



Western Technical College

10480112 Photovoltaic Design and Installation 2

Course Outcome Summary

Course Information

Description	Students in this capstone course design an integrated portfolio of energy systems, incorporating renewable energy options into a conventional system. Each learner will write a project proposal, work with project teams, sequence project tasks, develop project budgets, and identify project resources.
Career Cluster	Architecture and Construction
Instructional Level	Associate Degree Courses
Total Credits	3
Total Hours	90

Pre/Corequisites

Prerequisite Photovoltaic Design and Installation I 10480111

Textbooks

Photovoltaic Systems – with CD. 3rd Edition. Copyright 2012. Dunlop, James. P. Publisher: American Technical Publishers, Inc. **ISBN-13**:978-1-935941-05-7. Required.

Learner Supplies

Amatrol 206-LSUB4 Elearning License. **Vendor**: Campus Shop. Required.

Course Competencies

1. Identify the best location for a photovoltaic (PV) array for a selected site.

Assessment Strategies

1.1. Demonstration

Criteria

You will know you are successful when

- 1.1. you determine the solar window for the location.
- 1.2. you determine shading characteristics from future plant growth.

- 1.3. you describe and identify structures/plants that will protect the array from wind.
- 1.4. you describe the potential for future development that would impact solar window.

Learning Objectives

- 1.a. Identify type of plant growth and future plant growth.
- 1.b. Analyze building structure and orientation.
- 1.c. Examine wind loading for locations.
- 1.d. Explore possible neighborhood development.
- 1.e. Use a pathfinder to find the solar window.

2. Determine the best mounting solution for an array based on the roofing material.

Assessment Strategies

- 2.1. Activity
- 2.2. Written Objective Test

Criteria

You will know you are successful when

- 2.1. you identify the different types of roofing materials,.
- 2.2. you calculate roof angle based on a given roof pitch.
- 2.3. you determine the mounting system based on the roofing material.

Learning Objectives

- 2.a. Define types of roofing materials.
- 2.b. Explore different mounting systems.
- 2.c. Explore the mounting system that meets the roofing material needs.
- 2.d. Choose the best system based on cost effectiveness and application.
- 2.e. Calculate roof angle based on roof pitch.

3. Compare the cost advantages and disadvantages of using either micro-inverters or a string inverter.

Assessment Strategies

- 3.1. Research Application Activity

Criteria

You will know you are successful when

- 3.1. you determine the costs of a micro-inverter.
- 3.2. you determine the costs of a string inverter.
- 3.3. you describe the effectiveness of one over the other.
- 3.4. you make proposal based on customer's needs.

Learning Objectives

- 3.a. Research cost of wiring materials.
- 3.b. Examine ease of installation of micro-inverters.
- 3.c. Examine labor costs of installation for micro-inverters compared to string inverters.
- 3.d. Explore customer needs regarding system reliability vs. system cost.

4. Identify the role of project team members.

Assessment Strategies

- 4.1. Written Product

Criteria

You will know you are successful when

- 4.1. you determine the list of contractors needed based on the installation type.
- 4.2. you select contractors based on project expectations (i.e. budget, timeline, etc.)

Learning Objectives

- 4.a. Explore types of contractors based on installation system.
- 4.b. Select roofer.
- 4.c. Select contractor that determines structural integrity of the building.
- 4.d. Select electrician.

- 4.e. Select installation team.
- 4.f. Identify if others are needed (landscaper, concrete, etc).

5. Perform an energy audit for a selected residence or business.

Assessment Strategies

- 5.1. Written Project

Criteria

You will know you are successful when

- 5.1. you identify the client loads that can be shifted.
- 5.2. you determine if appliances need updates based on efficiencies.
- 5.3. you identify more efficient ways to use appliances.
- 5.4. you describe ways to cut energy use based on customer needs.

Learning Objectives

- 5.a. Determine loads that can be shifted.
- 5.b. Examine efficiency updates.
- 5.c. Educate on energy usage.
- 5.d. Explore ways to reduce energy consumption.

6. Size a PV system based on users energy needs and solar window.

Assessment Strategies

- 6.1. Written Product

Criteria

You will know you are successful when

- 6.1. you apply results of the energy audit and pathfinder results to determine PV system size.
- 6.2. you identify if a house will be net-zero based on PV system size.
- 6.3. you apply BOS losses to determine the system size.

Learning Objectives

- 6.a. Apply results of energy audit.
- 6.b. Explore difference between net-zero and off-setting energy consumption.
- 6.c. Incorporate BOS system losses into sizing calculations.
- 6.d. Use pathfinder results to determine system size required to meet customer needs.
- 6.e. Determine panel sizing based on available array location size.

7. Create a cost proposal for a PV system based on type of mounting system best suited for location.

Assessment Strategies

- 7.1. Written Product

Criteria

You will know you are successful when

- 7.1. you determine the cost to interconnect to the utility.
- 7.2. you identify any permit costs.
- 7.3. you collect bids from contracting teams.
- 7.4. you incorporate pre-determined costs plus costs of PV equipment into final proposal.

Learning Objectives

- 7.a. Using determined mounting location, estimate the cost for panels.
- 7.b. Determine the racking system and cost based on location and roofing material.
- 7.c. Determine contracting team costs per installation location.
- 7.d. Examine permit and inspection costs based on geographic location.
- 7.e. Examine grid interconnection costs.
- 7.f. Examine building codes (electrical, construction, etc.) for geographic location.

8. Develop scheduled task list for a PV installation project to meet a project deadline.

Assessment Strategies

8.1. Written Product

Criteria

You will know you are successful when

- 8.1. you establish a project timeline.
- 8.2. you determine the order of contractors based on the timeline.
- 8.3. you plan for delays based on weather.
- 8.4. you determine the order of inspections.
- 8.5. you contact the utilities for interconnection.

Learning Objectives

- 8.a. Determine the order of installation.
- 8.b. Establish project timeline.
- 8.c. Organize contractors based on timeline schedule.
- 8.d. Identify barriers to following timeline (weather, budget, delivery of supplies, etc.)
- 8.e. Schedule inspections.
- 8.f. Contact utilities for interconnection.