CONSERVATION STATION

CLASSROOM ACTIVITY

Electrify Everything

OBJECTIVES

Students will be able to:

- **Discover** where electricity comes from and how it is moved from the source to our cities and homes.
- **Compare** and **contrast** methods and sources of electricity production.
- **Create** a sales pitch for an innovation that would help create electricity to support the electrical grid of the future.

OVERVIEW

In this teacher-led activity, the driving questions for students are, "Why is it important to move to electricity as a primary power source in the future, and what is required for cities to become fully electric?" To begin this activity, students will review the ways that the electricity we use can be produced, both from fossil fuels and from sources like wind and solar energy. Students will compare these methods of electricity production and conclude that using sources such as coal and natural gas is not only non-renewable but also damaging to the environment and climate. They will then learn that cities, being the leading users of energy on the planet, use energy grids that are made up of complex networks of power plants, transmission lines, and distribution centers to transport electricity to consumers. Students will form groups and play the role of a company trying to sell an innovation that could help supply energy to help meet the electricity requirements a fully electric city needs. Each group will get a profile card for an innovation, such as smart roads, turning garbage into clean energy, and floor tiles that convert footsteps into electricity. Each group will research their innovation and create a sales pitch to encourage cities to buy their innovation. The activity culminates as each group presents their short sales pitch to the class for feedback.

GRADES

5–9

CONNECTION TO THE ENERGY-WATER NEXUS

- The production of electricity requires the use of water at many points.
- The creation of electricity from renewable energy sources is less water-intensive and can help reduce the use and waste of water.

NATIONAL STANDARDS

Next Generation Science Standards

Science

- **MS-ETS1-4 Engineering Design**
  Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.
- **MS-LS2-5 Ecosystems: Interactions, Energy, and Dynamics**
  Evaluate competing design solutions for maintaining biodiversity and ecosystem services.

BACKGROUND INFO

The increasing use of electricity in cities presents both challenges and opportunities for the electrical grid. With the introduction of EV fleets of buses and trucks, our daily dependence on powering technology such as cell phones and laptops, and the movement of people into cities requiring heating and cooling in their homes, the electrical grid will need to support the transition to cleaner, more efficient, and resilient energy systems. There must be enough electricity to enable technological advancements, meet evolving energy demands, enhance grid reliability, empower consumers, and address emerging challenges and opportunities in the energy sector. By looking at innovations that use renewable sources to produce electricity, we may be able to help reduce the burden that the grid faces in the future.

KEY VOCABULARY

- non-renewable resource
- renewable resource
- electrical grid

MATERIALS

- Butcher block paper or dry-erase boards
- Markers
- Electricity T-Chart Student Sheet (1 per student)
- Sketchnotes Student Sheet (1 per student)
- Electricity Innovation Profile Cards (1 per group)
- Sales Pitch Script Student Sheet (1 per group)
- Student devices with internet access

TEACHER PREPARATION

PROCEDURE

1. The teacher should begin by displaying or asking students the following question: How is electricity produced?
2. Tell students to form small groups and give them a piece of butcher block paper and markers or dry-erase boards and dry-erase markers. Ask students to discuss their ideas with their group and to create a flowchart or diagram that shows how electricity moves from energy sources to their homes and schools. Give each group 5 minutes to create their flowchart or diagram, and allow each group to briefly present it to the group.
3. Give each student a copy of the "Electricity T-Chart Student Sheet." Divide the class into two groups, calling one group "non-renewable" and the other "renewable." Direct the students in the non-renewable group to view videos Coal 101 and Natural Gas 101 on their devices and complete the non-renewable column in their T-chart. Have the renewable group view the videos Solar 101, Wind Power 101, and Hydropower 101 on their devices and complete the renewable column in their T-chart.
4. When students are finished, they should pair up with someone in the other group and take turns sharing the information they recorded with each other. Once they have completed both columns in the T-chart, they should discuss any similarities between electricity production from non-renewable and renewable resources and complete the bottom section of their student sheet.
5. Next, tell students that they will be taking "sketchnotes" as they learn what the electrical grid is—the process of taking the electricity produced and distributing it to homes, schools, and businesses in a city.
6. Explain that sketchnotes use arrows, lines, text, basic graphic shapes, and sketches to create images and drawings that summarize the content they are going to view, similar to the way a frame in a comic conveys an idea with limited words. Remind students that, as they view the video, they should visualize and synthesize what they are seeing and hearing to create notes that reflect their understanding.
7. Give students a copy of the Sketchnotes Student Sheet and play the video Electrical Grid 101 once without pause so students develop a general understanding of the content.
8. Play the video a second time, pausing frequently to allow students to assimilate the information they've heard and to make decisions about how to best represent it on their Sketchnotes page. Share completed Sketchnotes and discuss similarities and differences that students notice.
9. Next, explain to students that many cities are working to reduce and eliminate dependency on non-renewable resources and support the citywide use of electric vehicles and electric devices for powering homes and buildings. As the need for electricity increases as cities evolve, where will we get all of the energy to support the grid?
10. For the final part of the lesson, ask students to form groups of 3–4. Explain that they now will play the role of a company trying to sell an energy innovation that has the potential to supply energy that will help meet personal and community electricity requirements a fully electric city needs, such as smart roads that charge EV's, turning waste into clean energy, and using human movement to produce electricity.

11. Give each group an electricity innovation profile card. Each group will research their innovation using their devices and work together to create a short sales pitch that will encourage cities to buy their innovation. Give groups 15–20 minutes to research and create their pitch. They should complete the sales pitch script as they develop their pitch.

EXTENSION

As an extension of this lesson, student groups can take turns presenting their sales pitches to the whole class to inform others about their innovations and receive feedback and questions from peers.

ELECTRICITY T-CHART

View your assigned videos to complete one column of the T-chart. Next, work with a partner from the other group to complete the other column. Compare the two methods of creating electricity to complete the bottom section.

How Electricity is Produced From	
Non-renewable Resources	**Renewable Resources**
Similarities	

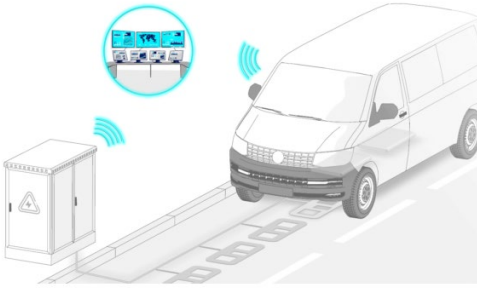
Sketchnotes: Electrical Grid 101

PROFILE: SMART ROADS

Company:
Electreon

Innovation

1. A roadway system that transfers power from the electricity grid to the in-road wireless charging coil segments when an authorized vehicle is directly above an in-road segment. Communication with vehicles is managed in real-time.
2. A vehicle unit that receives the wireless energy from the wireless charging coils and transfers it to the vehicle battery.
3. Cloud-based management software that enables live monitoring and provides smart charging insights.



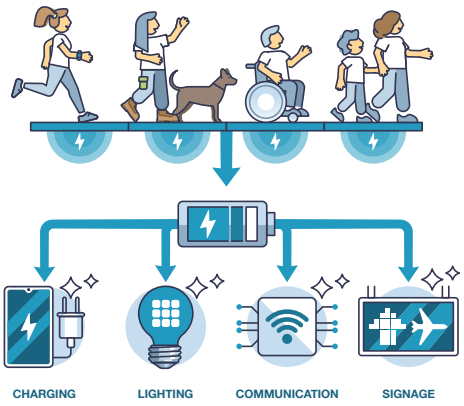
Website
https://electreon.com/technology

PROFILE: SMART FLOORING TECHNOLOGY

Company:
Pavegen

Innovation

A floor tile that generates power when the tile is compressed. It uses the piezoelectric effect–the ability of certain materials to generate an electrical current when compressed–as well as induction, through numerous tiny copper coils and magnets, to create a charge.



Website
https://www.pavegen.com/

PROFILE: ALPHA 311 WIND TURBI

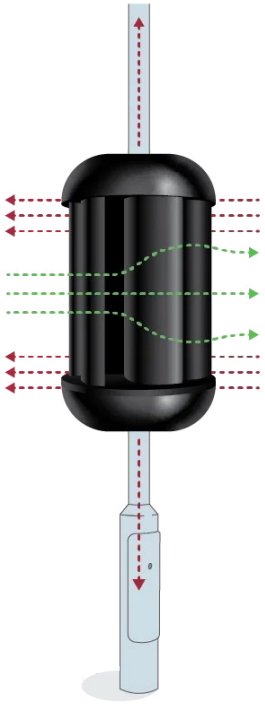
Company:
Alpha 311

Innovation

A vertical axis wind turbine that harnesses energy when placed next to a road or railway where it harvests airflow from passing vehicles and generates electricity even when the wind isn't blowing.

A sensor array collects localized atmospheric data. At roadsides, the Alpha 311 turbine can be attached to existing lighting columns close to roads where they can harvest energy produced by moving vehicles.

Website
https://alpha-311.com/



PROFILE: WAVE LINE MAGNET

Company:
Swel

Innovation

Designed as a spine-like device floating on water, it harnesses the power of waves to produce electricity—offering an affordable, low-maintenance, and climate-friendly alternative to traditional technologies.

The Waveline Magnet is comprised of an array of flexible assemblies linked by a spine power system. The patented technology allows the wave to pass through the system, generating power as the wave rises and falls.

Website
https://swel.eu/technology/

PROFILE: SOLROS REAL LIGHT

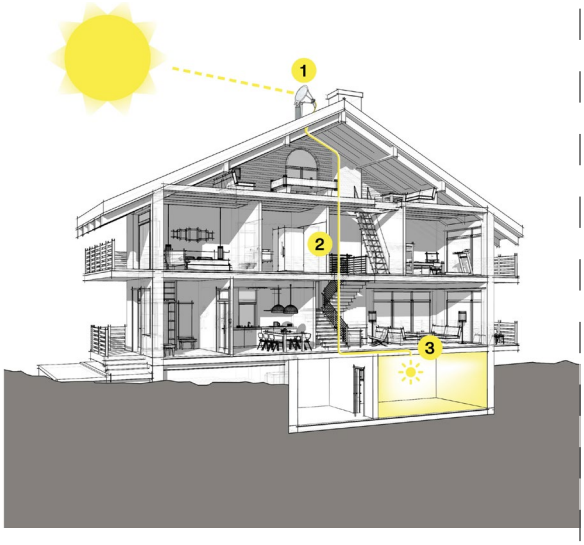
Company:
Solros

Innovation

This is a system that will allow the distribution of sunlight to places where it has never been seen before. The system comprises a sun-concentrating mirror dish that directs light onto the end of a fiber optic cable.

Then, the cable transfers the light to the Solros lightbox or any other luminary and lights up any place you want.

Website
https://solros.com/



PROFILE: HOME BIOGAS BIO-DIGESTER

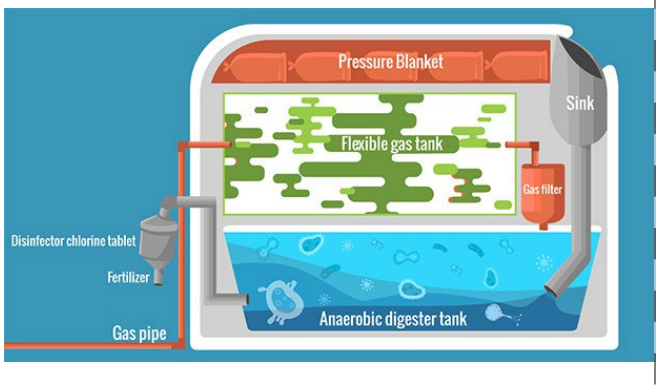
Company:
Home Biogas

Innovation

A biogas digester that converts organic waste into cooking gas and fertilizer.

The system uses bacteria to break down organic matter, such as meat, dairy, and animal manure, in an environment without oxygen—a process called anaerobic digestion. The biogas produced is similar to natural gas, around 60% methane, and can be used to cook for an hour per kilogram of waste. Biogas can also be heated to generate electricity.

Website
https://swel.eu/technology/



A Simple statement of what change you and your product are making
An explanation of the impact your product will have.

What problem are you trying to solve? What opportunities does it provide for people to be more connected, more efficient, or help their community and planet?	Introduce your product. As simple as possible: what does your product do for customers?
Explain the product—how does it work?	What is unique about your product? How does it improve upon other methods or products?
Is there any customer feedback or are there customer testimonials to support this product?	What are the next steps for this product? How could you grow or modify the product in the future?

Call to action

Finish the pitch with a clear request from the audience to take action—why do you care about solving this problem and why should the buyer care? Why should they buy this product?