Big Ideas:
• Students will construct wind turbines in order to learn about wind energy and how the wind can be harnessed to move objects.
• Students will test their own turbine design to determine which design works the most effectively (in terms of speed).

Assessment:
• Student’s turbine design will be graded using the following rubric:

<table>
<thead>
<tr>
<th>Engineering Rubric</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Wind Turbine" /></td>
</tr>
<tr>
<td>Engineering Portfolio thoroughly completed with accurate information.</td>
</tr>
<tr>
<td>4 points</td>
</tr>
<tr>
<td><img src="image" alt="Wind Turbine" /></td>
</tr>
<tr>
<td>Engineering Portfolio mostly completed with accurate information.</td>
</tr>
<tr>
<td>3 points</td>
</tr>
<tr>
<td><img src="image" alt="Wind Turbine" /></td>
</tr>
<tr>
<td>Engineering Portfolio partially completed with accurate information.</td>
</tr>
<tr>
<td>2 points</td>
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<tr>
<td><img src="image" alt="Wind Turbine" /></td>
</tr>
<tr>
<td>Engineering Portfolio not completed with accurate information.</td>
</tr>
<tr>
<td>1 point</td>
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</tbody>
</table>

- Environment, economy, and industry.
- Compare/Contrast wind and air turbines.
- Brainstorm different ways to construct/design turbines.
- Explore different designs of turbines and their effectiveness.
- Illustrate designs of turbine blades.
• Explore how wind is a natural source of energy and ways to conserve energy.
• Test designs and record data on designated charts. Compare/Contrast data.
• Discuss safety issues of workers while building turbine blades.
• Invite a guest speaker to speak about turbines (functions, design, purposes, safety, etc.)
• Formulate plans for use of appropriate aerodynamics.
• Create a journal consisting of which design was fastest, what they may do differently next time, and a sketch an improved model for the future. Also, record daily work in the reflection journal.

Timeline: (Students will record their work/accomplishments in their Engineering Portfolio after each lesson)
• Introduction activity: Bring in a local wind turbine (from Edwards or Pickens Middle) for students to look at and observe how it works.
• Day 1-3: Students perform research on turbines answering essential questions such as: what are the purposes of turbines, how do they work, how do they conserve energy, how does aerodynamics affect the use of a turbine, what effect do they have on our environment, how do they increase/decrease our economical standings, and how do they directly or indirectly effect industry?
• Day 4: Design a poster that demonstrates student’s research findings (as opposed to a full report).
• Day 5: Formulate plan of construction of wind turbine (use Plan and Development sheet)- list what materials are needed, sketch what their proposed turbine will look like (including shaft, tower, and blade).
• Day 6-9: Begin constructing blades (students should have at least 3 different blade designs for testing), shaft, and tower.
• Day 10-11: Test different blades for the speed in which the wind blows. Use a hairdryer for wind production. Test all three blades on low and all three blades on high. To test the speed, the string will wrap around the shaft. Time how long it takes to wrap around the shaft and this time will be your speed. Record the speeds on Data Sheet and transfer the data to the Data Graph Sheet.
• Day 12: Students complete the Test and Evaluate sheet to reflect on how they would do this differently.
• Day 13: Use the Test and Evaluate sheet to write a conclusion to our project in our journal.
• Day 14: Students will present their poster of research findings, their turbine designs, and data.
• Day 15: Guest Speaker- students will send the guest speaker thank-you cards at a later date.

*All worksheets/graph sheets will be included in the Engineering Portfolio Packet.

Materials:
• Rulers
• Glue
• Paper
• Paper plates
• Tape
• Poster board
- Scissors
- Cardboard
- Dowel rods
- Stopwatch
- Blow dryer
- Balsa wood/craft sticks
- Colored pencils
- Eyelets
- Engineering Portfolio Packets

**TEST AND EVALUATION SHEET**
**DAILY JOURNAL RECORD**

<table>
<thead>
<tr>
<th>DATE</th>
<th>DAILY REFLECTION: What did you discover today?</th>
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<tbody>
<tr>
<td>DATE</td>
<td>LEVEL (1 OR 5)</td>
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<tr>
<td>QUESTION??</td>
<td>YOUR ANSWER!!</td>
</tr>
<tr>
<td>-----------</td>
<td>---------------</td>
</tr>
<tr>
<td>WHAT ARE TWO THINGS YOU LEARNED BY BUILDING YOUR TURBINE?</td>
<td></td>
</tr>
<tr>
<td>EXPLAIN AND DESCRIBE THE RESULTS OF THE VARIOUS TESTS YOU CONDUCTED ON THE WINDMILL.</td>
<td></td>
</tr>
<tr>
<td>-----------------------------------------------------------------</td>
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</tr>
<tr>
<td>HOW WOULD YOU WANT TO REDESIGN A DIFFERENT TURBINE BASED ON YOUR RESULTS?</td>
<td></td>
</tr>
<tr>
<td>WHAT WOULD YOU DO DIFFERENTLY NEXT TIME? WHY?</td>
<td></td>
</tr>
<tr>
<td>WHAT DID YOUR DESIGN TEAM ENJOY MOST ABOUT THIS ACTIVITY?</td>
<td></td>
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</tbody>
</table>

SKETCH A MODEL OF A TURBINE THAT YOU WOULD DESIGN DIFFERENTLY NEXT TIME:
# PLAN AND DEVELOP SHEET

## HOW WILL YOUR GROUP MAKE THE WINDMILL?

<table>
<thead>
<tr>
<th>PART NAME</th>
<th>HOW WILL IT BE MADE?</th>
<th>WHAT MATERIAL IS NEEDED?</th>
<th>WHO WILL MAKE IT?</th>
</tr>
</thead>
<tbody>
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## MAKE SEVERAL SKETCHES OF WHAT YOU THINK YOUR TURBINE WILL LOOK LIKE? YOU MAY COMBINE IDEAS FROM EACH SKETCH TO MAKE ONE ILLUSTRATION...

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**Science Standards:**

5-5.1 Illustrate the affects of force (including magnetism, gravity, and friction) on motion.

5-5.2 Summarize the motion of an object in terms of position, direction, and speed.

5-5.3 Explain how unbalanced forces affect the rate and direction of motion in objects.

5-5.5 Use a graph to illustrate the motion of an object.

5-1.3 Use a simple technological design process to develop a solution or a product, communicating the design by using descriptions, models, and drawings.
ELA Standards:

5-6.1 Clarify and refine a research topic.

5-6.2 Use print sources (for example, books, magazines, charts, graphs, diagrams, dictionaries, encyclopedias, atlases, thesauri, newspapers, and almanacs) and nonprint sources to access information.

5-6.3 Select information appropriate for the research topic.

5-6.4 Paraphrase research information accurately and meaningfully.

5-6.5 Create a list of sources that contains information (including author, title, and full publication details) necessary to properly credit and document the work of others.

5-6.6 Use the Internet as a source of information.

5-6.7 Use vocabulary (including Standard American English) that is appropriate for the particular audience or purpose.

5-6.8 Use appropriate organizational strategies to prepare written works and oral and visual presentations.

5-6.9 Select appropriate graphics, in print or electronic form, to support written works and oral and visual presentations.

Social Studies Standards:

5-2.1 Illustrate the effects of settlement on the environment of the West, including changes in the physical and human systems. (G)

5-2.2 Explain how the Industrial Revolution was furthered by new inventions and technologies, including new methods of mass production and transportation and the invention of the light bulb, the telegraph, and the telephone. (E, H)

5-2.3 Explain the immediate and lasting effect on American workers caused by innovations of the New Deal, including the Social Security Act, the Federal Deposit Insurance Corporation, and the Civilian Conservation Corps. (P, E, H)

Math Standards

5-6.1 Design a mathematical investigation to address a question.

5-6.2 Analyze how data-collection methods affect the nature of the data set.

5-6.3 Apply procedures to calculate the measures of central tendency (mean, median, and mode).

5-6.4 Interpret the meaning and application of the measures of central tendency.
References:
Models for Introducing technology – A Standards-Based guide, copyright 2003, International technology Education Association