WIND STUDY

Wind Study is intended for grades 5-8 and 8-11
Questions posted on: Monday Answers posted on: Friday
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2021Q13 (ELECTRICTY, MAGNETIC FIELD)

You may have noticed that One Energy's wind turbines look a little different than most – rather than have a large rectangular nacelle, they have a round nacelle. This is because One Energy's turbines are *Permanent Magnet Direct Drive Generators.* This type of turbine takes advantage of one of the principles of magnetism: a magnetic field rotating around a wire creates an electric current. The generator of One Energy's turbine model has magnets that create the rotating magnetic field.

Level 1: The power created by the turbine's magnetic field is transported down the tower in cables with a resistance of 24.76 Ω. The voltage in the tower is 620 V. What current is being created?

Level 2: The equation for calculating a magnetic field is:

$$B = \frac{\mu_0 * I}{2\pi d}$$

where B is the magnetic field in Teslas (T), μ_0 is a constant with the value of $4\pi * 10^{-7}$ Tm/A, I is the current in Amperes (A), and d is the distance between the magnet and the cable in meters. What is the magnetic field generated when the distance between the magnet and the cable is 1.83 m and the current in the cable is as calculated in the Level 1 question?

A nacelle being flown.