**2.3 Lab Activity Details**

The activity is divided into two parts.

**PART 1 7 Class Periods Researching Methods for Generating Electricity and Collecting Energy Usage Data From Home.**

**Goals:** Students explore the pros and cons, comparing the use of various renewable and non-renewable resources for generating electricity.

1. Students will begin their exploration of alternative energy resources by exploring the power of wind and solar energy together by using the schools’ 10W wind turbine and 5W solar array. Students will study the wind turbines’ and solar arrays’ past data files of energy production and usage, and compare that to the past weather station data files, to look for patterns to determine how the wind speed affects the energy production by the wind turbine, and how solar radiance affects the energy production by the solar array. Students will also consider the cost per kilowatt and the cost of adding an alternative energy source to their home.
2. In groups of 2 or 3, students research another method for generating electricity on a large scale (Geothermal, Fossil Fuel, Hydroelectric, etc.). They will develop a Power Point presentation following specified guidelines to share their research with their classmates.
3. In groups of 2 or 3, students will build table top wind turbines to learn how to make energy measurements using the same probes they see displayed in GRED. Students will use the current and voltage probes, resistor boards, energy sensors and variable load that would allow students to discover the relationship between current, voltage and resistance and learn about Ohm’s Law. Students will use this experience to develop an experiment to collect data as they design and build their alternative energy machines.
4. During this time, students will also begin taking turns taking home the Watts Up Pro. They will select 3 appliances of their choice to measure the energy usage of each and record this data along with a description of whether the appliance was passive or actively performing the designated function. This will allow students to take this data and determine where the numbers for energy usage come from on their monthly home energy bill. Once all the students have collected their data, we will discuss the data and ask students to come up with a possible plan for energy conservation at home. This discussion will take place at the end of the entire lesson as students reflect on all parts of this lesson.

**PART 2 17 Class Periods Table Top Construction of Alternative Energy Generating Systems and Powered Machines**

**Goals:** Students demonstrate their understanding of alternative electricity generation and use.

1. Students will engage in the engineering process to design and build tabletop models of power generating systems such as wind turbines, hydroelectric turbines, or solar cells to power a light, or build a machine or building that their system will power. Students may also choose to build a vehicle or building, and power their project by combining small solar cells that they purchase.
2. In addition to designing and building their models of power generation systems, students will design an experiment to collect data they measure from their voltage, current or light sensor that will monitor the power that is generated by their system throughout the process, until it reaches the level where it successfully powers their project.
3. Students will graph the quantitative data and look for patterns to analyze what factors determine when they have more or less of the power they need for their project.
4. Students will present their projects to their class and parents

**PART 2 Timeline Break Down**

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| **3-4 Days** | 1. In their groups, students research ideas and examples of structures or machines they would like to build to use the energy they will generate with their alternative source. 2. Students will generate a scale drawing of their proposed energy generating system and label all the parts. 3. Student groups write a proposal for their alternative energy powered machine. They share these proposals with the class for feedback. They need to identify/determine: 4. Is this project feasible? 5. What materials are needed for this project? 6. How will you measure the success of this project? 7. What kind of data will you collect? 8. How will you collect, graph and analyze your data? 9. How does your project demonstrate the ability of the method of alternative energy to power your machine. |
| **6-7 Days** | 1. Students will record their daily progress in a journal. 2. Students will keep track of all of their revisions, and collect the appropriate data and record it in a table so they can look for patterns to analyze the power generated by their systems. Students will include a component interconnection diagram to check for proper flow of energy to generate appropriate data for analysis. |
| **3-4 Days** | 1. Students will complete a final drawing of their alternative energy generated system. 2. Students will generate a graph from the data they collected with their appropriate sensors to measure the power generated by their projects. 3. Students will analyze their data and discuss this in a 1 ½-2 page paper following specific guidelines 4. Students will write a reflection on their experience throughout the final unit and the impact it has made on them. 5. Students will prepare for their presentation |
| **2 Days** | 1. Students present their energy generating system and energy using devices to the class and parents. |

**2.4 Assessments**

**Formative**

* Project Building Design, Component Integration Diagram and Experimental Design Proposal
* Project Design and Building Process
* Experimental Design Process
* Journal Entries for Progress and Revisions
* Data Collection, Graph and Analysis
* Daily Informal Group Collaboration Evaluation and Project Process

**Summative – The completed project and student reflection is their Final Exam.**

* Power Point Presentations on Energy Generating Systems from Part 1
* Completed Project- Part 2 Student expectations are outlined below in the student expectation sheet
* Presentation of Alternative Energy Project
* Student Reflections of the Unit

**Student Guidelines and Expectations:** The instruction handout given to students is found below**.**