Summary: Students explore graphing techniques used in Wisconsin Energy Statistics and learn how to construct pie graphs.

A Piece of the Pie

Grade Level: 9–12 (5–8)

Subject Areas: English Language Arts, Mathematics, Science

Setting: Classroom

Time:
Preparation: 50 minutes
Activity: Two 50-minute periods

Vocabulary: British thermal unit (Btu), Data, Statistics

Major Concept Areas:
Theme II

- Development of energy resources
- Development of renewable energy resources

Theme IV

- Future outlooks for the development and use of energy resources

Standards Addressed:
Wisconsin Model Academic:
ELA: A.12.4, C.12.1, C.12.3
MA: A.12.1, A.12.4, A.12.5, A.12.6, B.12.3, B.12.5, C.12.1, C.12.2, D.12.2, D.12.3, E.12.3, E.12.4
SC: A.12.1, A.12.5, C.12.6, G.12.3, G.12.4, H.12.5, H.12.6

Common Core ELA: RST.9-10.1, RST.9-10.2, RST.9-10.7, SL.9-10.1, WHST.9-10.7

Common Core Math: MP4, MP5, 4.MD.6, N-Q.1, S-IC.6

NGSS:
SEP: Analyzing and Interpreting Data

Objectives
Students will be able to

- design pie graphs; and
- use pie graphs to compare and contrast data.

Rationale
By learning how to accurately analyze graphs, students learn an effective tool for comparing energy use during various time periods.

Materials

- Copies of the latest *Wisconsin Energy Statistics* or photocopies of selected pages (see **Getting Ready**).
- Copies of ***How to Construct Pie Graphs***
- Drawing compasses (or string)
- Pencils
- Rulers
- Protractors

Getting Ready
Copies of *Wisconsin Energy Statistics* are available online. Visit the KEEP website for the link.

Background
How does our energy use in Wisconsin today compare by type and amount to that used ten years ago? 20? 100? How about in the future? Energy resource managers and policy makers often use statistics to answer these questions. Graphing the data helps visualize the figures and numbers; it helps to see trends and patterns.

Each year, the Wisconsin Division of Energy of the Department of Administration publishes *Wisconsin Energy Statistics*. This document includes tables and figures about energy use in Wisconsin, based on type of fuel, sources, costs, and other modes of analysis. It includes information on renewable energy trends as well as transportation.

Home and business owners, even those not directly involved in energy resource management, can benefit from exploring and understanding the information within *Wisconsin Energy Statistics*. Interested in knowing the potential for wind energy in Wisconsin? How about the population of Wisconsin and average income? You can find this information and more by getting your own copy of *Wisconsin Energy Statistics* (see **Getting Ready** to find out how).

Procedure
Orientation
Ask students how they think energy use in Wisconsin has changed in the last 20 years. How have transportation, homes, businesses, and recreational habits changed? Ask students how they would find out information on past energy use trends and patterns. Introduce the term 'data' and ask students how they have heard it used.

Provide students with copies of *Wisconsin Energy Statistics* or selected pages from the document. Have them page through the document and comment on the data found. Ask students to locate charts referring to renewable energy resources. Note their observations and understandings.

Steps

1. Have students focus their attention on Wisconsin Resource Energy Consumption, by Economic Sector, within *Wisconsin Energy Statistics*. What data or information is provided on this page and how is it presented? As needed, ask students questions to ascertain their understanding of the data (e.g., Based on the graph, how many Btu of energy are used by the residential sector? What percent is this of the total?).

2. Discuss the use of various graphing methods, such as line and pie graphs. What are the advantages and disadvantages of each?

3. Tell students to find references to renewable energy in the statistics. For

example, renewable energy is listed within each set of data that describes fuel use by sector. There is also data about types of renewable energy used in Wisconsin.

4. Hand out copies of ***How to Construct Pie Graphs*** and demonstrate how to construct a pie graph.

5. Assign or allow students to select a particular set of data to construct a pie graph. Following are a couple suggested strategies:

- Divide the class into economic sectors (residential, commercial, industrial, agriculture, transportation). Each group can create a pie graph from the current data for that sector and examine what proportion of fuel use is renewable.
- Have the class work from one set of data, such as Wisconsin Renewable Energy, by Type of Fuel, but pick different years to graph.

6. As students work, check their pie graphs. Make sure they label and title appropriately.

Closure

Post all of the graphs and have students comment on the various sizes of the "pies" and the proportions of the pie slices for each type of energy source, especially renewable. Lead them in a discussion about trends and patterns. Discuss implications of those trends.

Assessment

Formative

- Did students create an accurate pie graph?
- Can students generate acceptable explanations of similarities and differences among graphs?

Summative

Assign students the task of creating another pie graph. This time they will not have any numerical data. Have students predict the amount and type of energy used in the future, especially renewable energy. Then they should write a description of why they believe the pie graph of the data would look like this.

Extension

Have students learn about different graphing methods and apply these to *Wisconsin Energy Statistics*.

How to Construct Pie Graphs

Basic steps for constructing a pie graph

1. Identify the data you want to convert to a pie graph. Make sure it provides the amounts for various items and a total value is provided (e.g., the amount of types of energy consumed and total energy consumed).

2. Draw a line from the top of your paper toward the middle. Identify one spot near the middle of the page to be the center of the circle.

3. To calculate the size of the pie, you'll need to first find the radius. Divide the total value by (3.14) and then find the square root of this number. The answer is the radius of your circle in centimeters. For example, let's say that in 1999, the total energy consumption was 1725.1 trillion Btu. The radius of your circle should be 23.43 cm.

4. Using a drawing compass (or a piece of string tied to a pencil), draw your circle. Start from the middle point you established in the first step and set the compass (or measure the string) to the radius you calculated in the previous step.

5. Calculate what degree or portion of the circle is taken up by each of the items that make up the total value (e.g., amount of each type of energy consumed).
   - Use the percentages provided by the data (if the percentages are not given, you'll need to figure this out first*).
   - Multiply each percentage figure by 360 (the number of degrees in the whole circle) and divide it by 100. For example, in the above circle about total energy consumption, if 29.5% is petroleum, 106.2° of the circle will be for petroleum.
   - The total of the degrees should add up to 360.

6. To make the pieces of the pie, set a protractor in the center of the circle and measure out the first portion in degrees from the line you drew down the middle of the page. Make a mark on the paper; next, draw a straight line from the center of the circle, through the mark, to the edge of the circle. This is your first slice. For the second slice, set the protractor in the center of the circle and measure out the second portion in degrees from the line you just drew; mark it and draw a straight line through the mark from the center of the circle to the edge. Proceed like this for the remaining slices, using your most recently drawn line as the center line.

* To figure out percentage, you'll need to find the total of all the figures and then divide each figure, in turn, by the total and then multiply by 100.