COURSE CALENDAR DESCRIPTION

This course is designed to teach students the operation principles, efficiencies, limitations, and environmental effects of a broad portfolio of sustainable energy technologies that are available to meet global energy demands. Topics covered include an overview of global energy demand and production, the environmental factors in energy generation systems, nuclear power, biomass, geothermal, hydropower, solar energy conversion, oceanic and wind energy conversion, energy storage and transport, and the technical, social, and economic factors involved with creating energy systems and policies.

This one-term course is delivered using three hours of lecture per week is designed to bring students up to speed on the global energy scene, the options that are available for sustainable energy generation and distribution, and the challenges associated with implementing these options. Students gain knowledge of present-day global energy demands and the methods and resources currently used to meet these demands.

Further, the environmental, societal and technical issues and challenges involved with meeting global energy demands in a sustainable manner will be discussed. The operation principles, efficiencies, limitations, and environmental effects of a broad portfolio of sustainable energy technologies including nuclear, biomass, geothermal, solar energy, oceanic and wind power systems will be covered. One lecture is dedicated to energy harvesting/scavenging technologies wherein piezoelectric, triboelectric, and thermoelectric power generation is discussed. Students also gain basic knowledge of energy storage methods including pumped hydropower, compressed-air, flywheels and batteries. Energy transport systems are also covered, including electric energy transport, liquid and gaseous fuels, the hydrogen economy, and the methanol economy. Also, related decision-making and governmental energy policies are debated.

INSTRUCTOR(S)

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<td>O'Brien, Paul G.</td>
<td>Sec. A / LECT / F</td>
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ADDITIONAL INFORMATION

This one-term course which will be delivered using three hours of lecture per week is designed to bring students up to speed on the global energy scene, the options that are available for sustainable energy generation and distribution, and the challenges associated with implementing these options. Students will gain knowledge of present-day global energy demands and the methods and resources currently used to meet these demands. Further, the environmental, societal and technical issues and challenges involved with meeting global energy demands in a sustainable manner will be discussed. The operation principles, efficiencies, limitations, and environmental effects of a broad portfolio of sustainable energy technologies including nuclear, biomass, geothermal, solar energy, oceanic and wind power systems will be covered. One lecture will be dedicated to energy harvesting/scavenging technologies wherein piezoelectric, triboelectric, and thermoelectric power generation will be discussed. Students will also gain basic knowledge of energy storage methods including pumped hydropower, compressed-air, flywheels and batteries. Energy transport systems will also be covered, including electric energy transport, liquid and gaseous fuels, the hydrogen economy, and the methanol economy. Also, related decision-making and governmental energy policies will be debated.
Topics:
The tentative course schedule (which may be subject to minor changes) is provided below:
Week 3: Nuclear Power
Week 4: Solar Energy
Week 5: Biomass Energy
Week 6: Geothermal Energy, Hydropower
Week 7: Ocean Wave, Tide, Current and Wind Energy
Week 8: Energy Harvesting
Week 9: Energy Storage
Week 10: Energy Transport
Week 11: Energy Systems and Policies
Week 12: Student Presentations

LIST OF LEARNING OUTCOMES
Students who successfully complete the course have reliably demonstrated the ability to:
• Outcome 1: understand the global energy scene, including the magnitude of energy demands and the resources consumed to meet these demands.
• Outcome 2: explain the portfolio of available sustainable energy technologies, including their operation principles and efficiencies.
• Outcome 3: critically access the limitations and environmental effects of emerging and existing sustainable energy generation technologies.
• Outcome 4: provide critical evaluation and recommendations as to which sustainable energy technologies should be utilized in different applications and geographical locations.
• Outcome 5: understand and debate the role and importance of energy policies in the development and implementation of sustainable energy technologies.

GRADED ASSESSMENT
The final grade will be computed as follows:

Participation: 20 %
Students will participate in class discussions for approximately 0.5 hours each week. More specifically, students will be provided with questions at the end of each lecture which will be taken up at the beginning of the next lecture. Each student will be assigned a few questions throughout the duration of the course. The students’ performance in answering these questions will be graded based on the quality of their explanation of the topic items, as well as their response to follow-up questions from their class-mates.

Quizzes: 50 %
There will be 4 quizzes worth 12.5% each. The quizzes will be held in-class and will each cover roughly one quarter of the course material.

Written Report: 15 %
Students will write about a sustainable energy technology topic of their choice (which has been approved by the instructor). The paper will provide a thorough description of how the technology works, its efficiency and limitations, potential future developments, and the costs and environmental burdens over the life-cycle of the technology.

Oral Presentation: 15%
During week 12, students will present the contents of their written report to the class, followed by a question and answer session. The duration of the presentations will be approximately 20 minutes.

ADDITIONAL INFORMATION

Recommended Textbook: