



PUZZLE: BUILD A PAPER WINDMILL

STANDARDS & CONNECTIONS: NGSS.3-5-ETSI, NGSS.MS-ETSI, NGSS.HS-PS3-3

SUGGESTED MATERIALS: Paper, pencils with eraser tops, push pins, scissors

BACKGROUND: Agriculture includes food, feed, fiber and energy. Energy powers our cities, farms, and rural communities. The most common energy sources are the fossil fuels coal, oil, and natural gas. A growing industry is renewable or clean energy, which includes energy sources like solar, wind and water.ⁱ We have been using wind energy for a long time – Egyptians used wind energy to power boats and American colonists used windmills to grind grain and pump water. Today we use windmills – tall towers with blades – that catch wind and convert it into energy.ⁱⁱ

1. IDENTIFY: Share the background information with the students, then share the puzzle to be solved. Determine constraints (e.g., time allotted, space, materials provided, etc.) and divide students into small groups.

2. IMAGINE: Ask a series of questions to help students brainstorm solutions to the puzzle. Encourage students to list all ideas – don't hold back! Before moving on, make sure each group selects a solution that fits within the constraints.

- Ask: *How can you solve this puzzle? Which of your ideas can you build a prototype for given the constraints?*

3. DESIGN: Students diagram the prototype, identify the materials needed to build the prototype, and write out the steps to take. Students describe the expected outcomes.

- Ask: *What steps will you take to create your solution? What do you expect your solution to look like and be able to do?*

4. CREATE: Students follow their design plan and build their prototypes. Monitor their progress and remind them about how much time they have.

5. TEST & IMPROVE: Students evaluate their creation and compare it with the expected outcomes. Students seek areas of improvement and make changes where needed.

6. SHARE: Students share their solution to the puzzle and communicate lessons learned.

- Ask: *What was your biggest takeaway? What would you do differently?*

ADDITIONAL RESOURCES: For more background information on this topic, please visit www.purpleplow.org.



Place the windmills outside in your school garden.

ⁱ U.S. Department of Energy. (n.d.). *Clean energy*. Retrieved from <https://www.energy.gov/science-innovation/clean-energy>

ⁱⁱ U.S. Department of Energy. (2014, June 20). *How a wind turbine works*. Retrieved from <https://www.energy.gov/articles/how-wind-turbine-work>