Western Technical College

10480101 Renewable Energy Overview

Course Outcome Summary

Course Information

Description	Students investigate the need for renewable energy systems and emerging careers in renewable energy. Students examine the basic design, function, cost and other considerations associated with various "green" energy systems, including solar photovoltaic, solar thermal, wind, geothermal and biomass. Students will also explore the production and use of alternative transportation fuels.
Career Cluster	Architecture and Construction
Instructional Level	Associate Degree Courses
Total Credits	3
Total Hours	54

Textbooks

No textbook required.

Course Competencies

1. Explore the growing need for renewable energy systems.

Assessment Strategies

1.1. Written Objective Test
1.2. Reflection

Criteria

You will know you are successful when:

1.1. you can identify energy efficiency terms and methods.
1.2. you can determine your daily energy consumption.
1.3. you can identify renewable energy projects in your area.
1.4. you can discuss current energy efficiency methods being used.

Learning Objectives

1.a. Discuss the most common current methods of producing electrical power globally.
1.b. Compare the production of greenhouse gasses from different types of energy production.
1.c. Analyze renewable energy projects in your community.
1.d. Study energy efficiency methods and trends.
1.e. Discuss energy conservation methods that you can apply in your daily life.
1.f. Study new and emerging energy storage systems being implemented globally.
1.g. Analyze your average daily energy consumption.

2. Examine electrical power generation and usage.

Assessment Strategies

2.1. Written Objective Test

Criteria

Performance will be satisfactory when:

2.1. you can calculate the voltage loss across a distribution line.
2.2. you can use watt's law to calculate power consumption of various electrical appliances.
2.3. you can calculate how much current an appliance uses based on wattage and voltage.
2.4. you can explain what distributed generation and how it is currently being used.

Learning Objectives

2.a. Discuss voltage, current and resistance as they relate to power production.
2.b. Apply ohms law to solve basic electrical problems.
2.c. Use watts law to solve basic power usage problems.
2.d. Calculate transmission line power losses.
2.e. Discuss the advantages and disadvantages of distributed power generation.

3. Summarize basic concepts of photovoltaic systems.

Assessment Strategies

3.1. Written Objective Test
3.2. Demonstration

Criteria

Performance will meet expectations when:

3.1. you can describe the operation of a photovoltaic cell.
3.2. you can locate a proper site for installing a photovoltaic system.
3.3. you can identify the different types of photovoltaic materials by sight.
3.4. you can list the criteria used for standard test conditions of photovoltaic cells/panels.

Learning Objectives

3.a. Describe the operation of photovoltaic (PV) cell.
3.b. List the different types of common photovoltaic materials.
3.c. Identify what is needed for a good solar window.
3.d. Define what standard test conditions (STC) are for a solar panel.

4. Explore solar thermal energy production.

Assessment Strategies

4.1. Project

Criteria

You will know you are successful when

4.1. you design a solar thermal collector.
4.2. you construct the collector based on designs.
4.3. you test the solar gain of the collector.
4.4. you identify the most efficient collector.

Learning Objectives

4.a. Examine heat transfer processes (radiation, convection, conduction).
4.b. Identify components of a solar thermal collector.

4.c. Construct a solar thermal collector.
4.d. Define solar gain.
4.e. Measure solar gain of the solar thermal collector.

5. Analyze the operation of hydroelectric power generation.

Assessment Strategies

5.1. Written Objective Test

Criteria

You will know you are successful when

5.1. you calculate hydropower based on given parameters.
5.2. you calculate flow rate given stream cross section and velocity.
5.3. you measure elevation using a transit.

Learning Objectives

5.a. Calculate hydropower based on location.
5.b. Complete a stream flow analysis.
5.c. Measure elevation difference from inlet to outlet.
5.d. Calculate flow rate.
5.e. Use USGS sensors to verify flow rate.
5.f. Explore microturbines.

6. Examine bio-fuels used for transportation fuel.

Assessment Strategies

6.1. Written Product

Criteria

You will know you are successful when

6.1. you identify the different types of bio-fuels.
6.2. you summarize characteristics of each bio-fuel (efficiency, land use, uses, etc.).
6.3. you calculate gallons per acre of production capability.
6.4. you explain fuel production based on bio-mass makeup.

Learning Objectives

6.a. Explore different types of bio-fuel (bio-diesel, ethanol, wood gas, etc.).
6.b. Examine land use for fuel use (i.e. gallons / acre).
6.c. Explore alternative fuel sources (i.e. waste oil).

7. Explore wind power generation.

Assessment Strategies

7.1. Written Objective Test
7.2. Skill Demonstration

Criteria

You will know you are successful when

7.1. you calculate power based on given parameters.
7.2. you describe the difference between a vertical axis and a horizontal axis wind turbine.
7.3. you describe other uses for land in a wind-farm area.
7.4. you identify wind velocity based on height of tower.
7.5. you explain the relationship between wind speed and power production.
7.6. you describe the relationship between the swept area of the turbine and power production.

Learning Objectives

7.a. Calculate wind power.
7.b. Explore the Betz constant.
7.c. Explore winds velocity relationship to power.
7.d. Explore swept area of a turbine.
7.e. Explore land use of wind farms.

8. Explore tidal and wave energy.

Assessment Strategies

8.1. Written Objective Test
8.2. Presentation

Criteria

You will know you are successful when

8.1. you summarize geographic requirements for wave energy.
8.2. you explain the geographic features for wave-pump storage.
8.3. you describe the different types of wave generators.
8.4. you explain the intermittent tendencies of wave power.
8.5. you summarize geographic requirements for tidal energy.
8.6. you explain the economic feasibility of energy types.

Learning Objectives

8.a. Explore types of tidal/wave energy.
8.b. Explore oscillating wave column.
8.c. Explore floating wave generators.
8.d. Examine geographic features related to wave/tidal energy.