Subject Description Form

Subject Code	EE2S01
Subject Title	Low-cost Energy Infrastructures for Developing Regions
Credit Value	3
Level	2
Pre-requisite/ Co-requisite/ Exclusion	Nil (but preference will be given to those with science background or experience of science design project activities at the secondary school level)
Objectives	The objectives of this subject are: 1. To introduce the concepts and practices of service-learning; 2. To educate students on the concept of low-cost electricity generation systems and electric devices as an infrastructure for improving quality of life; 3. To raise students' awareness about the reality of living environments in underprivileged areas and developing regions; 4. To educate students on significant issues related to the impact of energy poverty, including its psychological and physiological impact on underprivileged communities and individuals; 5. To equip students with knowledge and skills for basic electricity usage assessments and performing basic electricity improvements; and To nurture a sense of civic responsibility and engagement in our students through application of their knowledge in improving electricity supply conditions of underprivileged areas.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Link their service-learning activities and experiences with the academic content of the subject; b. Articulate the impact of energy poverty on the quality of life of underprivileged communities in developing regions, including its psychological and physiological impacts on individuals; c. Apply the science and engineering principles they have acquired to carry out basic electricity assessments, and to design and construct low-cost electricity improvement solutions for underprivileged families in developing regions; d. Demonstrate empathy for individuals facing energy poverty and a strong sense of civic responsibility; and e. Reflect on their role and responsibilities both as professional and as responsible citizens.
Subject Synopsis/ Indicative Syllabus	The lectures and workshops are designed to broaden the knowledge of students in regard to service-learning, and electricity supply and electric devices, especially on the problem of energy poverty faced by the service recipients. The syllabus covers: **Concept and Practice of Service-Learning:** • Principles, concepts and myths of service-learning • Benefits of service-learning to students, the university and the community • Ethical issues in service-learning • Social responsibilities of global citizens as intellectuals and professionals • Proper attitudes and behaviours in service delivery • Developing a service project proposal/plan • Effective team work and problem solving skills in service-learning projects • Reflection as a tool for learning

	Discipline-specific Concepts, Issues and Skills • Basic energy and electricity needs and energy poverty: Historical perspective of electricity supply and its impact on living environment. Linkages with poverty. Factors linking electricity, poverty, human psychological and physiological impacts and social problems. • Energy assessment methods: Survey method. Data collection including objective and subjective response. Basic data analysis and presentation. Electricity supply assessment techniques and instrumentations. • Principles of basic electricity: Power, current and voltage. Conductance and resistance. Circuits in series and parallel. Direct and alternating current. • Principles and cost-effective methods for improving electricity supply including: designing and constructing low-cost electricity generation networks, backup supply, redundant supply systems, solar, wind and human power systems, energy saving electric lightings and DC home appliances. Robustness and safety. **Project-specific Concepts, Issues and Skills** • Specific historical, cultural and political/economic background for the off-shore service sites. • Specific technical topics and skills on building electrical systems. Use of hand and power tools, working at heights, handling of electrical components and devices. • Health, safety and other issues related to the execution of the service project. • Moral and ethical concerns specific to the project and the community, including cultural sensitivity and handling of personal data
Teaching/ Learning Methodology	**1. e-Learning Module** The e-learning module, which is developed and delivered by the Office of Service-Learning at PolyU, consists of reading, exercises and assessments that are designed to introduce students to the basic concepts and practices of service-learning. Students are required to successfully complete the module within the first four weeks of the semester in which they are taking the subject. **2. Lectures, Seminars, Tutorials and/or Workshops** This subject aims to enable students to realise their role and responsibilities being professionals and global citizens through engaging in service-learning projects that address electricity supply issues in developing regions. The lectures focus on providing them with a basic understanding of service-learning, basic electrical engineering concepts such as batteries, resistors, circuits in series and in parallel, calculation of power and energy, basic electricity supply quality and impacts of energy poverty on service recipients' quality of life. Discipline-specific workshops will be used to give students hands-on learning and practice in using instrumentations, conducting surveys, performing basic data analysis techniques and to equip them with necessary skills for designing and constructing basic low-cost energy infrastructures to improve electricity supply. Project-specific workshops will be used to educate students about specifics of the project, including the specific implementations, the cultural and economic environment of the project, and other health, safety and ethical concerns. Where appropriate or necessary, guest speakers will be invited to contribute to some of these sessions. **3. Service-Learning Projects** The service will be conducted in early to mid-June in an underprivileged area in a developing country or region outside Hong Kong. In the first few offerings, the service will take place in Cambodia. Students will be introduced to the basic challenges faced by communities in underprivileged areas in developing regions, and how the lack of reliable energy supply might affect their quality of life. They will be presented with information about the specific environments and constraints of the site. If possible, they will meet representatives from the partnering community organizations to discuss the work and

community services that they are expected to perform before they are fully engaged in their service-learning project.

The students will then be required to consolidate and analyse the information to identify the specific needs for energy infrastructures of that particular underprivileged neighbourhood, and match these needs with a holistic engineering design to address the problems. This design will involve the construction of electrical power systems (e.g. electricity generation, supply system, or other resources) to realise their objective of improving the quality of life of the service recipients.

On site, they will adapt their plans to the actual context and implement their project. They will also prepare an interview survey and conduct a basic energy assessment to ascertain the potential impact of their solution in improving the livelihoods of the service recipients.

Some projects may necessitate specific selection requirements on participating students. The teaching team together with OSL staff will make the final decisions on project allocation. Students may also be asked to shoulder a portion of their incurred costs.

Students are expected to perform 40 hours of community service-learning. They will be monitored on their teamwork performance and community involvement. In assessing this, their skills in planning, implementing activities, communication and problems solving, as well as their commitments in service-learning will be holistically assessed by the subject team.

4. Review Sessions, Reflective Journals and Report

Periodic reflective sessions will be organized during the project to enable students to share with their peers and supervisors their learning experiences, service delivery and learning strategies. The focus of these reflective sessions is to educate students and give them practice in using observations and reflection as a tool for learning. In addition, students are required to submit 3 reflective journals at specific intervals throughout the service-learning project to demonstrate their learning from the service-learning experience, in particular the relationship between electricity supply and people's quality of living, including subjective feelings and objective measurements and statistics. Students should also reflect on their own design and solutions and potential impact to the community.

Upon completion of the project, students will (1) consolidate their findings and present their design, final engineering solutions, and potential impact on the targeted community in a group presentation and (2) document their reflections on their service-learning experience in an individual reflective essay on how the engineering knowledge and skills they have learned helped them design and implement a solution that positively impact the service recipients. They are also asked to reflect on their empathy for people living in underprivileged regions, and their role and responsibilities being professionals and responsible citizens.

Assessment Methods in Alignment with Intended Learning Outcomes

Students' performance in this subject will be assessed using a letter-grading system in accordance with the University's convention from grade F to A+. The relative weighting of the different assessment components are as follows:

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed				
		a	b	c	d	e
1. e-Learning Module	Pass-fail for completion	✓				✓
2. Proposed Design Solution	25%	✓	✓	✓		
3. Performance in rendering service (individual)	40%	✓	✓	✓	✓	
4. Reflective journals and final reflective essay (individual)	25%	✓	✓	✓	✓	✓
5. Final project presentation (group)	10%	✓	✓	✓		
Total	100%					

	Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes: • The e-learning module and events include assignments and learning tasks that are designed to assess students' ability to link service-learning with the academic content of the subject (ILO a) and their understanding of their roles and responsibilities in society (ILO e). • In the service project preparatory stage, students are required to develop a Proposed Design Solution to substantiate their understanding of relevant science and engineering concepts for assessing electricity supply and their ability to apply their knowledge to design an appropriate solution to improve the electricity supply quality of the recipient families (ILO a, b, c). As project involves making choices that take resources and energy efficiency into account, students should plan ways that are environmentally responsible and appropriate for the specific context (ILO c). • Students are expected to devote 40 hours to rendering the service. They will be monitored on their teamwork performance and community involvement. Students' understanding of classroom knowledge and skills, and their application of such in real contexts will be reflected in their performance in planning and implementing the service activities, communication and problem solving (ILO a, b, c); students' empathy towards the community they are serving will be demonstrated by their attitude and commitments in service delivery (ILO d). • The reflective journals and essay require students to link their service-learning experiences with the academic focus of the subject, and reflect on their intellectual, and personal learning outcomes as a result of attending the subject (ILO a, b, c, d, e) • The final project presentation requires students to document their findings and their final solution, which will require them to demonstrate their ability to apply the classroom-learned principles to the actual service setting, (ILOs a, c); and to present the potential impact of their project on the community recipients, which will require them to articulate the impact of energy poverty and its impact on the quality of life (ILO b).	
Student Study Effort Expected	e-Learning Module	10 Hrs.
	Class contact:	
	▪ Lectures, Seminars, Tutorials and/or Workshops	26 Hrs.
	▪ Reflection and review tutorials and session	8 Hrs.
	Other student study effort:	
	▪ Readings, self-study, and planning and preparation for the service project	25 Hrs.
	▪ Direct rendering of service	40 Hrs.
	▪ Reflection and review	15 Hrs.
	Total student study effort	124 Hrs.
Reading List and References	1. Cress, C.M., Collier, P.J. & Reitenauer, V.L. (2005). Learning Through Serving: A Student Guidebook for Service-Learning Across the Disciplines. Stylus Publishing. 2. Messenger, R. (2004). Photovoltaic Systems Engineering, CRC Press, 2004 3. Stiebler, M. (2008). Wind Energy Systems for Electric Power Generation, Springer 2008	