

Time Frame:	Standards:
45-60 minutes	Idaho Math Standard: 4.3, 5.1, 5.2, 5.3, 5.5
Objectives:	
<ol style="list-style-type: none"> 1. Students will be able to represent and organize data in scatter plots and tables. 2. Students will be able to calculate measurements of center. 3. Students will be able to formulate predictions from given data. 	
Background Information:	
<p>-The teacher should read through the lesson before teaching it and become familiar with the concepts covered.</p> <p>- The students should have a background knowledge of the following:</p> <ul style="list-style-type: none"> o Graphing on x-y-coordinate planes. o Converting rates (m/s to mph) <p>-This lesson uses wind turbine energy references, and thus the students and teacher should have already formed a background on wind energy. (A good way to do this is to teach the lesson Wind Power and Turbines.)</p> <p>-This lesson is designed to follow the Fractions, Decimals, & Percents lesson.</p>	
Materials:	
<ul style="list-style-type: none"> - Math Minutes A1.5 and Math Minutes A1.6 - Power Output and Wind Speeds 	
Procedure:	
<ol style="list-style-type: none"> 1. Students complete <i>Math Minutes A1.5</i> 2. Teacher explains and teaches the following statistical terms: <ul style="list-style-type: none"> - Statistics: a set of concepts, rules, and procedures that help us to: <ul style="list-style-type: none"> o Organize numerical information o Understand statistical techniques underlying decisions that affect our lives and well-being o Make informed decisions - Data: facts, observations, and information that come from investigations. <ul style="list-style-type: none"> o Measurement data (quantitative data) – the result of using some instrument to measure something. - Variable: property of an object or event that can take on different values. <ul style="list-style-type: none"> o Independent variable: a variable that stands alone; its value determines the values of other variables. (the independent is the cause, and the dependent is the effect) <ul style="list-style-type: none"> ▪ Domain: the spread of the independent variable. o Dependent variable: a variable that is not under the experimenter’s control (the data); it is the variable that is observed and measured in response to the independent variable. <ul style="list-style-type: none"> ▪ Range: the spread of the dependent variable. 	

- Graphs: visual display of data used to notice patterns.
 - o Line Graph: used to display trends over time
 - o Scatter Plot: compares pairs of values
 - o Bar Graph: comparing multiple values
 - o Pie chart: used to represent pieces of a whole
 - Measures of Center
 - o Mean: average, add all quantities together and divide by the total.
 - o Median: middle number when quantities are in numerical order.
 - o Mode: most often occurring quantity.
3. Handout *Power Output and Wind Speeds*. (If the school has their own wind turbine, or has access to data from a wind turbine, then the students could collect their own data for number 1.)

Vocabulary:

Math:

Statistics, Data, Quantitative data, Variable, Independent variable, Dependent variable, Domain, Range, Graphs, Line Graph, Scatter Plot, Bar Graph, Pie Chart, Measures of Center, Mean, Median, Mode

Assessment:

The anticipated assessment is the completed tables, graphs, and questions from the activity, with the correct answers.

Also the students will complete *Math Minutes A1.6* the following lesson day.

References:

www.noaa.gov (forecasted wind speeds)

http://69.20.174.50/Skyline_WindTurbine.html (realtime data on wind turbine)

Additional Material

Math Minutes A1.5

Name _____	MATH MINUTES A1.5	
Date _____		
Definitions	Application	
Percent = _____	Describe at least one thing percent of increase can represent: _____	
Percent of increase = _____		
Math Problems	Word Problems	
Write each fraction as a decimal and as a percent.	Write each decimal as fraction.	
1. $\frac{3}{4}$ = _____ = _____	3. .25 = _____	
2. $\frac{5}{8}$ = _____ = _____	4. $.3\bar{3}$ = _____	
	5. .44 = _____	
Word Problems		
6. Only 7.5% of the energy consumed in the U.S. is renewable energy, and 40.8% of the energy consumed in the U.S. is petroleum gas. What fraction of the total energy used in the U.S. is renewable energy and what fraction is petroleum?		
7. In percent, how much more Petroleum is consumed than renewable energy?		

Math Minutes A1.6

Name _____
Date _____

MATH MINUTES A1.6

Definitions

Quantitative Data = _____
Dependent Variable = _____
Scatter Plot = _____
Median = _____

Application

Describe what statistics are and name at least one thing they help us with: _____

Math Problems

1. Find the mean, median, and mode of the following data set: 7, 5, 2, 5, 3, 7, 11, 13, 4, 7, 6, 4

Word Problems

2. Forecasters and researchers use a wind damage scale called the F scale to classify tornadoes. The ratings are based on the amount and type of wind damage. The ratings are as follows:
F-0: Light damage. Wind up to 72 mph. **F-1:** Moderate damage. Wind 73-112 mph.
F-2: Considerable damage. Wind 113-157 mph. **F-3:** Severe damage. Wind 158-206 mph.
F-4: Devastating damage. Wind 207-260 mph. **F-5:** Incredible damage. Wind above 261 mph.

What is the range for an F-2? F-3?

What would the median wind be in an F-1 tornado?

If winds were clocked at 165 mph what would the tornado be classified? What kind of damage could be expected?

Energy for Educators

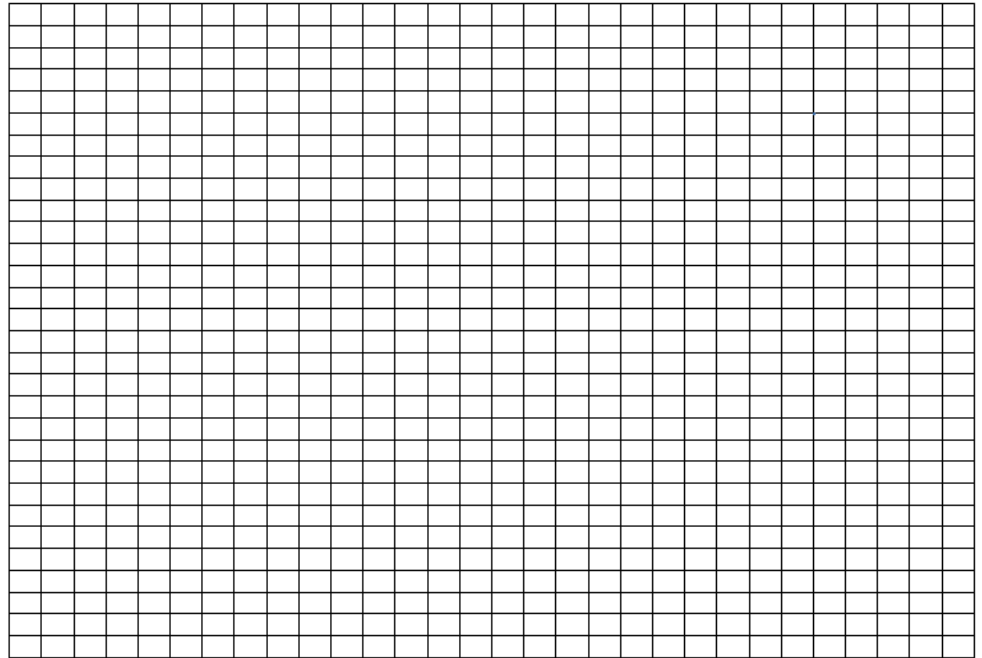
Bringing Energy into the Classroom

Name _____

Power Output and Wind Speeds

1. Make a scatter plot of the following data: (Be sure to label the axes and give it a title.)

Wind (m/s)	Power (watts)
0	0.0
1	6.2
2	7.1
3	67.0
4	168.9
5	316.0
6	524.9
7	791.0
8	1082.7
9	1406.7
10	1603.1
11	1806.8
12	1982.2
13	2071.8



2. Using the above data, identify the:

- a. Independent variable _____
- b. Dependent variable _____
- c. Domain _____
- d. Range _____

3. On the internet, find hourly wind forecasts for your area, by following these steps:
- a. Go to www.noaa.gov
 - b. Enter your zip code or city and state in the weather.gov box, which can be found on the left side about halfway down and click "GO"
 - c. Click on "Hourly Weather Graph" in the "Additional Forecasts and Information" box which can be found at the bottom right.
 - d. Uncheck all the boxes except "surface wind" and change it to m/s then click submit.
 - e. Click on the graph.
 - f. From here, you can click on "forward 2 days" to see more results.

Energy for Educators

Bringing Energy into the Classroom

4. Make a table which represents an entire day's forecasted wind speeds for each hour in that day. Also record any forecasted gusts.

5. Using your graph from #1, predict the power output of at least 3 different wind speeds.

a. Wind speed _____ Power Output _____

b. Wind speed _____ Power Output _____

c. Wind speed _____ Power Output _____

6. Using your data from #4 find the mean, median, and mode of the forecasted wind speeds.

a. Mean _____ b. Median _____ c. Mode _____

7. Were there any outliers in your data? _____ If so, what were they? _____

What is an outlier? _____

8. Using the mean, median, and mode wind speeds, predict the power output.

a. Mean power output _____

b. Median power output _____

c. Mode power output _____

9. Do you think the mean, median, or mode is most accurate? _____

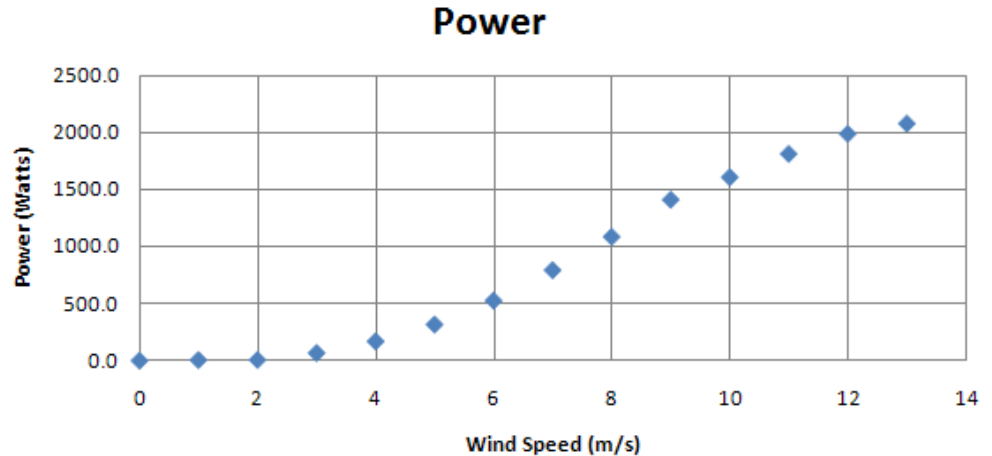
Why? _____

Name ANSWERS

Power Output and Wind Speeds

1. Make a scatter plot of the following data: (Be sure to label the axes and give it a title.)

Wind (m/s)	Power (watts)
0	0.0
1	6.2
2	7.1
3	67.0
4	168.9
5	316.0
6	524.9
7	791.0
8	1082.7
9	1406.7
10	1603.1
11	1806.8
12	1982.2
13	2071.8



2. Using the above data, identify the:

- a. Independent variable wind speed b. Dependent variable power
- d. Domain 0-13 d. Range 0-2071.8

3. On the internet, find hourly wind forecasts for your area, by following these steps:
- Go to www.noaa.gov
 - Enter your zip code or city and state in the weather.gov box, which can be found on the left side about halfway down and click "GO"
 - Click on "Hourly Weather Graph" in the "Additional Forecasts and Information" box which can be found at the bottom right.
 - Uncheck all the boxes except "surface wind" and change it to m/s then click submit.
 - Click on the graph.
 - From here, you can click on "forward 2 days" to see more results.
4. Make a table which represents an entire day's forecasted wind speeds for each hour in that day. Also record any forecasted gusts. (Answers Vary)

Energy for Educators

Bringing Energy into the Classroom

		6/9/2010	
		wind m/s	Gusts
Time	0	3	
	1	3	
	2	3	
	3	3	
	4	3	
	5	3	
	6	3	
	7	3	
	8	3	
	9	3	
	10	3	
	11	3	
	12	6	22
	13	6	22
	14	6	22
	15	6	22
	16	6	22
	17	6	22
	18	5	
	19	5	
	20	5	
	21	5	
	22	5	
	23	5	

5. Using your graph from #1, predict the power output of the following wind speeds.
 - a. Wind speed 6 mph = 2.7 m/s → Power Output ≈ 55
watts
 - b. Wind speed 13 mph = 5.8 m/s → Power Output ≈ 450
watts
 - c. Wind gust 45 mph = 20.1 m/s → Power Output ≈ 2500 watts or more

6. Using your data from #4 find the mean, median, and mode of the forecasted wind speeds.
(Answers vary)
 - a. Mean 4.25 m/s b. Median 4 m/s c. Mode 3
m/s

7. Were there any outliers in your data? yes If so, what were they? gusts at 22
m/s What is an outlier? Data that stands out from the other data around
it.



PREDICTING POWER

BLACKHAM

8. Using the mean, median, and mode wind speeds predict the power output. (*Answers vary*)

a. Mean power output ≈ 200 m/s

b. Median power output ≈ 169 m/s

c. Mode power output ≈ 67 m/s

9. Do you think the mean, median, or mode is most accurate? *Answers vary*

Why? *Answers vary*

Energy for Educators

Bringing Energy into the Classroom