

# **A System Approach in Energy Engineering Curriculum**

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“Fundamentals of Energy Engineering” course developed at Frostburg State University has been offered to senior level physics and engineering majors since 2012. Along with conventional primary sources, integration of renewable and alternative sources of energy is covered with an emphasis on solar and wind powered electric generation. An overview of energy flow from primary sources to consumers through processing facilities, power plants, fuel transportation, transmission, and distribution network is presented using a system approach.

A number of lower division physics and engineering courses cover a broad range of energy topics. The goal of the presented course is to show implementation of energy science and different fields of engineering to supply energy needs of a modern society for social and economic development.

In addition to introducing the technical content, the course shows students that an energy system is more than merely an engineering structure. Its development and operation involves different groups of the society. While engineers develop and show feasible technical options, planners, investors, and policy makers take part in the decision making process. In modern community professional societies, media, and various citizen groups develop public opinions that ultimately influence the decision-making process. Long-term policies on fuel mix and structure of an energy system are shaped based on social acceptance and preferences. Emerging issues such as energy security, environmental impacts, and ethical responsibility of energy professionals are discussed in lectures and student projects.

Upon completion of the course, students are expected to

- Describe conventional and alternative sources of energy, benefits and limitations of each primary energy source, and social responsibility of energy generation and consumption
- Analyze and design integrated energy generation and storage systems
- Analyze the cost-effectiveness of power generation systems
- Evaluate the environmental and social impacts of energy generation systems

Fundamentals of Energy Engineering course addresses the specific outcomes b, c, f, g, i, j, k of ABET Criterion 3.

The presentation includes an outline of the course topics, developed hands-on activities, and student design projects.