

# SOLAR ENERGY & PHOTOVOLTAIC SYSTEMS

## Lesson Title

### Introduction to Photovoltaic Systems

#### Background

#### Lesson Stage

Introductory/Instructional/or Culminating

*This is an instructional level module in developing content and skills.*

#### Intended Audience

Who is the intended audience?

What skills and prior educational experience is required to participate in this lesson?

*High School 9-12*

#### Designer's Name & Contact Email

Include this information so instructors have a resource to contact when implementing the lesson.

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#### Goals & Focus

#### General Topic

For example: Wind Energy or Photovoltaic

*Photovoltaics*

#### Central Questions/Overall Purpose/Key Content Ideas Taught in this Lesson

What is a general or central question that the lesson asks?

Provide an overall summary of the lesson objectives

- 1) *Do you think it is financially and environmentally a good idea to install a PV system?*
- 2) *What are some of the advantages of installing a Photovoltaic system?*
- 3) *What are some of the disadvantages of installing a Photovoltaic system?*

*The lesson objectives are the student will be to compare the advantages and the disadvantages of installing a PV system.*

Please outline the following for each lesson

*Understand some of the factors that have motivated the growth of the technology.*

*Evaluate the design priorities for PV systems in different types of applications.*

*Describe the primary levels of the PV industry and how they interact.*

*Understand why it is important for installers to be well trained.*

*Differentiate between flat-plate collectors and concentrating collectors.*

*Understand how the different types of solar energy technologies utilize solar radiation.*

### **Lesson Duration**

How long will it take to complete the lesson?

6 hours

### **Related Learning Standards (if applicable)**

Please refer to any work-based and/or academic learning standards that may apply to this lesson/course.

2.C.O.2 *Define voltage and identify the ways in which it can be produced.*

2.C.O.3 *Explain the difference between conductors and insulators.*

2.C.O.4 *Define the units of measurement that are used to measure the properties of electricity.*

2.c.O.5 *Explain how voltage, current, and resistance are related to each other.*

2.C.O.6 *Using the formula for Ohm's law, calculate an unknown value.*

2.C.O.7 *Explain the different types of meters and equipment used to measure voltage, current, resistance and power.*

2.c.O.8 *Using the power formula, calculate the amount of power used by a circuit.*

2.D.O.1 *Explain the basic characteristics of a series, parallel and combination circuit.*

### **Intended Learning Outcomes**

Outcomes should be "SMART"

Specific – Objectives should specify what they want to achieve.

Measurable – You should be able to measure whether you are meeting the objectives or not.

Achievable – Are the objectives you set, achievable and attainable?

Realistic – Can you realistically achieve the objectives with the resources you have?

Time – When do you want to achieve the set objectives?

- A) Students will be able to define photovoltaics, photovoltaic system and load.
- B) Identify the advantages of using PV systems.
- C) Identify the disadvantages of using PV systems.
- D) Describe the process of electricity distribution.
- E) Describe common applications of PV systems.
- F) Describe the different levels of the PV industry and how they interact.

Please outline the following for each lesson

- G) Identify and describe common types of collectors.
- H) Identify some common techniques of solar architectural design.
- I) Identify and describe common method of converting solar radiation into heat energy.
- J) Describe how solar energy can be harnessed through chemical process.
- K) Describe the characteristics and advantages of solar lighting.

### **KNOW**

By the end of this lesson students will know...

This may include facts, names, dates, places, information, vocabulary.

*By the end of this module students will have a full understanding of the following vocabulary:. Photovoltaics, photovoltaic (PV) system, load, utility grid, distributed generation, balance of system (BOS) components, integrator, solar energy collector, full-plate collector, concentrating collector, and concentrating solar power (CSP).*

### **UNDERSTAND**

By the end of this lesson students will understand....

This may include big ideas, generalizations, principles, ideas that transfer across situations.

By the end of this lesson students will have a better understanding of the factors that motivated the growth of PV technology worldwide.

Understand how the different types of solar energy technologies utilize solar radiation.

Students will have a better understanding of the development of photovoltaic technology, and environmental, health, and safety issues.

***Do By the end of this lesson students will understand.....This may include skills of the discipline, social skills, production skills, and processes.***

## **Implementation**

### **Pre-Assessment**

How will you determine students' prior knowledge and understanding for this unit?

What data will you collect?

How will you survey prerequisite learning?

*For this lesson there is no pre-assessment since it is based on entry level learning knowledge.*

### **Resources & Materials**

Attach copies of handouts, slides or visuals required

What equipment is needed to conduct the activities in the lesson?

What do the students need to be able to participate in the lesson?

*Photovoltaic Systems Textbook (American Technical Publisher, Inc.)*

Please outline the following for each lesson

*ISBN 978-0-8269-1287-9 and related Power point Presentation.*

*Photovoltaics Design and Installation Manual textbook.( Solar energy International) ISBN 978-0-86571-520-2N*

### ***Activities Plan (Optional)***

Provide as much detail as possible so that an instructor/trainer could use this plan to teach the course.

This may include a step by step action plan, teaching methodologies or types of activities (e.g. group work, lecture, case study, etc)

Each Lesson may have several activities.

For each activity provide a title and identify the duration of the activity.

For each activity outline the steps the instructor will take to complete the activity.

*Lecture series, demonstrations, explanations using a smart board, questions and answers throughout presentation.*

### ***Assessment/Demonstration of Competencies***

How will the students be assessed on what they have learned?

*Review questions throughout presentation and interaction with students.*

*Test which consist of True & False, multiple choice, and essay questions.*