MAKING NEW ELECTRICITY

Performance Standard 12C/11B/13B.G

Students will apply the processes of technological design from historic perspectives to explore the nature of energy conversions and conservation accordingly:

- *Knowledge*: Understand the basic foundations for the conversions of different energy sources into electrical energy from historic perspectives.
- *Application*: Design simulation models for testing conversions of energy into electrical energy.
- *Communication*: Explain the basic systems for generation of electrical energy with incorporation of the historic context of energy conversions.

Procedures

1. ***In order to know and apply concepts that describe properties of matter and energy and the interactions between them (12C), and the concepts, principles and practices of technological design 11B and the concepts that describe the interaction of science, technology and society(13)B,*** students should experience sufficient opportunities to develop the following:

   - Identify the important historic innovations associated with the generation of electricity (alternating and direct current) and its wider scale conversions from chemical energy (coal, natural gas, etc.) and mechanical (falling water, wind, etc.).
   - Research contextual foundation for original discovery and innovations and its impact on human activities worldwide.
   - Sketch the progression of energy conversions and design steps.
   - Construct a simulation model of one of the energy conversions for demonstration.
   - Conduct multiple trials to test the energy conversion.
   - Correlate historic conditions to simulation model.
   - Present report on historical, current and future significance of demonstrated energy conversion.

   Note to teacher: This activity relates to knowledge associated with standard 12C, while addressing the performance descriptors for stage G within standard 11B. Connections to the societal contexts of these concepts relates directly to performance descriptions in standard 13B.
2. Have students review and discuss the assessment task and how the rubric will be used to evaluate their work.
3. Begin inquiry on the generation of electricity from a historical perspective. Ask the class to begin a listing of what they already know about how electricity "happens", where does it come from and how was it discovered, etc. They also need to focus on the other forms of energy and energy sources which can be converted into electrical energy. Direct study into the 19^{th} century innovations for the generation of direct and alternating current and the ensuing commercial generation of electricity from conversions of other forms of energy. Create an energy timeline which continues to current sources of energy and near-future possibilities. Emphasize the general component for the generation of steam in the chemical energy models which have direct bearing on the generation of electricity from burning coal, oil or natural gas (perhaps garbage, etc.). Nuclear power generation also depends on the generation of steam. Similarly geothermal energy is associated with the use of super-heated water. Models which depend on conversions of mechanical energy (from falling water or wind power, etc.) should be introduced. Passive solar energy conversions which heat water as well as active solar energy conversions should be included as well. Assign students to create simple demonstrations of electrical energy generation in small groupings. Assign individual or small group research of the conversions of energy into electricity so that the energy timeline can be brought up-to-date from the 19^{th} century commercialization of this valuable energy form. Historic conditions and future prospects of each conversion should be considered for timeline extensions. The impact of World War II, the Nuclear Age, the Space Race and the Oil Embargo from the 1970's and ensuing interest in alternative energies should be integral components of the timeline. Students should present their research for class discussions and interactions.

4. Evaluate each student's work using the Science Rubric as follows and add the scores to determine the performance level:

    - *Knowledge*: The foundation definitions for energy generation and conversions are explained effectively.
    - *Application*: The simulation models were accurate and authentic.
    - *Communication*: The explanations of the basic systems of the generation of electricity were thorough, logical and well-detailed and incorporated the historic context of energy conversions.

Examples of Student Work not available

Time Requirements

- 3-5 class periods for introduction and model testing investigations for direct and alternating current, chemical, mechanical, solar, etc. conversions and research on conversions; 1-3 class periods for presentations and timeline completion.

Resources

- Access to research resources on energy generation and alternative energies
- Electricity investigation materials (batteries, wires, lights, clips, Ohm meter or multi-tester, "turbine" blades, magnets, etc---see text resources for simple demonstrations requirements)
- Science Rubric