

EECS 498

Sustainable Energy Solutions

Prof. S. Forrest

Course Description

Climate change is now affecting all life on earth, which is clearly visible through the changing ecosystems, extreme weather events, and extinction of species. It is the broad consensus of the scientific community that the cause of the rapid change in global climate is predominantly due to the emission of carbon dioxide from burning of fossil fuels. This course is focused on describing the technologies available or envisioned that can replace fossil fuels with alternative renewable sources of energy. The course begins by considering the environmental consequences of the use of fossil fuels for electricity generation, materials manufacturing, and transportation. Then we will present a case study for elimination of the use of fossil fuels by actions being taken at the University of Michigan. Next, we will systematically describe the science and technology for implementing sustainable energy solutions to replace fossil fuels on a global scale. This requires that we build foundations for understanding thermodynamics, electricity and magnetism, and electrochemistry that underlie most sustainable energy solutions. The technologies to be considered in this class include solar, wind, geothermal, hydro and tidal power, heat pumps, batteries and other energy storage methods, energy efficiency, and so on. Both the science behind each method, as well as its potential capacity to fulfill current and future energy demands will be discussed.

Prerequisites: EECS 230, 320

Text: *Sustainable Energy: Engineering Fundamentals and Applications*, Serdar Çelik, Cambridge, 2023.

Required reading prior to class: *The Worst Hard Time: The Untold Story of Those Who Survived the Great American Dust Bowl*, Timothy Egan, Mariner, 2006.