### Part I: Audience

**Who is your classroom audience? Age level, grade level, and content area?**

The audience is Young Adults ages 16 – 22 and is appropriate for grades 9-12. The GED content areas are Math and Science, while the Broad Topic area is Energy and the specific Project Topic is Solar Energy: Photovoltaic.

### Part II: Learning Standards

**Choose examples of learning standards that you wish to introduce, directly teach, or reinforce through a project. What do you hope students will be able to do by the end of this lesson?**

This lesson has been designed by the National Energy Education Development Project (NEED Project) entitled “Exploring Photovoltaics” and is based on the National Science Education Content Standards, as well as the Virginia Science Standards of the DOE. The following list of learning standards/goals are introduced, directly taught and reinforced throughout the project. (It is worth noting that these also correlate with the new state career cluster initiative.)

- Understand Scientific Inquiry
- Know the Attributes of Physical Science: Atoms, Matter, Chemical Reactions, Motion & Forces
- Earth and Space Science: Solar Energy in the Earth System
- Science and Technology: Ability to engage in Technological Design
- Science in Personal and Social Perspectives: Ability to use natural resources efficiently, sustainably, and for the greater good of society.

Students will be able to design a solar system that will power the essential needs of a modest size home that is not connected to an existing electrical grid.

### Part III: Essential Question

**What essential question will guide your students’ project-based learning? For more on writing essential questions visit:** [http://www.greekforme.com/writing.html](http://www.greekforme.com/writing.html)

If you were given the choice of using solar power, would you be able to determine what would be the most efficient design to use to meet your household needs and how would you share your results?

### Part IV: Alignment with GED

**List here your considerations for aligning your lesson and project with the GED. Does your plan allow for some test preparation?**

This lesson plan allows students to understand and apply the concept of measurements, linear and non-linear equations while gaining the ability to analyze scientific and technical information to determine hypothesis, data outcomes and application of those outcomes. Essentially, students will have developed fluency in the language, the math and the application of Solar Energy as a specific topic, while learning content relevant to the GED content areas of Math and Science.
Part V: Overview of Project

Give a brief overview of your project here—what will students be doing and what will the outcome of the project be? (a report, presentation, blog, demonstration, etc.) Who will the audience be for the final presentation?

Students will learn about Solar Power, its historical uses and present day applications; Photovoltaic cells, how they are made and how they work; as well as gaining knowledge about the consumption of energy in the United States and globally. Students will also engage in designing solar arrays for efficiency while maximizing output. The final project will result in a group designed stand alone system, which will be presented as a Power Point Report. The report will be presented to a student determined audience for sharing and ultimately for developing a prototype.

Part VI: Design the Learning Activities

Design specific learning activities students might undertake to address or solve this project problem while working towards the learning standards and competencies. Decide on what resources could be used as part of these activities. Be sure to include what the student product will be.

Four lab exercises have been designed to help students address the problem of “meeting the essential electrical needs of a modest size house;” as well as an individual electrical assessment for each students’ household. The lab exercises allow for group work and allow them to recall relevant concepts and vocabulary to obtain the answers for the experiments. The resources include the follow kits and materials:

<table>
<thead>
<tr>
<th>Materials In Kit</th>
<th>Materials Needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class set of student guides</td>
<td>6 Protractors</td>
</tr>
<tr>
<td>6 PV cell kits</td>
<td>6 Reflecting lamps*</td>
</tr>
<tr>
<td>12 Multimeters</td>
<td>6 Tape measures</td>
</tr>
<tr>
<td>6 Fresnel lenses</td>
<td></td>
</tr>
<tr>
<td>12 Sets of alligator clips</td>
<td></td>
</tr>
</tbody>
</table>

* Reflecting lamps are optional, but helpful if you have limited time to conduct the unit and do not want to depend on the cooperation of the sun. If you plan to use lamps, have 60W and 40W bulbs available to compare light intensity.

The outcome of these lab exercises will result in students having a solid comprehension of which is the best method to wire an array for the maximum electrical output under varying conditions.

Part VII: Assessment & Student Self-Reflection

How will you assess student progress towards competencies and standards? Will you create a rubric to help guide students?

How will you build in student self-reflection? How will you build in room for your own reflection as a teacher? How will student work lead you to new or different instructional choices?

Students will be assessed using nine (9) review quizzes that will scaffold each lesson and content standards. In addition each of the review questionnaires incorporates both a case scenario and reflection questions to further student’s critical thinking skills. A rubric can be developed, however, the unit is designed so that each student has his/her own guide and can be self-directed in terms of their reading, and assignment preparations. Lastly, student will be assessed on competencies and standards using a Hypothetical scenario to design a stand-alone Solar system. Each student will have the opportunity to participate in this challenge.

A teacher evaluation is included in the teacher guide, that will be used to assess teaching outcomes and any self-reflective issues that may have arisen. However, a student assessment could be developed to allow the students to share their insights on what worked well and what needs improvement.
Part VIII: Community Connection

*Finally, how will you and your students share this project with the community? What community?*

I will provide students with a list of options, however, it is my hope that the students will discuss and determine who their best audience will be to 1) help them develop a prototype and 2) that will allow them to have it used according to their set goals.

I would think of our county officials, our neediest populations and lastly as an entrepreneurial venture for my students.