Wind_turbines

Earth & Space Science | Engineering Design Process

Engineering Challenge

Visible Elements in Photo

- Multiple white wind turbines of varying heights arranged across a flat landscape
- Three-bladed rotor design on each turbine
- Tall cylindrical tower structure supporting each turbine
- Agricultural field (plowed rows visible in foreground)
- Power transmission lines running horizontally across the scene
- Blue sky with sparse clouds
- Flat terrain with distant tree line

Reasonable Inferences

- From turbine blades and open field location: Wind is a primary resource in this area; turbines are positioned to maximize exposure to wind currents.
- From power lines and multiple turbines: These structures generate electricity that is distributed to communities through an energy grid.
- From agricultural setting: Land use must balance farming and energy production, suggesting a design constraint around space efficiency.

Engineering Task

K-2 Challenge:

Build a Spinning Wind Catcher

Your job is to design and build a spinning blade that catches the wind. Use straws, paper, and tape to make three blades that stick out from a center point. Test your design by holding it up to a fan or blowing on it. Can you make it spin faster? Try different blade shapes and sizes. What works best?

3-5 Version:
Design a Wind Turbine Rotor for Maximum Power

Design a three-bladed rotor that generates the most rotational spin when exposed to consistent wind (fan). Your constraints:
- Rotor diameter cannot exceed 12 inches
- All blades must be identical in size and shape
- Must spin freely on a dowel or pencil axle
- Test conditions: fan speed set at one constant level

Success criteria:
- Rotor completes 50+ rotations per minute
- Blades remain balanced (no wobbling)
- Design can be reproduced by another team with the same results

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EDP Phase Targeted

Imagine / Plan (with quick progression to Create / Test)

Why: The photo clearly shows an existing, working solution (wind turbines in operation). Students don't need to ask "what is the problem?" — instead, they can observe the three-blade design, tower structure, and spacing, then imagine variations on this proven concept. This phase allows students to sketch, predict blade angles, and plan material choices before building.

Suggested Materials

- Straws or wooden dowels (8-12 inches)
- Paper, cardstock, or foam sheets
- Pencils or thin dowels (for axles)
- Tape (masking or duct tape)
- Small fan (for testing wind exposure)
- Ruler or protractor (for measuring blade angles)
- Markers (for tracking rotations or labeling designs)

Estimated Time

- K-2: 40–50 minutes (15 min. planning/observation, 20 min. building, 10 min. testing and tweaking)
- 3-5: Two 40-minute sessions (Session 1: research, sketch designs, gather materials; Session 2: build, test, measure rotations, redesign if needed)

Why This Works for Teachers

This task directly supports NGSS ETS1.B (Developing Possible Solutions) by having students study a real-world energy structure, identify key design features (three-blade rotor, tower height, spacing), and apply those principles to prototype and test their own functional model.