

JEE 683 Energy, Environment and Sustainability

(Course coordinator: Dr. Sebastien Bonnet)

1. Course Description *[Briefly describe the course content, especially how it supports the PLO].*

This course examines the interrelationships between the environment and the ways in which energy is produced, distributed, and used. Worldwide energy use patterns and projections are reviewed. Underlying scientific principles are studied to provide a basis for understanding the inevitable environmental consequences of energy use. Topics studied include fossil, and renewable sources, including hydropower, wind, and solar. The Use of alternative fuels such as biodiesel and ethanol are also included. Emphasis is placed on the environmental impacts of energy sources, including local effects resulting from emissions of nitrogen oxides, sulfur, hydrocarbons, and particulates as well as global effects such as mercury release from coal combustion. Carbon emissions are a continuing theme as each energy technology is studied and its contribution to climate change is assessed. All these energy and environmental challenges are addressed within the context of sustainable development. The purpose is to help students understand how energy is converted into useful forms, how this conversion impacts the environment, and how this shapes sustainable development strategies and action plans.

2. Target Knowledge, Skills, and Abilities (KSA) *[Indicate what KSA this course will provide the students with].*

This course provides students with basic knowledge on energy, environment and sustainability, skills to analyze energy systems and related environmental impacts in a life cycle thinking manner, and an ability to combine theoretical knowledge and analytical skills to address and identify strategies and action plans for the sustainable development of energy systems.

3. Target group of students *[Indicate if the course is opened for all students, including non-degree ones]*

The course is opened to Master and PhD students with a background in science or engineering.

4. Pre-requisites *[Indicate if the course requires some pre-requisites].*

This course is an introductory course and therefore no pre-requisites are required.

5. Course Learning Outcomes *[Indicate the alignment of CLOs with the PLOs].*

CLO 1: Able to define the concept of sustainable development.

CLO 2: Able to explain the challenges and potentials for development of various energy technologies.

CLO 3: Able to analyze the environmental impacts of conventional and alternative energy technologies.

6. Method of Teaching and Learning [Specify if it would be 1/ Online; 2/ On-site; 3/ Hybrid; 4/ Online for lectures and On-site in small groups for discussions and workshops; 5/ Others].

This course will be delivered in a hybrid format, i.e. a combination of online and on-site lectures and presentations.

7. Course Outline and Organization [Following KMUTT's recommendations, a course should be organized based on the OBEM approach. A course can, therefore, be split over the semester, but also organized in consecutive weeks as before. A module can contain from 2 up to a maximum of 5 lectures depending on the target LOs. A 3 credits course can be composed of 3 to a maximum of 5 modules. In addition, indicate if **the course is opened every Semester or a specific Semester**].

This course is opened every Semester. For the Semester 1/2022 (2565), this course is scheduled every Tuesday morning (9.00 am – 12.00 pm) from Tuesday 9 August to 6 December 2022.

MODULE 1: BASICS OF ENERGY, AIR POLLUTION AND CLIMATE CHANGE		
MLO 1: Understand energy development and environmental challenges.		
MLO 2: Gain knowledge on Earth atmosphere and air pollution.		
MLO 3: Can explain global warming and climate change.		
Lecture No.: Title	Name of Instructor (Affiliation)	Teaching Period
LECTURE 1: Introduction to energy and environment	Dr. Sebastien Bonnet, JGSEE	Week 1
LECTURE 2: Atmosphere	Dr. Kasemsan Manomaiphiboon, JGSEE	Week 2
LECTURE 3: Global warming and climate change	Dr. Sirintornthep Towprayoon, JGSEE	Week 3
EVALUATION: Essay questions and take-home work		

MODULE 2: FOSSIL-BASED ENERGY TECHNOLOGIES		
MLO 1: Gain knowledge on fossil-based energy technologies.		
MLO 2: Can assess emissions from fossil power plants.		
MLO 3: Can identify emission control technologies and strategies for environmental protection.		
Lecture No.: Title	Name of Instructor	Teaching Period
LECTURE 1: Fossil fueled power plants	Dr. Boonrod Sajjakulnukit, JGSEE	Week 4
LECTURE 2: Pollution control technologies	Dr. Savitri Garivait, JGSEE	Week 5
LECTURE 3: Assessment of emissions from energy production and use	Dr. Suneerat Fukuda, JGSEE	Week 6
LECTURE 4: Environmental protection	Dr. Boonrod Sajjakulnukit, JGSEE	Week 7
EVALUATION: Essay questions and take-home work		

MODULE 3: SMART AND ALTERNATIVE ENERGY SYSTEMS		
MLO 1: Gain knowledge on renewable energy technologies.		
MLO 2: Gain knowledge on smart energy systems.		
MLO 3: Understand the role of smart and renewable energy systems as alternative to fossil-based systems		
Lecture No.: Title	Name of Instructor	Teaching Period
LECTURE 1: Renewable energy	Dr. Boonrod Sajjakulnukit - JGSEE	Week 8
LECTURE 2: Smart urban planning and smart cities	Dr. Kanjaneer Budthimedhe, SoAD	Week 9
LECTURE 3: Green buildings	Dr. Pipat Chaiwiwatworakul, JGSEE	Week 10
LECTURE 4: Energy efficiency in Industry	Dr. Pipat Chaiwiwatworakul, JGSEE	Week 11
EVALUATION: Essay questions and take-home work		

Module 4: ENVIRONMENTAL SUSTAINABILITY MANAGEMENT		
MLO 1: Can define sustainable development, goals and indicators.		
MLO 2: Can analyze the environmental implications of energy systems based on life cycle thinking.		
MLO 3: Understand the nexus between energy, climate change and sustainable development.		
MLO4: Understand business strategies to move towards net zero emissions.		
Lecture No.: Title	Name of Instructor	Teaching Period
LECTURE 1: Sustainable Development	Prof. Shabbir H. Gheewala, JGSEE	Week 12
LECTURE 2: Life cycle thinking and sustainability assessment	Prof. Shabbir H. Gheewala, JGSEE	Week 13
LECTURE 3: Energy and climate nexus in industry	Dr. Ali Hasanbeigi, GEI	Week 14
LECTURE 4: Business: towards net zero emissions	Ms. Anittha Jutarosaga, STIPI	Week 15
EVALUATION: Essay questions and take-home work		

8. Evaluation Methods [Indicate the methods used to evaluate the LOs, e.g. online or on-site exams, assignments, take-home exams, projects, etc. Following KMUTT recommendations, the LOs evaluation should be organized at the end of each module].

Module 1: The exam consists of essay questions and take-home work (25% overall grade for the course)

Module 2: The exam consists of essay questions and take-home work (25% overall grade for the course)

Module 3: The exam consists of essay questions and take-home work (25% overall grade for the course)

Module 4: The exam consists of essay questions and take-home work (25% overall grade for the course)

9. Guided References/Resources [*Indicate the references/resources students are recommended to consult for the modules/course*].

1. Fay, J. A. Golomb, D.S. (2002) *Energy and the Environment*, Oxford University Press
2. Kerr, J. (2017) *Introduction to Energy and Climate: Developing a sustainable environment*, CRC Press
3. Michaelides, E.E. (2018) *Energy, the Environment, and Sustainability*, CRC Press
4. Tester, J. W. et al. (2012) *Sustainable Energy: Choosing Among Options*, Second edition, MIT Press
5. Wolfson, R. (2018) *Energy, environment, and climate*, Third edition, W. W. Norton & company, inc.