



Online Educator Library List of Units

Elementary Units (1 of 2)	
Unit Name	Unit Description
Keeping it Cool With Solar	An early learner's unit for K-2 exploring the sun's effect on the earth, and an engineering design project involving building and iterating a solar shade structure. 7 lessons.
Solar Ovens	A long lecture and group demo unit with some experimentation that has students learning the basics of energy and solar energy, understanding sources of energy as renewable and non-renewable, and moving into a detailed investigation of the variables affecting the efficiency of solar ovens. 12 lessons.
Our Place in Space	A series of explorations across the year that reveal how the relationship of the sun and earth affect our lives. Encompasses issues such as electromagnetic radiation, earth's magnetism, seasons and day/night. Includes observations, data taking and hands-on experiences. 3 parts.
Cooking with the Sun and Solar Ovens	Beginning with energy basics and explorations of the sun, light and heat, students will move into an exploration of how to design a solar oven, and how solar energy can be used to cook food. 10 lessons.
Introducing Solar Energy	A unit with stories, presentations, and explorations that introduce energy conceptually before moving to renewable and solar energy. 5 lessons.
Understanding Energy and Solar Thermal	An exploratory unit that engages students in the fundamentals of energy with a focus on sources of energy. Includes two home energy surveys and a student-designed investigation to compare various solar water heaters created by student teams. 9 lessons.
Solar Water Pumping	Students will learn that energy from the sun can be converted to electrical energy to do work by engineering a solar water pump system and collect and graph data in their investigations. 2 lessons.
Understanding Science and Engineering Through Solar Power	Students will learn the very basics of scientific exploration, energy & energy transformation, eventually designing their own solar powered water pump. Includes 2 lessons setting expectations for conduct and probing student knowledge, and multiple investigations including collecting data. 7 lessons.
Solar Cars	A complete engineering design challenge with solar cars. Students will design their own investigations with pulley or gear designs, build cars, take data, and argue from that data. 5 lessons.
Solar Boats	Students are led through a comprehensive unit leading them from the basics of energy through to a culminating solar boat engineering design project. 9 lessons.
Solar and SODIS: Creating Clean Water	Students will learn about the different energy sources in sunlight and how they can be used to kill microbes in water and investigate variables that affect microbial levels in water.

Elementary Units (2 of 2)	
Unit Name	Unit Name
Solar Updraft Towers	Students will combine research, direct observations, and hands on investigation to lead them into an engineering design project involving the construction of a solar updraft tower. 5 lessons.
Mini Solar Houses	Students will explore the basics of solar circuitry and use this learning to inform an engineering challenge to build a mini solar house that operates a fan and a light. 3 lessons.
How a Solar Cell Works: Photon Simulation	Students will play a modified game of musical chairs to simulate the movement of electrons at the p-n junction of a photovoltaic cell to create an electrical current. 1 lesson.
Energy Review	Students will take a short field trip around the school to identify different types of energy. 1 lesson.
Understanding E-Waste Through Battery Design	A unit in which students explore the phenomenon of e-waste, build multiple types of batteries, and engineer and investigate multiple sources of clean energy. 3 lessons with a 4th lesson for discussion and reflection.
Adrift in a Sea of Plastic	Students will explore the phenomenon of plastic garbage islands and develop engineering solutions to address the problem. Students will use 3-D modeling and 3-d pens/printers to create their model solutions, conduct research and present their solution. 4 lessons.

Middle School Units (1 of 2)

Unit Name	Unit Description
Solar Cars	A complete engineering design challenge with solar cars. Students will design their own investigations with pulley or gear designs, build cars, take data, and argue from that data. 5 lessons.
Solar Boats	Students are led through a comprehensive unit leading them from the basics of energy through to a culminating solar boat engineering design project. 9 lessons.
Solar and SODIS: Creating Clean Water	Students will learn about the different energy sources in sunlight and how they can be used to kill microbes in water and investigate variables that affect microbial levels in water.
Solar Updraft Towers	Students will combine research, direct observations, and hands on investigation to lead them into an engineering design project involving the construction of a solar updraft tower. 5 lessons.
Mini Solar Houses	Students will explore the basics of solar circuitry and use this learning to inform an engineering challenge to build a mini solar house that operates a fan and a light. 3 lessons.
How a Solar Cell Works	Students will play a modified game of musical chairs to simulate the movement of electrons at the p-n junction of a photovoltaic cell to create an electrical current. 1 lesson.
Energy Review	Students will take a short field trip around the school to identify different types of energy.
Solar Car Engineering Challenge	An engineering design challenge with solar cars. Students will build a solar car and then test to see how fast it can travel a 3m track. After students obtain initial results, they will research how to improve the car's top speed and then design and build an improved model. 8 lessons.
PV Output	A series of simple investigations of the factors affecting solar PV output, including amount of light, light intensity, and solar tilt. Includes data monitoring, graphing, and constructing explanations. 3 lessons.
Experimenting with Solar Heaters	An engineering design challenge that has students first building and taking measurements from a pre-designed solar water heater, then moving into designing their own solar water heater to beat the performance of the pre-designed one. 3 lessons.
Chemical Differences in Emergency Energy Sources	In the context of preparing a disaster supply kit, students develop atomic and molecular models of energy resources, analyze combustion of various fuels and build circuits. They then research and evaluate the impacts of converting natural resources into PV cells. Finally, students engineer a hand warmer that uses an exothermic chemical reaction. 5 lessons.
Solar Car Challenge	Students are led through an engineering design challenge to build a solar powered car. 8 lessons.
Solar vs. Wind Energy	Students learn the fundamentals of energy transformation and vocabulary, electrical circuits, explore energy usage in their homes. Students then explore energy generation, including the use of magnetism and renewable energy sources. 6 lessons.
Home Energy Consumption	Students will calculate the energy consumption of common household devices and investigate the power consumption of other devices in their homes. 1 lesson.
Solar SPRK+	This unit incorporates basic programming knowledge and solar energy into an engineering design challenge using Sphero SPRK+ robots. The theme for this challenge centers on the idea of Mars rovers, and the challenges faced in space exploration, specifically remote control of exploration tools and the energy generation needed to power these devices. 6 lessons.

Middle School Units (2 of 2)

Unit Name	Unit Description
Solar Mobile Design Challenge	This unit involves students learning about transferring solar energy to small motors, exploring the center of gravity and testing light sources (including the sun). The culminating engineering design project gives students the chance to pull together their new learning in order to design a tabletop solar powered mobile. 5 lessons.
Constructing a Solar-Powered MintyBoost USB Charger	A series of presentations and modeling where students learn about solar energy & circuitry, then apply concepts to the construction of a Solar Module MintyBoost USB Charger. Students will then use the charger to create a real-world product, presenting to a panel of “investors.” 7 lessons.
Off the Grid	Students are led through the basics of complex circuit building, including the use of buck and boost converters, converting AC to DC and back, with the ultimate goal of designing and building a solar cell phone charger. Involves learning circuit diagramming and calculating efficiencies of various circuits and comparing based upon measurements. 7 lessons.
Bioreactor Water Heating	Students are led through the concepts of solar and biomass heating to design a water pumping system that uses multiple technologies to avoid water freezing in winter. 3 lessons
Simple Solar Tracker	Students will be shown a working example of a solar tracker and asked to replicate the design based on their observations. 1-2 lessons.
Solar Tracker Challenge	Students will be shown a working example of a solar tracker and asked to replicate the design based on their observations. 1-2 lessons.
Solar Battery Charging	Students become familiar with circuits, batteries, and photovoltaic cells, then plan, build, test, modify, and re-test a small solar battery charger designed to maintain battery charge. 7 days.
Illuminate Me	Students design and build a wearable solar circuit using a microcontroller in a wearable garment project by recharging a renewable energy battery pack. 3 lessons.
Wave Attenuator	Students experiment with concepts of motion to electrical energy transformation. Students build models that demonstrate electromagnetic interactions, then apply this background knowledge to design a solution for wave energy conversion using a wave attenuator. 4 lessons.
Using a Multimeter to Analyze a Solar Circuit	Students will set up a simple circuit, learn to use a multimeter and calculate power, and be introduced to Ohm’s Law.
Circuit Analysis with Solar Energy	Students will set up a simple circuit, use a multimeter to measure the voltage and current through each circuit, and calculate the power consumption and resistance of each load. 2-3 lessons
Adrift in a Sea of Plastic	Students will explore the phenomenon of plastic garbage islands and develop engineering solutions to address the problem. Students will use 3-D modeling and 3-d pens/printers to create their model solutions, conduct research and present their solution. 4 lessons.
A Community Built on Renewable Energy	A comprehensive place-based and project-based unit where students develop a renewable energy plan to meet renewable energy goals. Students engage with local professionals, conduct a home energy survey, experiment with wind blade design, design a solar system for real buildings using professional tools. 7 lessons in 3 Parts.

High School Units (1 of 2)	
Unit Name	Unit Description
Cost Effective Solar Cells	A comprehensive unit exploring the chemistry and functionality of solar photovoltaic cells. Students will learn principles of energy conversion from light energy to chemical & electrical energy. Students test pre-constructed solar panels and construct two known types of solar cells. Finally, students will research, model, build, test, and present on their own unique solar cell designs. 14 lessons.
Off the Grid	Students are led through the basics of complex circuit building, including the use of buck and boost converters, converting AC to DC and back, with the ultimate goal of designing and building a solar cell phone charger. Involves learning circuit diagramming and calculating efficiencies of various circuits and comparing based upon measurements. 7 lessons.
Bioreactor Water Heating	Students are led through the concepts of solar and biomass heating as well as water pumping to design a water pumping system that uses multiple technologies to avoid water freezing in winter. 3 lessons
Simple Solar Tracker	Students will be shown a working example of a solar tracker and asked to replicate the design based on their observations. 1-2 lessons.
Solar Tracker Challenge	Students will be shown a working example of a solar tracker and asked to replicate the design based on their observations. 1-2 lessons.
Solar Battery Charging	Students will become familiar with circuits, batteries, and photovoltaic cells, then plan, build, test, modify, and re-test a small solar battery charger designed to maintain charge in batteries. 7 days.
Illuminate Me	Students will design and build a wearable circuit using a microcontroller and incorporating solar power into a wearable garment project. 3 lessons.
Wave Attenuator	Students will experiment with the basic concepts of motion to electrical energy transformation. Students start by building a series of models that demonstrate the interactions between magnetic and electric fields. Students then apply this background knowledge to design and optimize a solution for wave energy conversion using a wave attenuator. 4 lessons.
Using a Multimeter to Analyze a Solar Circuit	Students will set up a simple circuit, learn to use a multimeter and calculate power, and be introduced to Ohm's Law.
Circuit Analysis with Solar Energy	Students will set up a simple circuit, use a multimeter to measure the voltage and current through each circuit, and calculate the power consumption and resistance of each load. 2-3 lessons
Solar Panel Construction, Orientation and Use	An extended unit which runs through every aspect of constructing and siting solar panels. For this extended task, students will track the sun's altitude and Azimuth to determine the best position for their hand-built solar panel, learn solar cell operation basics, solar panel construction, series and parallel circuitry and basic array sizing. 39 parts.

High School Units (2 of 2)	
Unit Name	Unit Description
50 Year Energy Plan	Students are led through the basics of wind and solar production and efficiencies, as well as motors and generators to prepare them for assessing the impact of different energy sources and developing a 50-year plan for the State of Oregon by using a coded spreadsheet. 6 lessons.
Robotic Sunflower	Students will design a light-responding robotic sunflower using complex circuitry and microcontroller that requires scaffolded computer programming by the students. 5 lessons.
Solar Transportation	Students will explore how PV technology can be used in tandem with alternative transportation energy/fuels. In an engineering design process, students will research existing transportation technologies, learn circuitry and be challenged to charge a lead acid battery with solar power, and create a BEV that uses Solar PV as a complimentary technology. Circuitry and math heavy. 7 lessons.
Solar Resources Assessment	Through presentations and investigations, students will learn the chemistry, function, and siting of solar photovoltaic panels, including evaluating on-campus sites for a fictional solar PV system. 4 lessons.