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 understand 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 1/2025 (2568), this course is scheduled every Wednesday morning (9.00 a.m. – 12.00 p.m.) from Wednesday 13 August to 26 November 2025.

MODULE 1: ENERGY, ENVIRONMENT AND CLIMATE MLO 1: Understand energy development and environmental challenges. MLO 2: Gain knowledge on climate and climate change. MLO 3: Can explain the energy-environment nexus.		
Lecture No.: Title	Name of Instructor (Affiliation)	Teaching Period
LECTURE 1: Earth, energy and sustainability *Energy and development of society; Energy flows and use; Implications of energy in contemporary society and sustainability.*	Dr. Sebastien Bonnet, JGSEE, KMUTT	13 August 2025
LECTURE 2: Climate and climate change *Greenhouse effect; Earth's energy balance; Climate forcing, Climate sensitivity; Natural and Anthropogenic forcing agents; Carbon cycle and anthropogenic impacts.*	Dr. Sebastien Bonnet, JGSEE, KMUTT	20 August 2025
LECTURE 3: Energy, environment and climate nexus *Environmental stewardship; Climate change; Energy sustainability.*	Dr. Sebastien Bonnet, JGSEE, KMUTT	27 August 2025
EVALUATION: Essay questions (3 September 2025)		

MODULE 2: ENERGY TECHNOLOGIES AND THE ENVIRONMENT **MLO 1:** Gain knowledge on fossil-based energy technologies. **MLO 2:** Can knowledge on renewable energy technologies. **MLO 3:** Gain knowledge on energy related technologies and strategies for environmental protection.		
Lecture No.: Title	Name of Instructor	Teaching Period
LECTURE 1: Fossil fueled power plants *Energy chains; environmental impacts; economic costs.*	Dr. Boonrod Sajjakulnukit, JGSEE, KMUTT	10 September 2025
LECTURE 2: Renewable energy *Solar; wind; hydropower; biomass; hydrogen; environmental impacts; costs.*	Dr. Boonrod Sajjakulnukit, JGSEE, KMUTT	17 September 2025
LECTURE 3: Environmental protection *Regulations and agreements in the field of environmental protection in the energy sector; selection of power plants locations; management of solid and liquid waste from fossil fuel.*	Dr. Boonrod Sajjakulnukit, JGSEE, KMUTT	24 September 2025
EVALUATION: Essay questions (1 October 2025)		

MODULE 3: SMART ENERGY USE AND CLIMATE **MLO 1:** Gain knowledge on smart energy systems. **MLO 2:** Gain knowledge on energy conservation in the built environment. **MLO 3:** Gain knowledge on Sustainable and efficient energy use in the industry		
Lecture No.: Title	Name of Instructor	Teaching Period
LECTURE 1: Smart urban planning and smart cities *Urban planning and smart growth; smart infrastructures, smart transportation; smart cities and connectivity, smart living.*	Dr. Kanjanee Budthimedhe, School of Architecture and Design, KMUTT	8 October 2025
LECTURE 2: Green buildings *Energy efficiency and energy conservation in buildings.*	Dr. Pipat Chaiwiwatworakul, JGSEE, KMUTT	15 October 2025
LECTURE 3: Energy efficiency in industry *Energy audit; energy monitoring; energy management systems; best available technologies; best practices; benchmarking.*	Dr. Pipat Chaiwiwatworakul, JGSEE, KMUTT	22 October 2025
EVALUATION: Essay questions (29 October 2025)		

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 link between energy use, circular economy and climate change.		
Lecture No.: Title	Name of Instructor	Teaching Period
LECTURE 1: Life cycle thinking and sustainability *Analysis of environmental impacts of fossil and renewable energy systems based on a cradle to grave approach.*	Prof. Shabbir H. Gheewala, JGSEE, KMUTT	5 November 2025
LECTURE 2: : Green growth and circular economy *Resource efficiency; Raw material use; Sustainable consumption; Eco-innovation; Green production; Waste prevention and management.*	Prof. Shabbir H. Gheewala, JGSEE, KMUTT	12 November 2025
EXPERT TALK: Case-study presentation	Prof. Shabbir H. Gheewala, JGSEE, KMUTT	19 November 2025
EVALUATION: Essay questions (26 November 2025)		

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 (25% overall grade for the course)

Module 2: The exam consists of essay questions (25% overall grade for the course)

Module 3: The exam consists of essay questions (25% overall grade for the course)

Module 4: The exam consists of essay questions (25% overall grade for the course)

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.