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| ACTIVITY PLAN | | | | |
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| **Theme** | **Subtopic** | **Activity Title** |
| Creative and Critical Thinking in EcoSTEAM Education | Evaluating and Analyzing Environmental Information | Study of the Efficiency of Solar Lamps Under Various Lighting Conditions |

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| Introduction part (or activity overview) |
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| **Introduction part (or activity overview)** | There is increasing concern worldwide about energy sustainability and environmental impact, making solar energy a promising solution. Solar lamps are a simple yet effective application of solar energy technology, providing lighting in areas without access to the electrical grid. To maximize the potential of solar lamps, it is crucial to understand how lighting conditions affect their efficiency. |
| **SETTING** | Classroom and outdoor |

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| Materials Needed |
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| **Materials Needed** | Solar lamps  Lux meter / phone with an app  Ammeter, voltmeter / multimeter  Connection terminal blocks  Additional wires soldered for measuring voltage  Data recording sheets or computer/tablet |

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| **Learning Outcomes** | * Deepen knowledge about solar energy technologies and how solar lamps utilize sunlight to generate electricity. * Understand the interrelationship between renewable energy systems and environmental factors, such as the impact of sunlight and ambient light levels. * Improve data collection and analysis skills. * Enhance critical thinking skills by analyzing experimental results, identifying patterns, correlations, and possible sources of variability. * Improve abilities to collaborate effectively and communicate findings to others. * Have the opportunity to practically explore renewable energy technologies and contribute to sustainable solutions. |  |
| **Activity Contents** | **Activity1: Study of the Efficiency of Solar Lamps Under Various Lighting Conditions**  **Theoretical Part (Duration: 25 minutes):**  If students are not yet familiar with the operation of solar cells, they should be introduced to it.  **Videos:**  **How do solar panels work?**  <https://www.youtube.com/watch?v=xKxrkht7CpY&t=10s>  Overview: An educational video How do solar cells work?  Duration: Approx.5 minutes  Examine the structure and operation of a solar lamp. The solar cells installed in the lamps absorb solar energy during the day and store it in a rechargeable battery, automatically turning on the lamps after sunset.  **Videos:**  <https://www.youtube.com/watch?v=DQX3bKcl6N4>  Overview: This video examines how solar lamps work.  Duration: Approx.8.36 minutes  Remind students how to connect an ammeter and a voltmeter in a circuit. If using a multimeter, review this **video**:  <https://www.youtube.com/watch?v=DQX3bKcl6N4>  Overview: This video examines how to use a multimeter.  Duration: Approx.4.35 minutes  If you don't have a lux meter, you can use a mobile phone sensor.  **Task (Duration: 90 minutes)**  **Step 1.** Students are divided into groups (4-5 students per group). Within the groups, they assign roles.  **Step 2.** Each group receives materials: a tablet or a sheet of paper with the task (Appendix No. 1), a lux meter or a mobile phone, a disassembled and prepared solar lamp for measuring voltage and current. To facilitate measurements for students, the teacher should prepare measuring clamps for current measurement by cutting the wire from the solar cell and attaching a connection terminal block. For voltage measurement, a wire with a terminal block can be soldered.  **Step 3.** Students take measurements outside the school, walking around the school from all sides, i.e., in the sun and in the shade (this activity should be planned on a sunny day).  **Step 4.** Students take measurements in the classroom at various distances from the window.  **Step 5.** They analyze the results, summarize them, and draw conclusions.  **Step 6.** They present their work. A discussion about the use of solar cells in other areas follows. |  |
| **Assessments** | Evaluation Table (Appendix No. 2) |  |
| **Key Competences** | Cognitive competence  Creativity competence  Communication competence |  |
| **Connections with Eco STEAM** | Eco - Solar energy used to power lamps is a renewable energy source that reduces environmental impact.  Science – Physics knowledge.  Technology – Solar energy technologies for sustainable lighting solutions.  Engineering – Integration of engineering principles for practical application.  Art – The aesthetics of solar lamps, combining functionality and visual appeal.  Math- data analysis. |  |
| **References** | https://ez.analog.com/adieducation/university-program/b/blogs/posts/hacking-an-led-solar-garden-light  <https://www.youtube.com/watch?v=7TRyD_EXCbA&t=3s> |  |
| **Notes** | Solar lantern disassembled : Solar lantern is ready for examination: |  |
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| APPENDIX NO. 1. ACTIVITY RESEARCH SHEET |
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|  | | Study of the Efficiency of Solar Lamps Under Various Lighting Conditions | | |
| Objective: To investigate the dependence of the current and voltage output from the solar cell of solar lamps on illumination. | | | | | Objective: To investigate the dependence of the current and voltage output from the solar cell of solar lamps on illumination.  Hypothesis:  Materials: | | |
| Hypothesis: | | | | |
| Materials: | | | | |
| Environment | **Illumination, Lx** | | **Current amlifier, A** | **Voltage, V** |
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| Results Analysis and Summary |  | | | |
| Conclusions |  | | | |
| Reflection: How did the work go? What contribution did each group member make? What did you learn? Where can solar cells be used? | | | | |

**Appendix No. 2. Evaluation Table**

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| Evaluation Criteria | Points | Comments |
| Hypothesis Formulation | \_\_/1 |  |
| Data Collection | \_\_/2 |  |
| Data Analysis | \_\_/2 |  |
| Conclusion Formulation | \_\_/2 |  |
| Reflection | \_\_/1 |  |
| Work Presentation | \_\_/2 |  |