**Hydro-Energy Industry**

**Classroom Project**

**Learning Goal**

Upon completion of this activity, the students will understand how electrical energy can be generated and measured. Students will achieve this goal by using scientific methods, technical application, engineering design concepts, and mathematical processes to gather and analyze data.

**Project Outline**

During this project the student will:

* + Design and build a device that will generate electricity using water as the energy source
  + Students will research methods currently being used to generate electricity using water as the energy source
  + Collect data regarding the amount of electricity generated from their device
  + Identify at least two different variables that can be charted and used to predict outcomes based on the data that is gathered either individually or as a group
  + Record data that is gathered during this activity and write a summative analysis of the data
  + Students will theorize how they can improve their project design to increase electrical output
  + Students will present their device and data findings back to the class

**Instructional Activity**

Materials Required:

* 1 - 20 oz. plastic water bottles per student (same design for each bottle)
* 1 – 9” x ¼” diameter wooden dowel
* 3 ft rain gutter
* 2 - 5 gallon buckets
* Hot glue gun and glue sticks
* Large rubber band

Equipment Needed:

* Retractable blade utility knife
* Scissors
* Small DC Motor mounted for power measurement
* Volt-Ohm Multimeter

**Instructional Experience:**

Statement of the Problem-

Using only the materials provided, create a device that will convert the mechanical energy of water falling from a rain gutter into electrical energy generated from a small DC motor. Energy must be transferred to the electric motor using the rubber band provided. Determine one other variable (beyond volts and amps) that can be tracked in this project, i.e. device size, water fall distance, angle of shaft, etc.

1. Data Gathering:

Measure voltage and amperage output of your device and record the results on the supplied worksheet. Measure a third variable of your own related to this project to determine additional performance information. Repeat the experiment five times and determine the average voltage and amperage output of your device. (Variation: design a method of delivering the water at a consistent rate and have the student also record the duration/time of the experiment)

1. Calculations:

Calculate the following:

wattage output

Kilowatt output

(variation: watts/minute & Kilowatt/hours)

Extended Learning: Calculate stored energy in the water and determine the efficiency of the system by dividing the electrical power output by the stored energy in the bucket.

1. Graphing:

Create a graph that illustrates the output of your device using volts or amps and the other variable associated with your project data.

1. Analysis:

Hypothesize how your device can be improved to increase the output of electrical energy using the same power source.

1. Presentation:

Give a 5 minute presentation of your findings to the class. Include a summary of your data, what the wattage output of your device was, and your ideas for improving the output of your device.

Student roles within the group: Project Lead, Research facilitator, Writer/communication facilitator, engineer/design facilitator, construction facilitator

**High School – Community College Collaboration**

Collaboration can include using data gathered at the high school at the community college to analyze data and attempt to improve on project output.

At the Community College level students will introduce more variables into the project in an attempt to determine which variable has the greatest impact on electrical production.

Resources:

<http://www.slideshare.net/calebbartels/hydro-turbine-project-final>  
<http://www.youtube.com/watch?v=x8xow_R0YRI>  
<http://renewableteacher.wordpress.com/2009/12/10/model-hydroelectric-generator/>  
<http://www.re-energy.ca/docs/hydroelectric-generator-cp.pdf>  
<https://www.google.com/search?q=water+turbine+performance+curves&hl=en&client=firefox-a&hs=JzZ&rls=org.mozilla:en-US:official&prmd=imvns&source=lnms&tbm=isch&ei=9Ug1T8_RB_PXiAKvrezLCg&sa=X&oi=mode_link&ct=mode&cd=2&ved=0CCoQ_AUoAQ&biw=1366&bih=649>

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| --- | --- | --- | --- |
|  | *3-Expert* | *2-Proficient* | *1-Developing* |
| generates electricity using water |  |  |  |
| research methods used to generate electricity using water |  |  |  |
| Collect data regarding the amount of electricity generated from their device |  |  |  |
| two different variables were used to predict outcomes based data |  |  |  |
| Record data that is gathered and write an analysis of the data |  |  |  |
| theorize how to improve the project design to increase electrical output |  |  |  |
| present their device and data findings back to the class |  |  |  |

Hydro-Energy Project Rubric

Group Members:

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