



Watts On Your Mind?

Solar energy educational activities for schools

Activity Overview

Grade Level: Varies
Activity: WOS-3

Description

Students will use a computer with a spreadsheet application to analyze the data from their solar electric system and make inferences from their results.

Learning Outcome

Students will learn about their solar electric system's performance over a one-year period.

Subjects

Computer science

Process Skills Used

Discussion, application, research, and computer literacy, communicating, group interaction

Duration

2 class periods

Key Vocabulary

Fields, equivalent kilowatt-hours, download

Curriculum Standards

Texas (TEKS): 112.42.c.6

Louisiana (LSCS):

PS-M-C6, PS-H-F1

Arkansas (ASCF): 3.1.34,
4.1.28

National (AAAS Project
2061):

The Designed World – 12th

The Physical Setting – 12th

What's My Solar Electric System Producing?

Materials

- Computer with internet access or connected to solar electric system
- Computer spreadsheet application
- Worksheet (included in activity)

Method

Divide the class into groups according to the number of computers available. Download your school's data file for the current year and save it for use in a computer spreadsheet application. (See Activity WOS-2 "What's On The Website?") Assign each group a particular month and ask them to analyze data for their assigned month. Perform the data analysis as outlined in the worksheet.

Background

Data files for each site are saved in a comma-delimited format. The contents of each file look like something like this:

```
...  
1,1,1999,252,1415,30.47,1049,.914,3.707,118.5,9.1  
1,1,1999,252,1430,29.72,1030,1.343,3.659,119.4,9.14  
...
```

Average measurements are calculated, time-stamped and recorded every fifteen minutes; thus, each line (or record) in the file represents fifteen minutes of data. "Comma-delimited" means that each column (or field) is set off from the other data by commas. The columns (fields) are defined as follows:



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Field Definition

- 1 Array ID. You can safely ignore this value.
- 2 Program version ID. This helps us keep track of how we've programmed the datalogger unit. You can ignore it, too.
- 3 Year (YYYY).
- 4 Julian Day of Year (1-365). See the [Day of Year Calendar](#) below or use our [Excel Julian Date Worksheet](#) to compare and translate Julian date to month and day.
- 5 Time of Day (0100-2400).
- 6 Average Temperature (degrees Celsius).
- 7 Average Plane of Array Solar Irradiance (watts per square meter). This is a measurement of the amount of solar energy available to the array. Under normal conditions, about 10-12 percent of this energy will be converted into electricity.
- 8 Average Wind Speed (meters per second).
- 9 Average PV System AC Power Output (kilowatts). This is the net power of the system, after the DC power has been converted to AC power by the inverter.
- 10 Cumulative Energy Production Meter (kWh). This field simulates an electric meter, calculating and recording the cumulative number of kilowatt-hours of electricity produced by the system.
- 11 System Efficiency (percent). By dividing the system's AC power output (field 9) by the amount of solar energy available to the system (FIELD 7 times the array area), we calculate and record the average system efficiency.

All averages are fifteen minute values computed from 900 observations at one second intervals.



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Worksheet

Part A – Calculations/Observations

Calculate/identify the following values for your assigned month:

VARIABLE	VALUE
Month:	
Total monthly kilowatt hours generated:	
Average daily kilowatt hours generated:	
Peak kilowatts:	Date: _____
Peak wind speed:	Date: _____
Average daily temperature:	
Average peak daily solar irradiance (for the month):	

Part B - Graph

1. Make weekly graphs of the following:
 - Kilowatts
 - Solar irradiance
 - Temperature
 - Wind speed

(*Advanced: Plot 2 variables on the same graph)

2. Describe the system's performance for your assigned month:



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Part C – Monthly Comparison

1. Ask a representative from each group to summarize the statistics calculated in Part A and summarize the solar electric system's performance for the month.
2. Discussion: What, if any, differences did you notice about your system's performance over the months that were analyzed?