

7.	Sustainability & renewable energy
Target group	Pupils
Age pupils	7–11
Duration	1.5-2 hours
Overview	Students will learn about climate change and why we need to learn about energy sustainability. Through researching, reading, and discussion, students will understand that coal, gas, and oil are energy resources that are not renewable, meaning that once we use up the world's supply of these natural resources there will not be any left. There is a lot of debate about how long these resources will last, but one way to ensure that we will not find ourselves in an energy crisis is to develop energy resources that are renewable. Renewable energy is a resource that cannot be used up.
Engineering Activity	Students will design a model car (build a model car using their own creativity without guidance) powered by renewable energy, and then they will be introduced to the engineering design process, which engineers use to provide creative solutions to each of these challenges.
Materials	• Anchor chart papers • Computers with access to YouTube • Construction paper/cardstock • Corrugated cardboard • Hobby knife • Markers • Plastic straws (2) • Plastic bottle caps (4) • Scissors • Tape • Wooden skewers (3) • Student Handout sustainability & renewable energy
Essential Questions	1. What is sustainability? 2. Why do we need to develop energy resources that are renewable?
Engage	Storybook Introduction • Students inform themselves about climate change and discuss what sustainability is, and why we need to learn about energy sustainability. (NGSS SEP: Asking Questions and Defining Problems) • Students brainstorm and name different types of renewables, such as solar, wind, hydro, geothermal, biomass. • Students learn more about solar energy and the semiconductor field by watching this video <i>“How do solar panels work? – Richard Komp”</i>. → https://www.youtube.com/watch?v=xKxrkht7CpY
Explore	Renewable Energy Research • Students form 3-5 groups and each group should be named after one source of renewable energy (solar, wind, hydro, geothermal, biomass). • Groups research and explore the topic of climate change and their assigned renewable energy on NASA's Climate Kids website by watching videos, reading short articles, and playing games. → https://science.nasa.gov/kids/earth/ Group Presentation • Teacher explains Group Research and Presentation Guidelines Group Research and Presentation Guidelines and displays them during the activities. • Teacher provides each group with a large sheet of anchor chart paper for them to write and draw as they do the research. (NGSS SEP: Constructing Explanations and Designing Solutions)
Explain	Group Presentations

	After researching on the assigned type of energy, students present in groups to the class and explain their learning about renewable energy. The rest of the class asks questions or provides them with feedback. (NGSS SEP: Obtaining, Evaluating, and Communicating Information) Renewable Energy Word Match Students play the Renewable Energy Key Words Matching Game, in their Student Handout (Section A and B), to reinforce the key vocabulary words and concepts. (Culturally Responsive Practice: Students share their thoughts on survival needs. Teachers bring up new ideas regarding the consumption of energy depending on where you live and life styles, based on student input.) Sustainability Class Discussion Teacher facilitates a class discussion on our survival needs as human beings and as a community, emphasizing on the importance of sustainability. -> For example: We consistently need more energy, water, and food, but need it to be produced in a clean and sustainable manner, so we can continue fueling our needs for more energy, water, and food. And while water and food are the most fundamental to our physical health, energy is the hidden currency that fuels them both, along with virtually all of our other subsistence needs including housing, transportation, goods production, and disposal.
Elaborate	Imagination - Teacher asks students to close their eyes and imagine that we are running out of electricity. - Encourage students to think about how power outages may affect our lives and learning. Ask students to suggest solutions. (Career Highlight: In this task, students are playing the role of a Systems Operator, who manages the electricity grid and coordinates the supply and demand for electricity to many customers.) - Teacher explains that engineers have a good understanding about energy, so they can harness renewable resources to create electricity for use in our everyday lives. They design cleaner-burning engines and new car designs (such as hybrid cars) that require less fuel and result in improved gas mileage which in turn improves our planet. Engineering Design Challenge - Teacher introduces an engineering design challenge to create a new car powered by renewable energy. - Teacher provides each group of students with a list of materials and allows a free investigation session, where students will build a model car using their own creativity without guidance. (NGSS SEP: Planning and Carrying Out Investigations) - Teacher note: Providing students with a free investigation session motivates students to ask questions, grow awareness of variables in the experiment, and develop curiosity with the Engineering Design Process The goal is not to develop a finished or functional product. - Teacher finds a stopping point to check-in with the groups. - Explain to students that engineers use the Engineering Design Process to provide creative solutions to each of these challenges. Engineering Design Process - Students are introduced to the six steps of the engineering design process, with the assistance of the Engineering Process video and Engineering Design Process Flowchart. - Teacher informs students that they will have another opportunity to design a (wind-powered) model car by thinking like an engineer and applying the engineering design

	process, in another lesson (see Gone with the Wind! Building a Sail Car Lesson on the SEMI Teacher Resources website) ○ Possible extension: Teacher provides groups of students with specific design challenges such as changing the number of wheels, changing the base paper size, using different wind strengths (multiple fans or fans of different sizes). Teacher also specifies if students work on building all the parts, but change only the design size or materials such as construction paper, tissue paper, paper towel, etc. teacher can also provide students with the same wheels, or axles and then provide a goal for students: the car that can hold the most cotton balls, the car that rolls the fastest, and the car that can turn a corner on its own.
Evaluate	Model Car Evaluation Students set out their model car designs from the free investigation session and do a gallery walk to demonstrate their understanding about renewable energy and engineering connection. (NGSS SEP:Obtaining, Evaluating, and Communicating Information)
Extend	• Teacher asks students to engage in two energy saving activities before the next day. Students can describe in detail the impact these actions may have at a personal, community and global level. • Students can learn more about the semiconductor field by watching the video “What is a Semiconductor? / Band Gap, Doping & How Semiconductors work: → https://www.youtube.com/watch?v=nJsRUju_dQc
Evidence	participant count; Q&A summary, feedback survey