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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 | Energy Sources for Water Heating |

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| Introduction part (or activity overview) |
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| **Introduction part (or activity overview)** | This activity is designed to deepen knowledge about the use of fuel (natural gas, electricity, wood, etc.) or solar energy for heating water in the heating system of an individual house or apartment, to develop critical thinking by examining the efficiency, costs, and environmental impact of different fuel and heating systems. |
| **SETTING** | Clasroom / computer classroom |

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| Materials Needed |
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| **Materials Needed** | Digital Devices (tablets / laptops / mobile phones)  Projector (for presenting works) |

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| **Learning Outcomes** | * Deepen understanding of various energy systems and their use for water heating in residential spaces. * Develop critical thinking skills by analyzing the efficiency, costs, and environmental impact of different fuels and heating systems. * Learn to collect and analyze data, including market prices, energy quantities, and environmental indicators, using relevant tools and methods. |  |
| **Activity Contents** | **Theoretical part (Duration: 20 minutes):**  Initially, it is clarified which types of fuel can be used for water heating in the heating system of an individual house or apartment. Here are some common types of fuel used for heating water:  Natural gas: Widely used and relatively clean-burning fuel. It is often accessible through pipelines in cities.  Electricity: Electric water heaters are common and easy to install.  Wood: Wood can be used as solid fuel, often in the form of logs or pellets, in stoves or boilers.  Solar energy: Solar water heaters use solar energy to heat water. It can be an auxiliary or primary source of hot water.  Biomass: Biomass boilers use organic materials, such as wood pellets, agricultural residues, or other biofuels, to generate heat.  Geothermal energy: In some areas, geothermal heat pumps can be used to extract heat from the ground for water heating.  Recalled is how the heat quantity released by burning fuel is calculated:  Q=qm, where Q - heat quantity, q - specific combustion heat, m – mass.  https://neutrium.net/heat-transfer/heat-of-combustion/  Table of Specific Fuel Combustion Heats:  https://www.researchgate.net/figure/Fuel-heating-value-to-calculate-furnace-Watt-power\_tbl1\_236985748  Carbon footprint calculator:  <https://www.carbonfootprint.com>  **Task (Duration: 3 hours):** Students, working in groups, conduct research to determine the efficiency of fuel in terms of costs and environmental impact when heating water in the heating system of an individual house or apartment: Each group must investigate one type of fuel (e.g., natural gas, electricity, wood, etc.). Each group member is assigned a role (e.g., group leader, data collector, data analyst, economic analyst, environmental impact analyst, presenter, report writer, etc.). This will ensure that each student contributes meaningfully to the research. Questions to help students conduct the research:   * Assume that a person on average consumes about 1 cubic meter of hot water per month. Heating it requires about 51 kWh or 183.6 kJ of energy. * Evaluate the combustion heat – determine the theoretical amount of energy released when the fuel burns (if it is a combustible fuel). * Assess fuel efficiency - how much energy is converted to heat for warming water. (Find the specific efficiency coefficient of the heating device). * Calculate the cost per unit of energy. Note how it varies and what it depends on. * Analyze the impact on the environment. Calculate the CO2 footprint. * Evaluate the system's design and components. * Make a conclusion. Create a composite index combining energy efficiency, cost per energy unit, design, and environmental impact. * Prepare presentations and present them to classmates. |  |
| **Assessments** | After the presentations, students perform a written reflection: Reflection Sheet.  The final result is graded with a mark: Assessment Table for Group Presentations |  |
| **Key Competences** | * Cognitive competence * Communication competence * Social, emotional and healthy living competences * Citizenship competence * Digital competence * Cultural competence |  |
| **Connections with Eco STEAM** | **Eco** - choosing eco-friendly and sustainable fuel  Science - knowledge of physics, chemistry, economics, and environmental sciences.  Technology – utilization of advanced heating technologies and renewable energy sources.  Engineering - engineering solutions for heating systems, optimizing energy use.  Art - visually appealing heating systems.  Math - calculation of energy quantities, assessment of economic efficiency, use of mathematical models and statistical tools. |  |
| **References** | • <https://www.mat.lt/fizikos-formules/siluminiai-reiskiniai/kuro-degimas.html> |  |
| **Notes** | Attention is drawn to the fact that fuel availability can vary depending on geographic location, infrastructure, and local regulations. |  |
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# Reflection Sheet

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| I will heat the water in my house or apartment heating system with (this fuel) ...................................................., because...........................................................................................................................................................................................  ……………………………………………………………………………………………………………………………………………………………………………………………………… | |
| Working in a group with others, I learned....................................................................................................................................................  ……………………………………………………………………………………………………………………………………………………………………………………………………… | |

**Assessment Table for Group Presentations:**

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| Assessment Criteria | Points | Comments |
| Completeness of data presentation | \_\_/5 |  |
| Formulation of conclusions | \_\_/5 |  |
| Use of visual aids in presentations | \_\_/5 |  |
| Teamwork and collaboration | \_\_/5 |  |
| Clarity and interestingness of the presentation | \_\_/5 |  |