

# ENE 100 Conventional and Alternative Energy Applications COURSE OUTLINE

**Prerequisites:** Basic knowledge of algebra, ELE 176

## Course Description:

Provides an overview of hydroelectric, coal, and nuclear energy production methods and renewable solar, geothermal, wind, and fuel cell technology. A complete system breakdown of conventional power production methods, efficiency, and sustainability when compared with solar, geothermal, wind, and fuel cell applications.

This course provides the student with the basic understanding of renewable energy systems and their potential use for heating and power generation, including electricity. The course focuses on providing the student with an introduction to:

- Global sources of energy; conventional and renewable
- Energy consumption patterns
- Key concepts, terminology, and nomenclature specific to energy systems.
- Topics include fossil fuel, solar, wind, hydro, biomass, geothermal, and hydrogen fuel cells as renewable energy systems.
- Emerging technologies

**Semester Credits:** 4 hrs **Lecture Hours:** 3 Hours **Lab/Recitation Hours:** 2 Hours

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## Course Outcomes:

**At the completion of this course, the student should be able to:**

1. Describe energy consumption patterns in the U.S. and World.
2. Classify energy resources and describe their uses, availability, and environmental impacts.
3. Describe the principles of renewable energy systems.
4. Explain the basis for evaluating existing and proposed energy systems from energy efficiency, economic, and environmental standpoint.
5. Evaluate the potential of an energy resource for meeting energy requirements, including site assessments.
6. Explain the concepts of energy and economic return on investment and demonstrate how they are used to evaluate renewable energy resources.
7. Describe and evaluate the effectiveness of energy collection, conversion and storage methods and technologies.
8. Apply the principles of energy collection, conversion, and storage to design a renewable energy system for residential, farm, or commercial application.

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## Required Materials:

1. Vaughn Nelson; Introduction to Renewable Energy, Copyright 2011; CRC Press  
ISBN 978-1-4398-3449-7

2.

## Textbook (optional)\*:

The following supplementary materials are available:

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## Topical Description:

Content to be covered within this course includes the following topics:

### **Introduction**

Energy and Society  
Types of Energy  
Renewable Energy  
Advantages/Disadvantages  
Economics  
Global Warming  
Order of Magnitude Estimates  
Growth (Exponential)  
Solutions

### **Energy**

Introduction  
Definition of Energy and Power  
Heat  
Thermodynamics  
Energy Dilemma in Light of the Laws of Thermodynamics  
Use of Fossil Fuels  
Nuclear  
Finite Resource  
Summary

### **Sun**

Solar Power  
Electromagnetic Spectrum  
Energy Balance of the Earth  
Earth-Sun Motion  
Insolation  
Solar Resource  
Greenhouse Effect

### **Heat Transfer and Storage**

Introduction  
Conduction  
Convection  
Radiation

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Thermal Mass  
Seasonal Heating or Cooling  
Thermal Comfort  
**Solar Heating and Cooling**  
Building  
Passive  
Windows and Glazing  
Passive Heating and Cooling  
Active Heating  
Active Cooling  
Daylighting  
Hybrid and Other  
Drying Agricultural Products, Lumber  
Solar Cookers  
Water Purification  
**Photovoltaics**  
Introduction  
Physics Basics  
Energy Bands  
Photovoltaic Basics  
Performance  
Design Considerations  
Installed Capacity and Production  
Applications  
Comments  
**Concentrating Solar Power**  
Introduction  
Power Tower  
Line or Linear  
Dish/Engine  
Point Focus  
Solar Pond  
**Solar Systems**  
Introduction  
Passive Systems  
Hybrid Systems  
Active Systems  
Underground Homes  
Computer Software  
Other  
**Wind Energy**  
Introduction  
Wind Resource  
Wind Turbines  
Wind Farms  
Small Wind Turbines

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Village Power

Wind Diesel

Other

Performance

Comments

**Bioenergy**

Introduction

Conversion

Heat and Power

Biofuels

Comments

**Geothermal Energy**

Introduction

Resource

Types of Geothermal Resources

Direct Use

Geothermal Heat Pumps

Electricity

Comments

**Water**

Introduction

World Resource

Hydroelectric

Turbines

Water Flow

Tides

Ocean

Other

**Storage**

Introduction

Pumped Hydro

Compressed Air

Flywheels

Batteries

Other Storage Systems

Hydrogen

**Institutional Issues**

Introduction

United States

Regulations

Environmental Issues

Politics

Incentives

Externalities (Social Costs/Benefits)

Transmission

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## **Economics**

Introduction

Factors Affecting Economics

Economic Analyses

Life-Cycle Costs

Present Worth and Levelized Costs

Externalities

Project Development

Cost (Value) of Energy, Different Sources

Summary

The Future

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Notes to Instructors

1.

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