Narrative for STEM Energy Lesson Plan

Glen Lawson  Chestatee Academy  8th Grade Physical Science

1. Georgia Standards are addressed in the lesson. They are included on the first page of the plan. Related energy standards for Middle School NGSS are also included.

2. Project Based Learning – Solar House Project. See Friday’s plan for details.

3. Asking questions and defining problems – Tuesday’s discussion of issues session after the class notes.

4. Community Connections -- Discussion of Georgia Power’s Solar Panel initiative in the “How much Solar was produced today section of Tuesday’s discussion.

5. Obtaining and evaluating information: One of the Monday videos is actually a commercial for a solar panel project. Discussion can be focused on how it differs or does not differ in content from the National Geographic video.

6. Planning and carrying out investigations—Thursday’s lab is an investigation of solar panels in series or parallel arrangement. There is also a station to observe about the angle of sunlight on solar panels.

7. Developing and using models – the Solar House project is a model of how solar panels could be used in a home.

8. Use of technology and software – the PhET simulation

9. Collaboration – the PhET activity will be a partner activity. The solar panel lab will have about 3 people per lab group.

10. Critical Thinking – I am asking students to consider whether solar energy is as effective in the winter as in the summer. They will use information obtained from the station observation to communicate their thoughts.

11. Creativity – is encouraged in the Solar House project. Especially in the area of using re-used materials.

12. Communication – I’m asking students to communicate their thoughts in a written response. I am communicating with students and parents in a weekly newsletter.

13. Mathematics and Computational thinking. – This is address in the Solar House project. The lights in their house cannot use more than 2.9 volts and 1.1 amps. Usually voltage
is the limiting factor. Can they calculate how many lights they can have and still get them to light up? Can they think of a way to make their wiring efficient so they don’t lose energy in the resistance of their circuit?

14. Analyzing and interpreting data – Students are given data in Thursday’s lab about the angle of the Sun and solar panels. Can they use that information to understand about the angle of the Sun at different times of the year and how that affects the energy that a solar panel receives?

15. Constructing explanations and designing solutions – Part of this is addressed in Friday’s written assignment. It is also addressed in the design and building of the Solar House.

16. Engaging in argument from evidence – My plan would be for this to occur on Tuesday when we discuss issues related to solar power.

17. Assessment plan – there are multiple areas of assessment. There is a comprehension check early in the week. There is a ticket out the door related to the lab. There is a formal assessment on Friday with a written component. There are two lab assessments related to the activities on Wednesday and Thursday. And there is a performance assessment with the Solar House which will be due 2 weeks after the material is taught.

18. Implementation plan – Most of these materials are on hand. There are numerous small solar panels which are identical for use in Thursdays lab. There are 3 of the Pittsco panels available for testing the Solar Houses. One resource that is needed would be about 6 small multimeters to give better information about the effect of series and parallel solar panels. These are about $10 each times 6 or a cost of about $60.
**Solar Energy Unit Lesson Plan**

**Teacher:** Glen Lawson

<table>
<thead>
<tr>
<th>Dates:  TBD</th>
<th>Unit: Solar Energy Transformations</th>
<th>Duration:  5 days</th>
</tr>
</thead>
</table>

**GPS:**

S8P2. Students will be familiar with the forms and transformations of energy.

- Explain the relationship between potential and kinetic energy.
- Compare and contrast the different forms of energy (heat, light, electricity, mechanical motion, sound) and their characteristics.

**NGSS**

MS-PS3-4. Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.

**Essential Questions:**

- What is solar energy?
- What is the source of solar energy?
- How is solar energy transformed?
- What are some uses of solar energy in your life?
- What are some benefits of using solar energy?
- What are some challenges of using solar energy?
- How could increased use of solar energy affect climate change?

<table>
<thead>
<tr>
<th>Enrichment/Remediation</th>
<th>Assessment Strategies</th>
<th>Assessment Uses</th>
<th>Communication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enrichment:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remediation:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Differentiated Instruction**

Students who demonstrate an early mastery of key concepts will be given a Science News article on Solar Power to read and analyze rather than working through the Concept Mastery worksheet.

Students who show a grasp of the key ideas of solar power will be given the option to investigate both parallel and series circuits with their solar house model.
Day by Day Plan:

**Monday (Day 1)**

- Class Notes on Solar Power
  Another short video on Solar Power ([https://www.youtube.com/watch?v=x4CTceusK9I](https://www.youtube.com/watch?v=x4CTceusK9I))
- Vocabulary Assignment for Weekly Homework

**Tuesday (Day 2)**

- Finish Class Notes on Solar Power
  Discussion of Issues Related to Solar Power (cost, efficiency, policy, tax rebates, low interest loans, etc)
  How much Solar was produced today? ([http://buildingdashboard.com/clients/southernco/](http://buildingdashboard.com/clients/southernco/))
  Concepts Check on Solar Power.

**Wednesday (Day 3)**

- PhET Computer Activity (use the energy systems tab)
  [handout for computer activity](#)
- Preview Solar Panel lab activity – what skills and knowledge are needed for the lab.

**Thursday (Day 4)**

- Solar Panel lab Series or Parallel pages 57 – 62 of attachment
  [NREL Renewable Energies Activities](#)
- Station to view: 3 solar panels set up at different angles to the same kind of lights.
- Ticket out the door understanding check:
  - Which arrangement of solar panels was more effective for the electric motor?
  - Which angle of the solar panel produced the most electricity?
  - What do you think was special about the angle the lights were set to?
  [Solar Angle Calculator](#)
- Content Quiz on Notes and Vocabulary Question
- Written Response on this topic: Is Solar Energy an effective year-round alternative energy resource? Use data from yesterday’s observations to help explain your answer.

- Introduction of the Solar House Project (due in 2 weeks)
- General overview: Build a small model house with Christmas tree lights designed to be powered by a solar cell. The solar cell that will be used to test your house is the Pittsco Ray Catcher Solar panel with an output of 2.9 volts and 1.1 amps. This is roughly equivalent to 2 AA batteries.
- Requirements: Your house should be shoe box sized or smaller. You should have at least 2 rooms in your model house. You should have at least 1 light per room but try to maximize the number of lights that will actually light up. Ideally, your lights will be parallel to each other. Bonus points will be given for electrical features such as switches and design features such as neatness. No additional points are awarded for bought furniture or decorations. Preference is given toward projects that appear to be made from recycled materials.
- Scoring guidelines:
  | Shoe box size or smaller: | no | yes |
  | Two or more rooms: | one room | two rooms | three rooms |
  | Total lights | one | two | three | four |
  | All lights light | no | yes |
  | House actually lights when connected to panel? | no | yes |
  | Parallel circuits | no | yes |
  | Switches (bonus) | no | yes |
  | Other design features? | 
  | Recycled Materials? | 
  | Other comments? |