

SEE4116: ENERGY AND CARBON AUDITING

Effective Term

Semester A 2022/23

Part I Course Overview

Course Title

Energy and Carbon Auditing

Subject Code

SEE - School of Energy and Environment

Course Number

4116

Academic Unit

School of Energy and Environment (E2)

College/School

School of Energy and Environment (E2)

Course Duration

One Semester

Credit Units

3

Level

B1, B2, B3, B4 - Bachelor's Degree

Medium of Instruction

English

Medium of Assessment

English

Prerequisites

SEE1003 Introduction to Sustainable Energy and Environmental Engineering

Precursors

SEE2204 Principles of Sustainability; AND
SEE3103 Energy Efficiency for Buildings

Equivalent Courses

Nil

Exclusive Courses

Nil

Part II Course Details

Abstract

This course aims to provide the students with the knowledge of energy and carbon auditing. The students will learn how to measure anthropogenic greenhouse gas (GHG) emissions for major human activities and identify effective GHG mitigation measures for proper GHG control and management. As energy consumption is often one of the dominating factors in carbon footprint analysis, the students will also learn energy auditing and various energy management opportunities (EMOs).

Course Intended Learning Outcomes (CILOs)

CILOs		Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Explain the sources of greenhouse gas emissions and their climate change effects. Quantify anthropogenic GHG emissions for major human activities.		x	x	
2	Describe the determinants of energy use in a range of sectors. Describe how to compare energy use with targets and 'Benchmarks' . Describe how to measure energy use and conduct an energy audit.		x	x	
3	Identify, design and analyse innovative, effective GHG mitigation measures.		x	x	
4	Conduct energy audit, identify EMOs and predict energy savings in a range of sectors.			x	x

A1: Attitude

Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability

Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

A3: Accomplishments

Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

Teaching and Learning Activities (TLAs)

TLAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lecture	Explain key theories and concepts of energy and carbon auditing	1, 2, 3, 4
2	Tutorial	Learn through case studies and example data sets, demonstration of techniques and application of energy and carbon auditing	1, 2, 3, 4

3	Analysis	Students to analyse data sets and examples to demonstrate critical thinking and interpretation of energy and carbon auditing	1, 2, 3, 4	
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Assessment Tasks / Activities (ATs)

ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Assignments	1, 2, 3, 4	40
2	Mid-term Test	1, 2, 4	20

Continuous Assessment (%)

60

Examination (%)

40

Examination Duration (Hours)

2

Additional Information for ATs

Examination duration: 2 hrs

Percentage of coursework, examination, etc.: 60% by coursework; 40% by exam

To pass a course, a student must do ALL of the following:

- 1) obtain at least 30% of the total marks allocated towards coursework (combination of assignments, pop quizzes, term paper, lab reports and/ or quiz, if applicable);
- 2) obtain at least 30% of the total marks allocated towards final examination (if applicable); and
- 3) meet the criteria listed in the section on Assessment Rubrics.

Assessment Rubrics (AR)**Assessment Task**

1. Assignments

Criterion

Ability to evaluate and solve practical problems related to energy and carbon auditing

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not even reaching marginal level

Assessment Task

2. In-class Exercises

Criterion

Ability to analyse and solve problems related to energy and carbon auditing

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not even reaching marginal level

Assessment Task

3. Mid-term Test

Criterion

Ability to apply engineering knowledge and skills to analyse, calculate, and solve problems related to energy and carbon auditing

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not even reaching marginal level

Assessment Task

4. Examination

Criterion

Ability to apply engineering knowledge and skills to analyse, calculate, and solve problems related to energy and carbon auditing

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not even reaching marginal level

Part III Other Information

Keyword Syllabus

Energy auditing; Carbon auditing; Energy benchmarking; Carbon benchmarking; Greenhouse gases; Anthropogenic GHG emissions; Carbon dioxide; Nitrous oxide; Methane; Sulfur hexafluoride; Hydrofluorocarbons (HFCs); Perfluorocarbons (PFCs); Climate change; Global warming potential; GHG accounting; GHG mitigation measures; Energy Management Opportunities (EMOs); GHG management; CO₂ equivalent, Carbon footprint; Life cycle analysis; GHG protocol; GHG inventory; Emissions reporting; Emission trading.

Reading List

Compulsory Readings

	Title
1	Tony Eggleton. A Short Introduction to Climate Change. Electronic E book available from City University library
2	Steffen D. Saldana (editor), Sources and Reduction of Greenhouse Gas Emissions, New York : Nova Science Publishers, 2010.
3	Richard Vaillencourt, Simple Solutions to Energy Calculations, Lilburn, 3rd ed.GA: Fairmont Press, 2001
4	Moncef Krarti, Energy Audit of Building Systems: An Engineering Approach, 2nd Edition, CRC Press, Taylor & Francis Group, 2010.
5	Technical Guidelines on Code of Practice for Building Energy Audit. EMSD, HKSAR Government, 2015.
6	Guidelines to Account for and Report on Greenhouse Gas Emissions and Removals for Buildings in Hong Kong, EMSD, HKSAR Government, 2010.

Additional Readings

	Title
1	Code of Practice for Energy Efficiency of Building Services Installation, EMSD, HKSAR Government, 2015.
2	Albert Thumann, Terry Niehus and William J. Younger, Handbook of Energy Audits, 9th ed., Fairmont Press, 2012.
3	Chung, W., Hui, Y. V., & Lam, Y. M. (2006). Benchmarking the energy efficiency of commercial buildings. Applied Energy, 83(1), 1-14.
4	Chung, W. (2011). Review of building energy-use performance benchmarking methodologies. Applied Energy, 88(5), 1470-1479.
5	Carbon Trust (2008), Product Carbon Footprinting: the New Business Opportunity.
6	Ian S.F. Jones, Engineering Strategies for Greenhouse Gas Mitigation, Cambridge University Press, 2011.

7	IPCC Fifth Assessment Report. http://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml
8	2013 ASHRAE Handbook – Fundamentals, ASHRAE, 2013.