Physics 130/Environmental Studies 130
Science of Renewable Energy
Fall 2021

Office: OLRI 131 doyle@macalester.edu MWF 1:10 – 2:10 OLRI 150

Introduction

Welcome to the Science of Renewable Energy! This course provides a detailed treatment of the state-of-the-art science and engineering of our energy systems with a focus on renewable energy. The purpose of the course is to provide a broad and rigorous foundation in the basic science, technology, and economics of energy to inform social and policy decisions around our energy sources and use. It can also serve as an introduction to renewable technology for those are interested in pursuing scientific and engineering research in this area. While energy policy will not be a focus of the course, we will touch upon some aspects of policy when appropriate.

Prerequisite and Materials

There is no textbook for the class, but there will be numerous handouts (on Moodle) throughout the semester.

Assignments

HW Sets: Problems will usually be assigned roughly every other class period, due two class periods from the assignment date (for example problems assigned on a Friday would be due the following Wednesday). You are encouraged to consult with each other on the problems *after you have made your best effort to solve the problems on your own*. However, if you work together, each student must still submit their own copy of the problems. Five problems will normally be assigned per set, each graded out of 10 points (50 points total) with partial credit assigned. Your two lowest homework scores will be dropped in calculation your final grade. **HW Sets will count 40% towards your final grade.**

Readings: Seven readings will be assigned throughout the semester. These will be articles for which you will asked to write a one page summary and/or briefly answer some questions. The reading summaries will be graded as Satisfactory (10 pts), Satisfactory with Major Omission (5 pts), Unsatisfactory (0 pts). Your lowest Readings score will be dropped in computing your final grade. **The Readings will count 30% towards your final grade.**

Quizzes: There will be four ½ hour Quizzes. Your lowest Quiz score will be dropped in computing your final grade. **The quizzes will count 30% towards your final grade.**

Attendance and Consultation

Since there is no textbook for the course, the material presented in class is your only reference for the homework and the quizzes. Therefore, *class attendance is mandatory*. We cover a lot of ground every class, so if you miss a class you need to get the notes from another student.

You are *encouraged to see me if you have difficulties with assigned problems or any other aspect of the course*. My office hours are posted on Moodle, and you may also make an appointment.

Tentative Schedule

Week of	Topic
8/30	Energy Fundamentals
9/6	Energy Fundamentals, Thermal Energy
9/13	Chemical Energy and Internal Combustion Engines
9/20	Biofuels
9/27	Electrical Energy **Quiz 1: Fundamentals and Biofuels**
10/4	Conventional Electrical Power Generation (Fossil Fuel, Nuclear)
10/11	Electrochemistry: Batteries and Fuel Cells
10/18	Electrification: Electric Vehicles and Electric Heating
	Fall Break October 21 - 24
10/25	Photovoltaics **Quiz 2: Conventional Electrical Power and Electrification**
11/1	Photovoltaics
11/8	Wind Energy
11/15	Wind Energy **Quiz 3: Solar and Wind Energy**
11/22	Geothermal, Fusion
	Thanksgiving Break November 24 - 28
11/29	Energy Storage and Grid Integration
12/6	Energy Storage and Grid Integration **Quiz 4: Storage and Integration**