THE SCIENCE OF "FRINGE"

EXPLORING: WIND TURBINES

A SCIENCE OLYMPIAD THEMED LESSON PLAN
EPISODE 319: Lysergic Acid Diethylamide

Overview:
Students will learn about wind power and turbine design.

Grade Level: 9-12

Episode Summary:
The Fringe team continues to attempt to remove William Bell's consciousness from Olivia's body and transfer it to a suitable host. However, they realize they first have to find Olivia's consciousness, which has hidden within her mind, before they can separate the two. The team takes a drug in order to jointly interact within Olivia's mind, where they go on a hunt for the hiding consciousness. During this search they are chased by various angry characters, forcing them to ride a zeppelin airship across the country to search for Olivia.

Related Science Olympiad Event:
Wind Power: Teams will build a blade assembly that consists of any kind of propeller/pinwheel/rotor attached to a compact disc (CD) which will be used to capture wind power. Students will also be tested on their knowledge regarding alternative energy.

Learning Objectives:
Students will understand the following:

- Wind is a renewable energy source.
- Turbines can harness the power of wind and convert it to electricity.
- Turbine blade design can have a great effect on turbine efficiency.

FOX CODE

FOR SMARTPHONES

Episode Scenes of Relevance:
- The Fringe team discusses the plan (7:01 "Kids…" - 7:30 "Very self explanatory")
- Peter, William and Walter escape via the zeppelin (22:40 (door to roof opens, no dialogue) – 24:36 (Peter jumps to ladder, zeppelin flies away)

Online Resources:
- Fringe "Lysergic Acid Diethylamide" full episode: http://www.fox.com/watch/fringe
- Science Olympiad Wind Power event: http://soinc.org/wind_power_c
- Danish Wind Industry Association (English): http://windpower.org/en/knowledge/guided_tour.html
- Wikipedia page for Wind Power: http://en.wikipedia.org/wiki/Wind_power

Procedures:
1. Tell your students that they are going to learn about wind power and turbine design.
2. Have your students research wind power and turbine design in resources such as science textbooks and websites and discuss what they have learned.
3. Have your class complete the following activity:
    a. Materials: Card-stock (or other construction sheet materials), tape, clay, small DC motor (broken CD players work well), voltmeter, box fan or hair dryer.
    b. Have the students construct their own turbines either based on their research or personal predictions for efficient designs.
    c. Attach the turbines to the DC motor either with clay, tape or an old CD (if a motor from a CD player is used).
    d. Attach the voltmeter to the leads directly attached to the motor.
    e. Hold the assembly in front of either the hair dryer or fan such that the turbine spins the motor.
    f. Record the voltage readout for every student. Higher voltage indicates more efficiency.
4. Discuss with the class the results of the activity. Be sure to address:
    a. Which designs worked better than others?
    b. How might certain features (such as number and shape of blades) affect efficiency?
    c. How does this test model the operation of full-scale turbines?

Additional Discussion Suggestions:
- Propellers are not the same thing as turbines. What is the difference and how might their design be affected?
- Some turbines are designed to be oriented vertically (instead of the spinning axle facing the wind, it points straight up like a tower). How do these turbines work and what are their benefits?

Extension to Other Subjects:
History: Wind has been harnessed throughout human history to perform a variety of tasks. What are some of these tasks and how have they molded the societies in which wind is commonly used?

Geography: Wind is a highly variable geographic quality. Some locations have near-constant wind whereas others rarely have windy days. A steady supply of wind is not the only factor in choosing where to place wind farms. Why are some regions windier than others? What are some of the factors involved in the placement of wind farms?

Social Studies: Many wind turbine projects encounter resistance from the local communities prior to their construction. Research some of the complaints citizens voice about these projects and what energy companies are doing to address those complaints.

National Science Standards Alignment:

H.B.5 Conservation of energy and increase in disorder

a. The total energy of the universe is constant. Energy can be transferred by collisions in chemical and nuclear reactions, by light waves and other radiations, and in many other ways. However, it can never be destroyed. As these transfers occur, the matter involved becomes steadily less ordered.

b. All energy can be considered to be either kinetic energy, which is the energy of motion; potential energy, which depends on relative position; or energy contained by a field, such as electromagnetic waves

H.E.1 Abilities of technological design

b. Propose designs and choose between alternative solutions.

c. Implement a proposed solution.

d. Evaluate the solution and its consequence

H.F.6 Science and technology in local, national, and global challenges

d. Individuals and society must decide on proposals involving new research and the introduction of new technologies into society. Decisions involve assessment of alternatives, risks, costs, and benefits and consideration of who benefits and who suffers, who pays and gains, and what the risks are and who bears them. Students should understand the appropriateness and value of basic questions–"What can happen?"–"What are the odds?"–and "How do scientists and engineers know what will happen?