*Photovoltaic and Renewable Energy Engineering*

# *Course Outline*
## *Term 3  2020*

# SOLA5056

# Sustainable Energy for Developing Countries

# Contents

# 1. Staff contact details

**Contact details and consultation times for course convenor**
Dr Anna Bruce, TETB 318, a.bruce@unsw.edu.au

**Contact details and consultation times for additional lecturers/demonstrators/lab staff**
Manu Rawali, m.rawali@student.unsw.edu.au
Darcy Small, d.small@unsw.edu.au

**Consultations:** For all course administration enquiries, contact the course convener. For content-related questions, you are encouraged to ask staff during class and/or initiate discussion related to your question on the project Facebook page.

**Staying Informed:** Moodle and the project Facebook Page will be used to disseminate course material and announcements. Students are expected to monitor their UNSW email account and take careful note of all announcements.

# 2. Important links
- Moodle
- Health and Safety
- Student Resources
- UNSW Timetable
- UNSW Handbook
- Engineering Student Support Services Centre
- UNSW Photovoltaic and Renewable Energy Engineering

# 3. Course details

**Credit points**

This is a 6 unit-of-credit (UoC) course and involves 4 hours per week (h/w) of face-to-face contact.

The normal workload expectations of a student are approximately 25 hours per term for each UOC, including class contact hours, other learning activities, preparation and time spent on all assessable work.

You should aim to spend about 13-15 h/w on this course. The additional time should be spent in making sure that you understand the lecture material, preparing for class, research, design or analysis for your major assignment, including working on your research journal, and further reading.

**Contact hours**

|  | Day | Time | Location |
|---|---|---|---|
| **Lectures** | Monday | 2pm - 3pm | Online (real time) |
| (Web stream) | Any | Any | Moodle |
|  |  |  |  |
| **Mixed-Mode Class** | Monday | 3pm – 6pm | TETB G16 |
|  | Monday | 3pm – 6pm | Online (real time) |

**Summary and Aims of the course**

Energy services are critical for health and livelihoods, while enabling productive activities and economic prosperity. However, more than a billion people around the world in rural areas and urban slums do not have access to these services and infrastructure. Many projects and programs in rural areas of developing countries, fragile states, communities in disaster recovery and other disadvantaged communities aim to improve access to modern energy services. A range of renewable energy technologies, from small and appliance-integrated to utility-scale, are available to deliver these services cost-effectively. However, delivery of these interventions presents a range of technical, economic, social and institutional challenges. The aims of this course are to:

- Introduce students to many of the technical and non-technical issues related to the delivery of accessible, affordable and appropriate energy services and infrastructure in developing countries and other disadvantaged communities.

- Develop and apply skills and approaches for assessing, designing and specifying sustainable rural energy projects. The course guides students in collection of data, technical characteristics of system components, building appropriate technical and economic models, and project planning.

- There is an emphasis on understanding context, appropriate design and technology selection, implementation models and capacity building for sustainable projects.

**Student learning outcomes**

After successful completion of this course, you should be able to:

1. Interpret a brief, present proposals for feedback and assessment in a range of written, oral and visual formats.

2. Understand the technical characteristics of, and design, size and specify renewable energy systems commonly deployed in developing country contexts.

3. Apply a range of multi-disciplinary methodologies, frameworks and best practices to scope, design and implement sustainable solutions to complex real-world humanitarian engineering problems.

4. Assess the performance and sustainability of these energy systems by modelling the technical and economic outcomes.

5. Creatively integrate multi-disciplinary considerations into the design process and work in interdisciplinary teams.

This course is designed to address the learning outcomes below and the corresponding Engineers Australia Stage 1 Competency Standards for Professional Engineers as shown. 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 Outcome | | EA Stage 1 Competencies |
|---|---|---|
| 1. | Interpret a brief, present proposals for feedback and assessment in a range of written, oral and visual formats. | PE3.2, PE3.4 |
| 2. | Understand the technical characteristics of, and design, size and specify renewable energy systems commonly deployed in developing country contexts. | PE1.5, PE2.1 |
| 3. | Apply a range of multi-disciplinary methodologies, frameworks and best practices to scope, design and implement sustainable solutions to complex real-world humanitarian engineering problems. | PE1.6, PE2.3 |
| 4. | Assess the performance and sustainability of these energy systems by modelling the technical and economic outcomes. | PE2.1, PE2.4 |
| 5. | Creatively integrate multi-disciplinary considerations into the design process and work in interdisciplinary teams. | PE3.1, PE3.3, PE3.6 |

## 4. Teaching strategies

Engagement with the course material will be centred around the major project, which, this year, will be set in the Fijian islands of Yanuca and Viwa. The project will be carried out in teams of around 4 students, and will focus on household, community, clean water and livelihoods energy needs and the development of an appropriate implementation structure for the selected technologies and the local context.

Mixed-mode classes will support the major project, including:
- Presentations from the lecturer and other experts within class to describe the status and experiences with relevant projects and technologies in developing countries; introduce development concepts and analysis frameworks; and to review best practices in design and implementation of projects.

- Discussion of concepts raised in readings, presentations and other materials during class, to assist the application of material from the lectures to the project.

- Guided interpretation of the project brief, needs assessment and human-centred design.

- Support for technical and implementation aspects of the project.

- Note that the readings and other preparation and project work must be done outside of class. This will involve meeting regularly with your group.

*Attendance*

You must attend all classes. If, for any reason you cannot attend class, you must contact the course convenor and notify your group in advance.

## 5. *Course schedule*

| Wk | Date | | Journal |
|---|---|---|---|
| 1 | 14-Sep | 2:00-3:00: Course and Project Introduction<br><br>3.00-4.00: Lecture - Energy, Poverty & Sustainable livelihoods<br><br>4:00-5.30: Project Context and form teams | *Development studies concepts* |
| 2 | 21-Sep | 2:00-3:00: Lecture - Energy Access Options<br><br>3:00-5:30: Human centred design and needs assessment workshop | *Energy Access Precedents* |
| 3 | 28-Sep | 2.00 - 3.00: Lectures - Bioenergy and Clean Water<br><br>3.00-5.30: Present and discuss preliminary research, project ideation | |
| 4 | 5-Oct | *Public Holiday* | |
| 5 | 12-Oct | **Present Preliminary Proposal** | *Reflection on another group's proposal* |
| 6 | 17-Oct | Project consultations in groups (Flexibility Week) | *Load and Resource profiles* |
| 7 | 26-Oct | 2.00-3.00: Lecture - Rural energy project design & planning<br><br>3:00-5.30:  Project consultations in groups | *Local equipment selection and costing* |
| 8 | 2-Nov | 3:00-4:00: Planning frameworks and economic analysis<br><br>3:00-5.30:  Project consultations in groups | *Capacity Building or M&E case study* |
| 9 | 9-Nov | 2.00-3:00: Case study<br><br>3:00-5.30:  Project consultations in groups | |
| 10 | 16-Nov | **Final Submission Due** | |
| 11 | 23-Nov | **Panel Follow Up Questions** | |

# 6. Assessment

Assessment focusses on the major project, which takes the form of a request for proposals, as used in the development industry. In addition to the final submission, intermediate deliverables include a preliminary proposal and a research journal used to scaffold progress.

**Assessment overview**

| Assessment | Group Project? | Length | Weight | Learning outcomes assessed | Assessment criteria | Due date and submission requirements | Marks returned |
|---|---|---|---|---|---|---|---|
| Research Journal | No | 6 entries | 10% | 2, 4 and 5 | • Research<br>• Content knowledge, analysis, critique<br>• Reflection<br>• Communication<br>• Engagement and collaboration | Weeks 1-10 | Two weeks after submission |
| Preliminary Proposal | Yes (5) | Online presentation and summary | 20% | 1, 3 and 5 | • Meets the objectives<br>• Progress towards scope and approach<br>• Appropriate to the context<br>• Use of references including development studies concepts and project precedents<br>• Innovative and sustainable<br>• Clear, concise, engaging presentation | Week 5 | Two weeks after submission |
| Project Final Submission (Individual) | No | Final Report (10,000 words) with follow up questions | 50% | 1-5 | • Meets the objectives<br>• Appropriate to the context<br>• Use of references including development studies concepts and project precedents<br>• Appropriate data / modelling / calculations design choices and demonstrate sustainability<br>• Proposal credible, fundable and innovative<br>• Clear, concise, engaging presentation | Week 10, follow-up questions in Week 11 | Two weeks after submission |
| Project Final Submission (Group) | Yes (5) | | 20% | | | | |

**Assignments**

Details of assessment criteria and expectations for the project will be provided separately on Moodle e.g. in the project brief. Students will work in teams on the project, with individual assessment for the individual contribution, and a group mark component. The preliminary project proposal is an intermediate assessment for the project and will be assessed as a group, with peer assessment used to allocate marks on the basis of contribution.

An assessable research journal will be created by each student to record and collate work each week throughout the semester, which will encourage and provide structure for consistent progress and provide a way to share and collaborate with peers working on the same part of the project.

*Presentation*

All submissions are expected to be well structured and clearly set out. Writing and presenting clearly and concisely increases understanding of your work, and the coherence and hence value that can be obtained from your work.

*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%) mark reduction on the first day and an additional 10% per day thereafter, consistent with other SPREE courses.

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 assessment 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:

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

*Marking*

Marking guidelines 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.

**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, which means that if you sit 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 see the information on UNSW's Special Consideration page.

## 7. Expected resources for students

There is no textbook for this course. However, announcements, readings and other resources related to lectures and the major project will be made available via Moodle and the Project Facebook page.

*Online Resources*
Moodle and Facebook will be used to disseminate teaching materials, share resources, host discussion forums and connect students with any project stakeholders outside of UNSW. Assessment

UNSW Library website: https://www.library.unsw.edu.au/
Moodle: https://moodle.telt.unsw.edu.au/login/index.php

## 8. 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 using the research journal to break down the major assignment into smaller parts, and providing more detailed information about the format of the presentations.

# 9. 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. 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

# 10.      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
- UNSW Email Address
- Special Consideration
- Exams
- Approved Calculators
- Academic Honesty and Plagiarism
- Equitable Learning Services

## 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 |