

**City University of Hong Kong  
Course Syllabus**

**offered by School of Energy and Environment  
with effect from Semester A 2018/19**

---

---

**Part I Course Overview**

**Course Title:** Energy and Carbon Auditing

**Course Code:** SEE4116

**Course Duration:** One semester

**Credit Units:** 3

**Level:** B4

**Proposed Area:**  Arts and Humanities  
(for GE courses only)  Study of Societies, Social and Business Organisations  
 Science and Technology

**Medium of Instruction:** English

**Medium of Assessment:** English

**Prerequisites:** SEE1003 Introduction to Sustainable Energy and Environmental Engineering  
(Course Code and Title)

**Precursors:** SEE3103 Energy Efficiency for Buildings; AND SEE2204 Principles of Sustainability  
(Course Code and Title)

**Equivalent Courses:** Nil  
(Course Code and Title)

**Exclusive Courses:** Nil  
(Course Code and Title)

## Part II Course Details

### 1. Abstract

(A 150-word description about the course)

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).

### 2. Course Intended Learning Outcomes (CILOs)

(CILOs state what the student is expected to be able to do at the end of the course according to a given standard of performance.)

| No. | CILOs <sup>#</sup>   | Weighting<br>*<br>(if applicable) | Discovery-enriched curriculum related learning outcomes (please tick where appropriate) |    |    |
|-----|--|-----------------------------------|---|----|----|
|     |  |                                   | A1  | A2 | A3 |
| 1.  | Explain the sources of greenhouse gas emissions and their climate change effects. Quantify anthropogenic GHG emissions for major human activities.   |                                   | ✓   | ✓  |    |
| 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. |                                   | ✓   | ✓  |    |
| 3.  | Identify, design and analyse innovative, effective GHG mitigation measures. .  |                                   | ✓   | ✓  |    |
| 4.  | Conduct energy audit, identify EMOs and predict energy savings in a range of sectors.  |                                   |   | ✓  | ✓  |
|     |  | 100%                              |   |    |    |

\* If weighting is assigned to CILOs, they should add up to 100%.

# Please specify the alignment of CILOs to the Gateway Education Programme Intended Learning outcomes (PILOs) in Section A of Annex.

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 self-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.

### 3. Teaching and Learning Activities (TLAs)

(TLAs designed to facilitate students' achievement of the CILOs.)

| TLA      | Brief Description  | CILO No. |   |   |   |  | Hours/week<br>(if applicable) |
|----------|--|----------|---|---|---|--|-------------------------------|
|          |  | 1        | 2 | 3 | 4 |  |                               |
| Lecture  | Explain key theories and concepts of energy and carbon auditing  | ✓        | ✓ | ✓ | ✓ |  |                               |
| Tutorial | Learn through case studies and example data sets, demonstration of techniques and application of energy and carbon auditing  | ✓        | ✓ | ✓ | ✓ |  |                               |
| Analysis | Students to analyse data sets and examples to demonstrate critical thinking and interpretation of energy and carbon auditing | ✓        | ✓ | ✓ | ✓ |  |                               |

### 4. Assessment Tasks/Activities (ATs)

(ATs are designed to assess how well the students achieve the CILOs.)

| Assessment Tasks/Activities                                  | CILO No. |   |   |   |  | Weighting<br>* | Remarks |
|--|----------|---|---|---|--|----------------|---------|
|  | 1        | 2 | 3 | 4 |  |                |         |
| Continuous Assessment: <u>60</u> %                           |          |   |   |   |  |                |         |
| Assignments  | ✓        | ✓ | ✓ | ✓ |  | 40%            |         |
| Mid-term Test  | ✓        | ✓ |   | ✓ |  | 20%            |         |
| Examination: <u>40</u> % (duration: 2 hours , if applicable) |          |   |   |   |  |                |         |
| * The weightings should add up to 100%.                      |          |   |   |   |  | 100%           |         |

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.

## 5. Assessment Rubrics

(Grading of student achievements is based on student performance in assessment tasks/activities with the following rubrics.)

| Assessment Task       | Criterion   | Excellent (A+, A, A-) | Good (B+, B, B-) | Fair (C+, C, C-) | Marginal (D) | Failure (F)                      |
|-----------------------|---|-----------------------|------------------|------------------|--------------|----------------------------------|
| 1. Assignments        | Ability to evaluate and solve practical problems related to energy and carbon auditing  | High                  | Significant      | Moderate         | Basic        | Not even reaching marginal level |
| 2. In-class Exercises | Ability to analyse and solve problems related to energy and carbon auditing   | High                  | Significant      | Moderate         | Basic        | Not even reaching marginal level |
| 3. Mid-term Test      | Ability to apply engineering knowledge and skills to analyse, calculate, and solve problems related to energy and carbon auditing | High                  | Significant      | Moderate         | Basic        | Not even reaching marginal level |
| 4. Examination        | Ability to apply engineering knowledge and skills to analyse, calculate, and solve problems related to energy and carbon auditing | High                  | Significant      | Moderate         | Basic        | Not even reaching marginal level |

### Part III Other Information (more details can be provided separately in the teaching plan)

#### 1. Keyword Syllabus

*(An indication of the key topics of the course.)*

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; CO<sub>2</sub> equivalent, Carbon footprint; Life cycle analysis; GHG protocol; GHG inventory; Emissions reporting; Emission trading.

#### 2. Reading List

##### 2.1 Compulsory Readings

*(Compulsory readings can include books, book chapters, or journal/magazine articles. There are also collections of e-books, e-journals available from the CityU Library.)*

|    |   |
|----|---|
| 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. |

##### 2.2 Additional Readings

*(Additional references for students to learn to expand their knowledge about the subject.)*

|    |  |
|----|--|
| 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. <i>Applied Energy</i> , 83(1), 1-14. |
| 4. | Chung, W. (2011). Review of building energy-use performance benchmarking methodologies. <i>Applied Energy</i> , 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.<br><a href="http://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml">http://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml</a> |
| 8. | 2013 ASHRAE Handbook – Fundamentals, ASHRAE, 2013.   |