



POINT OF NO RETURN

EDUCATIONAL EXPERIENCE

A new hands-on environmental STEM enrichment curriculum using the documentary *Point of No Return* – the gripping story of the first solar powered flight around the world – as a dynamic jumping off point to inspire K-12 students to innovate and collaborate towards sustainable solutions.

The Point of No Return Educational Experience curriculum is organized into six themes: Students first explore fundamental themes of energy storage and renewable energy, building batteries, solar circuits, and solar-powered machines, and then build on this knowledge to think bigger around renewable energy and its fundamental role in designing sustainable communities and cities. In later themes around sustainable development and climate solutions, students will imagine innovative energy solutions and assess the potential impact. Team-based activities around tackling the climate crisis give students real world insight into decision-making challenges and the vital role of collaboration between cultures, industries, and nations.

The curriculum, created by NYC non-profit Solar One, is differentiated for upper elementary (ES: 3-5th), middle (MS: 6-8th), and high school (HS: 9-12th). The program is supported by builder materials kits for hands-on activities (including solar cells, motors, multimeters, wind turbine parts) for classrooms, after school programs, and distance learning at home (Builder Kit description below). The class time estimates are 2-3 hours per unit/theme, adding up to 12-18 hours total, not including the 57 min. film. The program is flexible so teachers can pick and choose units, and how they want to facilitate discussion questions (group discussions vs. written assignments). On the website, educators will have access to shorter video clips from the film that correspond to each unit and discussion.

Educators and students engaged in distance-learning can access the film and all six units/themes of the curriculum, including in-depth readers, discussion guides, and content and film specific questions. While some activities are hands-on engineering and or specific to classroom collaboration, much of the curriculum and activities do not require building materials and can also be done individually or through video conferencing. Optionally, individual student builder kits for distance learning/home use are available so that students can order the kits directly and access all of the building activities in the six themes of the curriculum.

Once the order is received, educators will be sent a password-protected link to stream/download the 57 min educational version of the film which they can share with their students, and a password-protected link to download the full curriculum (PDFs), along with short clips from the film which tie directly to each theme in the curriculum.

Following is a preview of each theme.

THEME 1: Energy Storage



Students learn about the usage of batteries on the Solar Impulse airplane and explore why energy storage is so crucial to a future without fossil fuels. Students also learn about the challenges and limitations of battery technology today and explore what is required to design the batteries of tomorrow.

ACTIVITIES

Build your own Battery – ES-MS-HS (differentiated for different grade levels)

Students will learn how to construct their own non-toxic batteries to power lights and motors. Middle and High School students will use a multimeter to measure voltage and think about additional materials that they could use to construct a more energy- efficient battery.

THEME 2: Renewable Energy



Students explore the difference between nonrenewable and renewable energy sources, learn about established forms of renewable energy, and discuss the historic significance of the Solar Impulse flight. Students consider small-scale and large-scale applications, including rooftop solar and “smart grids” powering entire cities – and explore their role in reducing carbon emissions to mitigate climate change.

ACTIVITIES

Designing a Solar Plane – ES

Students design and build a model paper airplane and configure the plane for solar power. Students evaluate and choose their airplane shape and solar design, including which size and orientation of solar panels will yield maximum power output for their planes.

Wind Turbine Blade Design – ES-HS

Students apply engineering and design skills, as well as the four C's to build, test, and redesign wind turbine blades. The goal: to design the wind turbine that produces the highest voltage.

Sizing for Rooftop Solar and Beyond – MS-HS

Students are challenged to determine which type of solar panels and configuration would be the best fit for a simulated rooftop, considering potential hazards and obstructions. As an extension, students can use the Google Project Sunroof to assess putting solar power on an actual building in their own community.

THEME 3: SOLAR CIRCUITS



Students are introduced to solar concepts such as: how solar panels work, how electricity is measured, and different ways to configure solar circuits for maximum energy output. Students explore how circuits on board the Solar Impulse were designed and are challenged to experiment and build their own circuits.

ACTIVITIES

Designing Circuits – ES- MS

In this inquiry-based activity, students are given supplies to build different types of solar circuits. They measure the electrical output of their different circuits and make observations and draw conclusions about how solar works.

Solar Field Study – MS-HS

In this inquiry-based activity, students learn about basic electricity units (volts, amps and watts) and then measure electrical output with multimeters to explore how different variables such as shading, tilt angle, and circuit configuration impact electrical output.

THEME 4: DESIGNING SUSTAINABLE CITIES



This unit explores the concept of sustainability and sustainable development globally and introduces the UN's Sustainable Development Goals (SDGs). The theme draws parallels between the decision-making that the Solar Impulse crew made during the flight and the tough choices and compromises between communities and countries, needed to reach our global sustainable development goals. Students are introduced to cost-benefit analyses and risk management as they engage in decision making exercises about designing sustainable towns and cities.

ACTIVITIES

Energy Decision Making in Tesla Town – ES-MS

Students think about their own personal decision making processes. Students then consider which renewable energy technology is best suited for a hypothetical town – “Tesla Town” and consider factors like cost, location of energy source, health and environmental impacts.

Designing “Tesla Town” – MS-HS

In this role playing activity, students take on the roles of industrial engineers that are in charge of re-designing the energy infrastructure of “Tesla Town”- a coal powered coastal town riddled with air pollution and frequent losses of power as more powerful hurricanes batter their coastline. They will need to look at factors like cost, feasibility, climate, consumption and potential environmental impacts to create a more sustainable future for their city.

THEME 5: ENGINEERING FOR THE FUTURE:



This lesson explores the engineering and design process and draws connections to the film by highlighting the steps taken by the team to design the Solar Impulse. Students build skills using the four C's – Communication, Critical Thinking, Creativity, and Collaboration, as they build their own solar device and work through their engineering design challenge and come up with innovative ways to tackle environmental issues on a planetary scale.

ACTIVITIES:

Solar Device Engineering – *ES-MS-HS* Students are challenged to build a small device that moves using a solar panel, a vibrating motor, and recycled materials as building supplies. The students work in teams and use the engineering and design process to prototype, test, and redesign what they build.

Design Thinking Challenge – *MS-HS*

How can we reduce negative environmental impacts from air travel? Students learn the principles of design thinking and systems thinking to explore solutions for this pressing global environmental issue.

THEME 6: GLOBAL CLIMATE SOLUTIONS



Students learn more about the Paris Agreement and the work that the UN is doing to tackle the global problem of climate change. How can innovation, design thinking and engineering play a role in achieving our climate goals? How does access to clean and affordable energy impact other sustainable development goals? Students analyze and prioritize global climate solutions and explore different ways to locally take action in their own schools and communities.

Activities:

Energy Audit and Conservation Campaign – ES-MS-HS Students calculate their school's energy usage and develop a plan to reduce energy consumption in their school building. Students explore potential for implementing solar in their schools.

Analyzing Climate Solutions – MS- HS

Students explore the UN's sustainable development goals and draw connections to sustainable energy production.

Students research and analyze the pros and cons of some of the more ambitious

climate solutions and debate their effectiveness in achieving a sustainable future for the planet.

Available from:
Bullfrog Films • PO Box 149 • Oley, PA 19547
T 610-779-8226 • T 800-543-3764 • F 610-370-1978
info@bullfrogfilms.com