

**CLASSROOM ACTIVITY**

# Increasing e-Mobility

**OBJECTIVES**

Students will be able to:

- **Discover** what the electricity grid is as well as the changes that must be made for e-mobility and sustainability to increase in the cities of the future.
- **Create** a city plan and map to increase e-mobility in their town or city that takes into account the needs and lives of stakeholders while mitigating other electricity consumption.

**OVERVIEW**

In this teacher-led activity, the driving question for students is, “What are the challenges and benefits of modifying city infrastructure to support a switch from traditional gas-powered vehicles to vehicles that are powered by electricity?” Students will work as project managers for an energy company that has been tasked with creating a preliminary plan for how to increase electromobility (e-mobility) in their town or city. By following Itron’s model for EV solutions, they will learn about electricity grids and determine what types of electric vehicles and EV fleets are needed for citizens and industry in their areas. Students will discuss and research the types of EVs for their communities and brainstorm the best places and ways to provide charging opportunities for vehicles powered by electricity. The final product that student groups will create is a map of their town or city and a plan that will showcase their ideas about how they would increase e-mobility while taking into consideration other electrical demands.

**GRADES**

5–9

**CONNECTION TO THE ENERGY-WATER NEXUS**

- Technology research, development, demonstration, and deployment in areas such as e-Mobility address vulnerabilities and increase resilience of people and communities.
- Water is used in the production of electricity, and using sources such as wind and water to produce the energy needed for increased electricity is crucial.

## NATIONAL STANDARDS

### [Next Generation Science Standards](#)

#### Science

- **MS-LS2-5 Ecosystems: Interactions, Energy, and Dynamics**  
Evaluate competing design solutions for maintaining biodiversity and ecosystem services.
- **MS-ETS 1-1 Engineering Design**  
Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

## BACKGROUND INFO

As electric vehicles become increasingly popular in the U.S. and states look to passing laws to incentivize buying and using EVs, there are changes that must be made in cities to keep up with the new electricity demands that come with increased e-mobility. The U.S. Energy Information Administration predicts that there will be a 50% increase in electricity consumption worldwide by the year 2050 and that the majority of this will come from the widespread use of electric vehicles, such as cars, trucks, buses, and trains. With the need for more energy and new places and methods of charging all these vehicles, how might your town or city look different in the future?

## KEY VOCABULARY

- Electrical grid
- E-Mobility
- EV

## MATERIALS

- FIRST Thought Student Sheet (1 per student)
- Electric Grid and EVs Infographic Sheet (1 per pair of students)
- Markers or Colored Pencils
- e-Mobility: Planning for Your Community Student Sheet (1 per group)
- Devices with internet access

## TEACHER PREPARATION

### PROCEDURE

1. The teacher should explain to students that to begin this lesson, they will be introduced to a problem that cities and communities will need to create solutions for in the future.
2. Provide each student with a copy of the FIRST Thought Student Sheet and review the graphic organizer with the class to explain each portion of the strategy. Ask students to complete the steps on the sheet as they view a video.

3. Show the video "[Scripps News: EPA Plans Stricter New Rules for Electric Vehicles, Emissions](#)" to students on the overhead screen or TV as they complete their student sheets. When students have completed the FIRST Thought student sheet, ask them to share predictions and evidence with the whole class.
4. Explain to students that as cities and countries transition into making EVs a primary way of transporting goods and people—called “e-mobility”—one important question that must be answered is: What are the challenges and benefits of modifying city infrastructure, such as the electric grid, to support the switch from traditional gas-powered vehicles to vehicles that are powered by electricity?
5. Ask students to partner up and give each pair a copy of the “Electric Grid and EVs Infographic Student Sheet.” Tell students that they should use the links provided on the sheet to help them complete the infographic. They should also draw small pictures or graphics in each section of their infographic that help to represent the information and make it more visually appealing. Provide students with markers or colored pencils to add color to their infographics.
6. Once students have finished their infographics, they can be displayed around the classroom for other students to visit and read.
7. Tell students that in the next part of this activity, they will take on the role of project manager in the e-Mobility department of an energy company.
8. To introduce students to e-mobility and the challenge they will face, play the video "[Modernization of the Electric Grid](#)" (stopping at ~4:00) for students on the overhead screen. Ask students to think about how cities will need to change as the need to provide electricity to power fleets of EV buses, cars, semis, and other electrically powered vehicles grows.
9. After viewing the video, ask students to form small groups of 3 or 4. Give each group a copy of a map of your town or city (this can be printed from Google Maps; turning on the street view option will highlight all of the streets in your town or city for students) and a copy of the “e-Mobility: Planning for Your Community Student Sheet.”
10. Ask groups to follow the instructions and use the links provided and their maps to create an e-mobility plan for the town or city. When groups are finished with their plans and maps, if time allows, each group can share their plan with the whole class for feedback.

## EXTENSION

As an extension of this lesson, students can look at the equity of transportation in their community and brainstorm ways that a transition to electric vehicles can help all people have access to the transportation they need to get to school, work, appointments, and all the places they need to go. To see one of the ways a major city like Chicago is using EVs to increase equity in mobility, have students read the article "[Black-owned companies seek to close electric transportation gaps in Chicago | Energy News Network](#)." Next, students can use the [Department of Transportation's Equitable Transportation Community Explorer](#) to find out what the transportation insecurity is for their community. Students can discuss ways that EVs might help increase transportation equity and compose a letter to a local government representative encouraging them to increase e-mobility for all people in the town or city.

## **SOURCES**

<https://app.discoveryeducation.com/learn/player/77470557-b032-4293-9d08-fd9eb2009337?shared=true>

[Electrical Grid 101](#)

[Electric Vehicle Types | US Department of Transportation](#)

[Background and Context for Urban Electric Mobility | US Department of Transportation](#)

[Modernization of the Electric Grid](#)

[Department of Transportation's Equitable Transportation Community Explorer](#)

[Black-owned companies seek to close electric transportation gaps in Chicago | Energy News Network](#)

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| <p><b>Fill</b> in the blank space below with the title of the video: Think about all the information the title gives you. What would you know about the video before you watch it?</p>   |  |
| <p><b>Insights:</b> As you view the video, think about what has led to the problem in the video. What background knowledge do you have about the problem with emissions from vehicles?</p>   |  |
|  | <p><b>Insights and Questions:</b><br/>                 Replay the video: as you view the video again, write down some of your initial thoughts about the topic being discussed in the video. Record 2–3 questions or insights that come up in the video.</p> |
| <p><b>Say and share:</b> Make predictions about issues that will need solutions based on the information about EVs and city infrastructure in the video and share your predictions with a partner. Listen to your partners' predictions and use their predictions to reshape the ones you have. Then, write your predictions. Why? You may hear ideas that you haven't considered and writing them down will help you.</p> |  |
| <p><b>Tie</b> to evidence: Collect evidence from the video to support or refute your predictions.</p>  |  |

Use the following resources to complete the infographic that will help the viewer learn what the electric grid is and why it needs to be updated for the future of electric vehicles.

- [Electrical Grid 101](#)
- [Electric Vehicle Types | US Department of Transportation](#)
- [Background and Context for Urban Electric Mobility | US Department of Transportation](#)
- [Electric Vehicles in the Community: Benefits and Challenges—Clean Energy Group.](#)
- [Electric vehicles reduce carbon pollution in all U.S. states » Yale Climate Connections.](#)

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| <p>What is the <b>ELECTRIC GRID</b>?</p>                       |  |
| <p><b>Parts of the Electric Grid:</b></p>                      | <p><b>How does The Grid work?</b></p>  |
| <p><b>Types of EVs used in cities include...</b></p>           | <p><b>What is the “Smart Grid”?</b></p><br><p><b>Why is it an improvement?</b></p> |
| <p><b>Why are EVs better for cities?</b></p>                   |  |
| <p><b>Why are EVs better for the health of our planet?</b></p> |  |

To begin, discuss with your group how people in your town or community move from place to place—do they bike? Drive? Take the bus or train? Add your ideas below.

Next, create a list of the ways that electricity is used in your community or city. Go to <https://www.eia.gov/energyexplained/electricity/use-of-electricity.php> to help you create your list in the space below. When you are finished, rank the uses from most to least.

Finally, brainstorm and create a plan to increase e-mobility in your city or town. Think about the types of EVs that would be most appropriate and useful for your community and where and how those EVs would be charged to ensure that people are able to have the transportation they need.

Traditional EV chargers that we see in parking lots and on the streets aren't necessarily the only ways to charge electric vehicles. Use the following links as inspiration to come up with new and creative ways to charge EVs in your community in the future!

<https://www.wri.org/update/creative-solution-public-ev-charging-united-states>

<https://www.purdue.edu/newsroom/releases/2023/Q2/building-the-first-highway-segment-that-can-charge-electric-vehicles-as-they-drive.html>

Describe your plan for your community's e-Mobility in the space below.

Finally, use your city or town map to mark how and where your plan would add EV vehicles and charging stations, and minimize other electricity use to help meet the needs of e-mobility.