LESSON

STC and the Impact on Solar Production

BIG IDEA(S)

STC (Standard Test Conditions) are how PV modules are tested and are the conditions under which the module performance is measured.

OBJECTIVES

Students will:

- Evaluate the output of a solar panel
- Explain when solar panels can perform at their best
- Explain the following solar fundamental terms
  - Standard Test Conditions (STC)
  - Voltage open circuit (V_{OC})
  - Amperage max power (Ipmax)

TASK LIST SUBCATEGORY

601 Demonstrate ability to monitor system

603 Demonstrate the use of testing and performance equipment

607 Analyze monitoring results for solar power systems

OVERVIEW

STC (Standard Test Conditions) are how PV modules are tested and are the conditions under which the module performance is measured.

STANDARDS

PA/SDP

3.4.10.B2. Demonstrate how humans devise **technologies** to reduce the negative consequences of other **technologies**.

3.4.12.A2. Describe how management is the process of planning, organizing, and controlling work.

3.4.12.B2. Illustrate how, with the aid of **technology,** various aspects of the environment can be monitored to provide information for decision making.

INSTRUCTIONAL

TEXTS/REFERENCES

Solar Photovoltaic Basics, White, 2019. p. 44

Solar Electric Handbook, SEI, 2013. Pp. 96; 102; 104-5

MATERIALS NEEDED

Teacher Preparation/Presentation:

https://www.pveducation.org/pvcdrom/properties-of-sunlight/air-mass

Understand how to use an Amprobe Solar 100 irradiance meter

Content: How to use an irradiance meter for successful solar inspections

BRIGHT SOLAR FUTURES

SOLAR

TOPIC OF STUDY

Solar Fundamentals

Level 1:
2 HOURS
Level 2:
3 HOURS
Level 3:
3 HOURS

KEY TERMS

standard test conditions (STC)
voltage
current
irradiance
insolation
solar radiation
voltage open circular (V_{OC})
Amperage short circuit (I_{SC})
Ipmax
Vpmax

INSTRUCTIONAL - CONTINUED

MATERIALS

- Irradiance meter
- Thermometer (infrared)
- Multimeter

IMPLEMENTATION (LESSON PLAN)

1. Standard test conditions (STC) refers to the circumstances in which a solar panel will produce its rated wattage output (Pmax). STC has the following characteristics
    a. 1,000 W per meter squared of light irradiation
        i. Use an irradiance meter
        ii. Ensure the meter is measuring irradiance using the W/M^2
    b. 1.5 Air Mass (AM)
        i. Air Mass is difficult to measure. Usually you are very close to 1.5 AM unless you are in an area with elevation or some other special circumstance.
    c. 25° C / 77° F
        i. Use a weather app to check ambient temperature
        ii. Use an infrared thermometer
2. Understanding STC is very important. All calculations on the performance of solar panels is based on STC. If the ambient weather conditions do not match STC one has to determine how great the difference is between the actual conditions and STC and then derate the solar panel output by that amount.
3. Voltage appears with the presence of very little light. So even in low light conditions you will get significant voltage from a solar panel.
4. However, in order for current to flow a solar panel needs intense light. So current will not flow without bright, direct light.
5. When measuring the light also measure voltage open circuit (V_{OC}) and amperage short circuit (I_{SC}) so that all readings will be coordinated.
6. Remember, if you are at STC then a solar panel should be able to achieve it's Ipmax, Vpmax, and Pmax ratings.
7. Solar time reflects the sun's position in the sky. For example solar noon is when the sun is highest in the sky. When measuring solar output it is good to be as close to solar noon as possible. Measuring PV output in low light conditions can be very difficult.
8. ACTIVITY: Take a solar panel outside and measure the temperature and solar irradiation. Using a multimeter measure Voc and Imp. Do the results match up with what you would expect? https://www.pveducation.org/pvcdrom/properties-of-sunlight/air-mass
9. Understand how to use an Amprobe Solar 100 irradiance meter

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