

## Project Starter

# Evolving Energy Sources

### GRADE RANGE

Elementary, primarily grades 3–5

### DURATION

Two 50–60-minute class sessions

### Overview

Students will be introduced to the devastation that natural disasters can have on electricity through the lens of Hurricane Maria’s effect on Puerto Rico. They will then collaborate to consider nuclear power’s potential as they weigh whether nuclear power could be a promising option for this recovering island. They will ultimately use a digital tool to explain nuclear energy’s potential in natural disaster recovery and communities struggling with electricity around the world.

### Essential Question

How can nuclear power help the world recover from natural disasters?

### Instructional Note

Students will benefit most from this Project Starter if they have already completed **Activity 1: Amazing Atoms** and **Activity 2: Energy Decisions**.

### Instructional Delivery Method

This project starter is presented as an in-classroom experience, but it can also be easily completed at home. Feel free to make modifications based on your teaching environment. For example:

- The Picture Walk images may be shared virtually.
- All partner activities may be completed independently.
- The small-group discussions can be facilitated virtually or performed in writing using a collaborative document.
- Presentations can be held virtually.

## NGSS Standards

|   |   |
|---|---|
| <p>Next Generation Science Standards</p> <p><b>Energy:</b></p> <ul style="list-style-type: none"> <li>4-ESS3-1. Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.</li> </ul> <p><b>Engineering Design:</b></p> <ul style="list-style-type: none"> <li>3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.</li> <li>3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.</li> </ul> | <p>English Language Arts Standards</p> <p><b>Speaking and Listening:</b></p> <ul style="list-style-type: none"> <li>CCSS.ELA-LITERACY.CCRA.SL.5. Make strategic use of digital media and visual displays of data to express information and enhance understanding of presentations.</li> </ul> <p><b>Reading:</b></p> <ul style="list-style-type: none"> <li>CCSS.ELA-LITERACY.CCRA.R.1. Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.</li> </ul> |
|---|---|

## Materials

- Device with Internet access and projection capabilities, one for the teacher
- Devices with Internet access and recording capabilities, at least enough for half the class
- **Picture Walk images**, one copy
- **Picture Walk handout**, one per student
- **Puerto Rico: After the Hurricane handout**, one per student
- **Findings Cards**, copied and cut for one-third of the class
- **Spread the Word rubric**, one per student

## Educator Prep

Before the class session begins, place the six **Picture Walk** images around the classroom.

## Procedure

1. Begin by challenging students to brainstorm different kinds of natural disasters, and create a list as students share.
2. Point to “hurricane” (or add “hurricane” if it is not on the list). Tell the class that in order for a storm to be a hurricane, its winds must reach at least 74 miles per hour. That’s faster than the speed limit on many highways!
3. Then prepare the class for a picture walk by performing the following steps:
  - Tell the class that they are about to look at photographs of Puerto Rico just after it was hit by a huge hurricane in 2017. Use [Google Maps](#) or a classroom map to help students understand where Puerto Rico is in relation to their location.
  - Ask students: How do you think the hurricane may have affected Puerto Rico and the people who live there?
  - Then distribute the **Picture Walk handout** to each student and review the questions provided.
  - Show students where the images are located around the classroom and explain that they will walk independently from picture to picture. They should observe each one and jot notes to help them answer at least one of the questions before moving on to the next image.
  - Assign each student a starting point and then instruct them to move clockwise around the room. They should return to their seats and elaborate on their answers if they finish their observations before time is called.
4. After 5–10 minutes have passed, bring the class back together. Ask students to describe anything that surprised them about the effects of the hurricane. Then facilitate a group discussion around the handout’s questions and encourage students to share what they have recorded.
5. Summarize that Hurricane Maria, like different natural disasters around the world, caused many different problems. Homes, farms, and buildings were destroyed, roads were flooded, and bridges collapsed. It became hard for people to get food and water. The entire island also lost electricity! This affected everything on the island. For instance, supermarkets no longer had cold fridges and freezers, gas stations no longer had power to pump their gas, and wells could no longer supply water.

## Create

1. Explain that students are about to investigate whether a certain type of power—nuclear power—would be beneficial for Puerto Rico and other areas of the world that don’t have stable and constant electricity. In order to do this, they will first learn more about how and why the hurricane affected Puerto Rico’s electricity.
2. Distribute one **Puerto Rico: After the Hurricane handout** to each student. As students read the handout, instruct them to annotate (highlight or underline) the problems that Puerto Rico has related to electricity. You may instruct students to work individually, with partners, or in small groups, depending on your students’ needs.
3. When students have finished reading, gather the class back together and ask them to share the issues that they identified. Keep a list on the board as students share.
4. Then take a class vote: Based on this list of issues, should Puerto Rico begin to think of other ways to get electricity?

5. Explain that Puerto Rico *has* decided that it should start looking into other ways to get electricity. Fossil fuels are not working very well for it right now! Remind students of the energy sources they learned about in **Activity 2: Energy Decisions** and review:
  - Puerto Rico is currently getting its electricity from fossil fuels. Fossil fuels are actual fossils of animals and plants that are found deep below the ground. Once the fossil fuels are dug up, they are shipped to Puerto Rico and brought to a power plant where they are burned. When they are burned, they can create electricity. Power lines bring this electricity from the power plants throughout the island.
  - We can also get energy for electricity from the sun, water, and even wind. For instance, wind causes turbines to spin. As they spin, they can create electricity.
  - Lastly, remind students about nuclear power—which comes from the nucleus of atoms. When one uranium atom is split in half at a power plant, it begins a chain reaction. This chain reaction causes more and more atoms to split in half, too. As they do, they create energy for electricity!
6. Explain that some scientists in Puerto Rico are interested in switching to nuclear power. As a first step, they did a lot of research and published a study on whether they thought Puerto Rico should further look into nuclear power.
7. Divide the class into groups of two or three and share one set of **Findings Cards** with each group. Instruct groups to read through the cards together and then sort the cards into two categories:
  1. Reasons *for* looking into nuclear power, and
  2. Reasons *against* looking into nuclear power. Give groups about 10 minutes to read and sort their cards.
8. As they finish, ask groups to develop a final answer to the question: Based on these findings, does it make sense for Puerto Rico to look into nuclear power? Why or why not?
9. Conclude this portion of the activity by asking groups to share their responses.

## Connect

1. Explain that areas affected by natural disaster often have many of the same problems as Puerto Rico. It would therefore be helpful for regions all around the world to understand if nuclear power could help Puerto Rico, so they can apply it to their own communities.
2. Pass out the **Spread the Word Rubric** to students. Explain that they will create a digital message that spreads the word about whether nuclear power has the potential to help disaster-stricken communities. They may create a video, write a blog entry, or record their voice like a podcast as they explain whether nuclear power should be considered after natural disasters.
3. Based on the needs of your class and teaching environment, decide whether students should work individually or in small groups. Then review the **Spread the Word Rubric** criteria with students and then encourage them to begin!











## Puerto Rico: After the Hurricane Handout

### Hurricane Effects

When Hurricane Maria hit Puerto Rico in 2017, it knocked over almost all of the island's power lines. Power lines help transmit, or send, electricity from one place to another. Without power lines, there was no electricity. The entire island (more than 1.5 million people) lost power. It was the second largest blackout ever.

Having no power causes many problems. Some people had trouble getting food and keeping it from spoiling. Hospitals had trouble taking care of people. There was no Internet, and people couldn't get in touch with their family and friends. Some places, like schools, tried to reopen without power. But without lights and without air conditioning, it was hard to learn. Many people moved off the island.

It took 328 days for power to be brought back to every home in Puerto Rico. That's almost one entire year! It also cost more than 3 billion dollars. Parts of the island were fixed more quickly than others. More remote areas (which are faraway areas with fewer people) were the last to get fixed.

### How is Puerto Rico's power now?

After the hurricane, workers fixed the power lines that had fallen. They rebuilt the poles that hold the wires, and they put the power lines back up. However, they didn't do anything to prevent this from happening if another storm hits again.

Today, most of Puerto Rico gets its electricity from fossil fuels but these fossil fuels are not from Puerto Rico. They are dug up somewhere else, and they are then shipped to Puerto Rico. This takes time, and sometimes the fuel doesn't arrive when it should. Once the fossil fuel arrives in Puerto Rico, power plants burn it and create electricity. Power lines then bring this electricity from the power plants to the people.

But there is another problem! Most of Puerto Rico's power plants are in the south (or bottom half) of the island. But most people in Puerto Rico live in the north (or top half) of the island. Because of this, power lines must carry the electricity long distances. Also, many of the power plants are very old and have equipment that needs to be replaced. The plants don't work all of the time.

Before the storm, some of Puerto Rico also got electricity from solar power. Just as wind power gets its energy from wind, solar power gets its energy from the sun. Solar farms collect this sun energy and turn it into electricity. Unfortunately, many solar farms were destroyed during the storm.

Because Puerto Rico is an island, it is hard to get help from other places. It is also very expensive to ship fossil fuels to the island. Puerto Ricans already pay double what Americans pay for their electricity. And this number could get even higher! Puerto Rico has one power company, and it needs money. So, it may raise its prices even more.

Many people think that Puerto Rico needs to start thinking of other ways to get energy. They think fossil fuels and power lines are not a good solution. Do you agree or disagree?

#### Sources:

- [eia.gov/state/analysis.php?sid=RQ](http://eia.gov/state/analysis.php?sid=RQ)
- [npr.org/2018/08/15/638739819/nearly-a-year-after-maria-puerto-rico-officials-claim-power-totally-restored](http://npr.org/2018/08/15/638739819/nearly-a-year-after-maria-puerto-rico-officials-claim-power-totally-restored)
- [vox.com/identities/2018/8/15/17692414/puerto-rico-power-electricity-restored-hurricane-maria](http://vox.com/identities/2018/8/15/17692414/puerto-rico-power-electricity-restored-hurricane-maria)

## Findings Cards

- **Fact:** The people of Puerto Rico use electricity a lot. They need it to be steady, and they want to be able to depend on it. They don't want to be afraid that the electricity will go out again.
- **Helpful Background:** Nuclear power plants (where electricity is created) work almost all of the time. They need much less human help than fossil fuel power plants.
- **Discuss and Sort:** Based on this information, does it make sense to look into nuclear power? Why or why not?

- **Fact:** Puerto Rico's fossil fuel power plants are very old and often have problems. In the next 10 years, Puerto Rico will have to replace most of its power plants.
- **Discuss and Sort:** Based on this information, does it make sense to look into nuclear power? Why or why not?

- **Fact:** Puerto Rico would like to move to "clean" power.
- **Helpful Background:** When power is "clean," it does not give off green house gases. Greenhouse gases cause the Earth to heat up, which is called global warming. This hurts the environment and living things.
- When fossil fuels are burned, they create greenhouse gases. Nuclear power does not create greenhouse gases.
- **Discuss and Sort:** Based on this information, does it make sense to look into nuclear power? Why or why not?

- **Fact:** Puerto Rico does not have its own fossil fuel. Fossil fuel must be shipped from far away so that Puerto Rico can have electricity.
- **Helpful Background:** A nuclear power plant could be built right on the island. Or Puerto Rico could use mini nuclear power plants called microreactors. These are the newest nuclear power invention. A microreactor can fit in a large truck. It can be driven to a remote area and quickly used for power.
- **Discuss and Sort:** Based on this information, does it make sense to look into nuclear power? Why or why not?

## Findings Cards

- **Fact:** Puerto Ricans are paying a lot for electricity and many can't afford it. One reason for this cost is because fossil fuel must be shipped to the island.
- **Helpful Background:** Fossil fuels must be shipped to Puerto Rico all the time. Nuclear power plants would only need shipments every few years. Though a nuclear power plant would cost money to build, it would then be cheaper to run!
- **Discuss and Sort:** Based on this information, does it make sense to look into nuclear power? Why or why not?

- **Fact:** Small nuclear power plants could be placed around the island.
- **Helpful Background:** Right now, all of Puerto Rico's power plants are in one part of the island, and most of the people live on the other side of the island. Electricity is carried over long power lines.
- **Discuss and Sort:** Based on this information, does it make sense to look into nuclear power? Why or why not?

- **Fact:** Learning about, building, and operating nuclear power plants would give jobs to people in Puerto Rico.
- **Helpful Background:** Puerto Rico's economy (how it makes money) was badly hurt by the hurricane. It is still having trouble today.
- **Discuss and Sort:** Based on this information, does it make sense to look into nuclear power? Why or why not?

## Spread the Word Rubric

### Could nuclear power help communities that have had natural disasters?

**Your answer must:**

- Take the form of a video, blog, or podcast.
- Use Puerto Rico as an example and explain the problems it has had since the hurricane.
- Explain whether nuclear power could help Puerto Rico.
- Explain if this could also help other parts of the world that have been affected by natural disasters.

**Content Criteria:**

|                                     | 3  | 2  | 1   |
|-------------------------------------|--|--|---|
| <b>Problems in Puerto Rico</b>      | Describes at least three problems Puerto Rico has faced since the hurricane and why.       | Describes two problems Puerto Rico has faced since the hurricane and why.                | Describes only one problem Puerto Rico has faced since the hurricane or does not give details about the problems. |
| <b>Nuclear Power in Puerto Rico</b> | Explains at least three ways that nuclear power may or may not help Puerto Rico.           | Explains two ways that nuclear power may or may not help Puerto Rico.                    | Explains one way nuclear power may or may not help Puerto Rico or does not explain their reasoning.               |
| <b>Global Application</b>           | Explains if this information may be helpful to other communities and provides reasons why. | States if this information may be helpful to other communities and gives one reason why. | States if this information may be helpful to other communities but does not explain why.                          |