design a study plan for the term, based on the learning activities and assignments of each of your courses, detailing the number of hours you will spend on each learning task. A simple study guide for SOLA 5051 is shown in the table below (e.g. the work related to the Article Peer Review should take you around 12 hours, while the LCA Project should take a total of around 42 hours per in team member, including all individual tasks).

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Period** | **Self-****Study** | **Online** **Activities** | **Online Quizzes** | **D1** | **D2.1** | **D2.2** | **D2.3** | **Total****Hours** |
| Week 01 | 4 | 4 |   | 4 |   |   |   | 12 |
| Week 02 | 4 | 4 | 2 | 4 |   |   |   | 14 |
| Week 03 | 4 | 4 | 2 | 4 |   |   |   | 14 |
| Week 04 | 4 | 4 | 2 |   | 4 |   |   | 14 |
| Week 05 | 4 | 4 | 2 |   | 4 |   |   | 14 |
| Week 06 | 8 |   |   |   | 2 | 4 |   | 14 |
| Week 07 | 4 | 4 | 2 |   |   | 4 |   | 14 |
| Week 08 | 4 | 4 | 2 |   |   | 4 |   | 14 |
| Week 09 | 4 | 4 | 2 |   |   | 4 | 2 | 16 |
| Week 10 | 4 | 4 | 2 |   |   | 4 | 2 | 16 |
| Week 11 |   |   |   |   |   |   | 8 | 8 |
| **Total Hours** | **44** | **36** | **16** | **12** | **10** | **20** | **12** | **150** |

# Expected resources for students

*Course Textbook*

The course will use *Life Cycle Assessment: Theory and Practice by Michael Hauschild, Ralph Rosenbaum and Stig Irving Olsen (Springer International Publishing: Imprint: Springer, 2018)*, as the course textbook. The eBook version can be access via the UNSW library in the following link <https://primoa.library.unsw.edu.au/permalink/f/1gq3lal/UNSW_ALMA51226734490001731>

*Software Tools*

Students must use the software OpenLCA to complete the project. This software can be downloaded in your personal computer, but it is also available on all computers in computer labs LG34 and LG35 in the TETB building.

*Standards (via UNSW Library)*

ISO 14040 Environmental management — Life cycle assessment — Principles and framework.

# Course evaluation and development

Feedback on the course is gathered periodically using various means, including the UNSW myExperience process, informal discussion in the final class for the course, and the School’s Student/Staff meetings. Your feedback is taken seriously, and continual improvements are made to the course based, in part, on such feedback.

In this course, recent improvements resulting from student feedback include changes in the assessment tasks and the online content.

# Academic honesty and plagiarism

UNSW has an ongoing commitment to fostering a culture of learning informed by academic integrity. All UNSW students have a responsibility to adhere to this principle of academic integrity. Plagiarism undermines academic integrity and is not tolerated at UNSW. *Plagiarism at UNSW is defined as using the words or ideas of others and passing them off as your own.*

Plagiarism is a type of intellectual theft. It can take many forms, from deliberate cheating to accidentally copying from a source without acknowledgement. UNSW has produced a website with a wealth of resources to support students to understand and avoid plagiarism, visit: [student.unsw.edu.au/plagiarism](https://student.unsw.edu.au/plagiarism). The Learning Centre assists students with understanding academic integrity and how not to plagiarise. They also hold workshops and can help students one-on-one.

You are also reminded that careful time management is an important part of study and one of the identified causes of plagiarism is poor time management. Students should allow sufficient time for research, drafting and the proper referencing of sources in preparing all assessment tasks.

If plagiarism is found in your work when you are in first year, your lecturer will offer you assistance to improve your academic skills. They may ask you to look at some online resources, attend the Learning Centre, or sometimes resubmit your work with the problem fixed. However more serious instances in first year, such as stealing another student’s work or paying someone to do your work, may be investigated under the Student Misconduct Procedures.

Repeated plagiarism (even in first year), plagiarism after first year, or serious instances, may also be investigated under the Student Misconduct Procedures. The penalties under the procedures can include a reduction in marks, failing a course or for the most serious matters (like plagiarism in an honours thesis) even suspension from the university. The Student Misconduct Procedures are available here:

[www.gs.unsw.edu.au/policy/documents/studentmisconductprocedures.pdf](http://www.gs.unsw.edu.au/policy/documents/studentmisconductprocedures.pdf)

# Administrative matters and links

All students are expected to read and be familiar with UNSW guidelines and polices. In particular, students should be familiar with the following:

* [Attendance](https://student.unsw.edu.au/attendance)
* [UNSW Email Address](https://www.myit.unsw.edu.au/services/students/email-students-and-staff)
* [Special Consideration](https://student.unsw.edu.au/special-consideration)
* [Exams](https://student.unsw.edu.au/exams)
* [Academic Honesty and Plagiarism](https://student.unsw.edu.au/plagiarism)
* [Equitable Learning Services](https://student.unsw.edu.au/els)

# Appendix A: Engineers Australia (EA) Competencies

*Stage 1 Competencies for Professional Engineers*

|  |  |
| --- | --- |
|  | **Program Intended Learning Outcomes** |
| **PE1: Knowledge****and Skill Base** | PE1.1 Comprehensive, theory-based understanding of underpinning fundamentals |
| PE1.2 Conceptual understanding of underpinning maths, analysis, statistics, computing |
| PE1.3 In-depth understanding of specialist bodies of knowledge |
| PE1.4 Discernment of knowledge development and research directions |
| PE1.5 Knowledge of engineering design practice |
| PE1.6 Understanding of scope, principles, norms, accountabilities of sustainable engineering practice |
| **PE2: Engineering****Application Ability** | PE2.1 Application of established engineering methods to complex problem solving |
| PE2.2 Fluent application of engineering techniques, tools and resources |
| PE2.3 Application of systematic engineering synthesis and design processes |
| PE2.4 Application of systematic approaches to the conduct and management of engineering projects |
| **PE3: Professional****and Personal Attributes** | PE3.1 Ethical conduct and professional accountability |
| PE3.2 Effective oral and written communication (professional and lay domains) |
| PE3.3 Creative, innovative and pro-active demeanour |
| PE3.4 Professional use and management of information |
| PE3.5 Orderly management of self, and professional conduct |
| PE3.6 Effective team membership and team leadership |