CEE 494/CEE 598: Sustainable Energy Technologies

Fall 2013

**Class-Times:** Tuesdays/Thursdays 10:30-11:45 am

**Location:** TBD

**Instructor:** Prof. T. Agami Reddy (reddyta@asu.edu), ERC 479
Office Hours: Mon/Wed 9:30-11:00 am, or email for appointment

**Description** (approved undergraduate tech elective)
This course is a survey course focusing primarily on the scientific principles and technology pathways leading to a sustainable energy future. Topics in energy conservation and renewable energy technologies as well as the short-term role of fossil fuels and nuclear energy will be covered along with some treatment of the associated health and environmental issues as well as social and policy aspects.

**Learning Outcomes**
The outcomes of this course are to provide the students with better overall understanding and/or quantitative analysis skills related to:

- Energy consumption patterns in modern society: current and future, limits of growth, growth models
- Limits of non-renewable energy supplies (coal, oil, gas and nuclear) and their adverse impacts
- Fundamentals of energy science and thermodynamic cycles
- Traditional conversion technologies using fossil fuels and nuclear energy
- New concepts in electricity generation (combined cycles, combined heat and power, distributed generation)
- Renewable energy: resources, technologies, and maturity status of large scale solar and wind electricity
- Energy conservation in buildings: science, energy equipment, energy efficiency measures, green buildings
- Energy use in transportation and vehicle technologies
- Biofuels, biomass and alternative fuels
- Adverse impacts of traditional energy use on human health and the environment (ecology and climate change).

**Assigned Textbook:**

While not required for the course, there are several textbooks covering parts of the course material, including:


**Grading Policy**
ASU’s +/- grading will be used: A (93-100%), A- (90-92), B+ (87-89), B (83-86), B- (80-82), C+ (77-79), C (70-76), D (60-69), E (<60), XE (failure due to academic dishonesty).

The final grade will be assigned on the basis of the following categories and according to the indicated weights:

- Assignments 25%
- Term Project 20%
- Mid-term exam 20%
- Final exam 25%
- Attendance and participation 10%
Total 100%

**Pre-requisites**
Graduate students from engineering and hard sciences with the necessary background in undergraduate physics, science, mathematics, thermodynamics and fluid sciences.
**Academic Integrity:** Graduate students are expected to be ethical in their multiple roles as students, as researchers, as teachers and/or supervisors of undergraduate students, and as representatives of the School, Institute, and University.

### Course Schedule

<table>
<thead>
<tr>
<th>Week</th>
<th>Class Day</th>
<th>Topics (tentative)</th>
<th>Reading</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Overview: Sustainable Energy pathways</td>
<td>Sustainability concepts: Limits of growth</td>
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<tr>
<td>2</td>
<td>Primary energy supply and consumption, nonrenewable minerals</td>
<td>Review of fluid mechanics, thermodynamic properties and laws, heat transfer</td>
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<td>3</td>
<td>Principles of energy science</td>
<td>Heat engines, Carnot cycle</td>
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<td>4</td>
<td>Coal, oil and gas resources</td>
<td>Coal power plants- Rankine cycles</td>
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<tr>
<td>5</td>
<td>Cycles: Brayton, Otto, Diesel, Sterling</td>
<td>Advanced cycles</td>
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<tr>
<td>6</td>
<td>Fossil fuel issues</td>
<td>Guest lecture</td>
<td>Nuclear power cycle and plants</td>
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<tr>
<td>7</td>
<td>Nuclear issues</td>
<td>Guest lecture</td>
<td>Electric generation and transmission, distributed generation, smart grid</td>
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<td>8</td>
<td>Energy storage and hydrogen</td>
<td>Review</td>
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<td>9</td>
<td>Mid-term (material from weeks 1-7)</td>
<td>Renewable energy- solar energy basics</td>
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<td>10</td>
<td>Solar thermal systems</td>
<td>Solar photovoltaic systems</td>
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<td>11</td>
<td>Renewable energy- Wind+ other sources</td>
<td>Renewable energy issues</td>
<td>Guest lecture</td>
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<td>12</td>
<td>Energy conservation principles</td>
<td>Building science and systems</td>
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<td>13</td>
<td>Transportation systems</td>
<td>Biofuels and alternative fuels</td>
<td>Guest lecture</td>
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<td>14</td>
<td>Energy use impacts on humans and ecology</td>
<td>Climate change, carbon wedges and policy</td>
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<tr>
<td>15</td>
<td>Class presentations</td>
<td>Class presentations</td>
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**Final comprehensive exam**