

POWERING AGAINST BLACKOUTS (PART 2) (LEVEL 3)

Description	In this project, learners will explore the environmental and sustainability tensions around the generation of electricity and craft recommendations for local officers who are trying to address the issue of blackouts.
Leading Question	What can you do to minimize blackouts?
Total Time Required	5.5 hours over 5 days
Supplies Required	Paper, pencils, post-it notes (if available)
Learning Outcomes	<p>Language:</p> <ul style="list-style-type: none"> - Determine two or more main ideas of a text and explain how they are supported by key details; summarize the text. - Analyze multiple accounts of the same event or topic, noting important similarities and differences in the point of view they represent. - Write informative/explanatory texts to examine a topic and convey ideas and information clearly. <p>Science/Environmental Studies:</p> <ul style="list-style-type: none"> - Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost. - 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
Previous Learning	We recommend learners to work on “Powering Against Blackouts-Part 1” before engaging with this project.

DAY 1

Today, we will learn about how blackouts affect communities all over the world.

Suggested Duration	Activity and Description
5 minutes	1. If you have worked on “Powering Against Blackouts-Part 1,” begin by recalling some important concepts of electricity, current, circuit, and

	<p>power grid. Share one thing that you learned from working on that project.</p> <p>2. The goal of the new project is to understand how blackouts affect their communities and to write a newspaper article to share and to craft recommendations to solve the problem.</p>
<p>20 minutes</p>	<p>Read and take a close look at some of these resources. You choose ANY 2 of resources to focus on for Day 1. Since you will be asked to write a newspaper article, make sure you include at least one of these in the list of resources. When contextualizing the project, you can include an article from a local newspaper that addresses the issue of blackouts too.</p> <p>Resource #1 (newspaper article):</p> <p>Weak Power Grids in Africa Stunt Economies and Fire Up Tempers (Excerpt and adaptation from https://www.nytimes.com/2015/07/03/world/africa/weak-power-grids-in-africa-stunt-economies-and-fire-up-tempers.html)</p> <p>July 2, 2015</p> <p>JOHANNESBURG — “It’s like death” Buhle Ngwenya, 45, said, referring to the blackouts imposed to prevent a collapse of the national electricity grid.</p> <p>With winter in South Africa, the worst blackouts in years are plunging residents into darkness in poor townships and wealthy suburbs alike. The cutoffs have affected the economy, Africa’s second biggest, and are expected to continue for another two to three years.</p> <p>Despite a decade of economic expansion, sub-Saharan Africa is still far behind in its ability to generate something fundamental to its future, electricity.</p> <p>Nigeria’s electrical grid generates so little power that the country mostly runs on private generators. So when a fuel shortage struck this spring, a national crisis quickly followed, disrupting cell phone service, temporarily closing bank branches and grounding airplanes.</p> <p>“It’s not only a symbol of failure when the lights go off,” said Anton Eberhard, an energy expert and a professor at the University of Cape Town. “It’s experienced directly by people. If you’re about to cook or if your child is studying for an exam the next day and your lights go off, people feel this very directly. There is a very concrete and dramatic expression of failure.”</p> <p>South Africa’s recent history of electrification is more complicated, and it has been the subject of fierce debate as the current blackout crisis has dragged on for several months. In the last years of apartheid, before a democratic government was elected in 1994, electricity reached only a third of South African households, few of them black.</p>

85 percent of households now have electricity, a remarkable accomplishment by any standard.

President Jacob Zuma has forcefully rejected any blame for the energy crisis. The strain on the grid, he said, resulted from the burden of bringing light to millions of black households that lacked power under white-minority rule.

But energy experts say that these households, many of them low-income, consume little electricity. Instead, they said, the shortages result from frequent breakdowns at aging plants and, most critically, the delayed construction of two new facilities.

South Africa, which has the continent's only nuclear power plant, has around half of sub-Saharan Africa's power generating capacity. Still, the power cuts contributed to a recent drop in economic growth and a spike in unemployment to 26.4 percent, the worst level in a dozen years.

The blackouts have affected everyone, including giant gold mining companies, small businesses, and individuals.

South Africans are buying up generators, rechargeable lights and gas burners. They plan their days and evenings around blackouts scheduled by the utility. Dominating South Africa's list of popular app downloads are ones that alert smartphone users to the impending start of a cutoff in their neighborhood or the risk of one as load shedding across the nation increases.

Resource #2 (Newspaper article):

2nd Day of Power Failures Cripples Wide Swath of India

(Excerpt from:

<https://www.nytimes.com/2012/08/01/world/asia/power-outages-hit-600-million-in-india.html>)

July 31, 2012

NEW DELHI — On Tuesday, India suffered the largest electrical blackout in history, affecting an area encompassing about 670 million people, or roughly 10 percent of the world's population. Three of the country's interconnected northern power grids collapsed for several hours.

Theories for the extraordinarily extensive blackout across much of northern India included excessive demands placed on the grid from certain regions, due in part to low monsoon rains that forced farmers to pump more water to their fields, and the less plausible possibility that large solar flares had set off a failure.

For millions of ordinary people, Tuesday brought frustration and anger; for some, there was fear. As nighttime arrived, Kirti Shrivastava, 49, a housewife in the eastern city of Patna, said power had not been restored in her neighborhood. "There is no water, no idea when electricity will return," she said. "We are really tense. Even the shops have now closed. Now we hope it is not an invitation to the criminals!"

Sushil Kumar Shinde, the power minister, who spoke to reporters in the afternoon, did not specify what had caused the grid breakdown but blamed several northern states for consuming too much power from the national system.

Surendra Rao, formerly India's top electricity regulator, said the national grid had a sophisticated system of circuit breakers that should have prevented such a blackout. But he attributed this week's problems to the bureaucrats who control the system, saying that civil servants are beholden to elected state leaders who demand that more power be diverted to their regions — even if doing so threatens the stability of the national grid.

India's power sector has long been considered a potentially crippling hindrance to the country's economic prospects. Part of the problem is access; more than 300 million people in India still have no electricity.

But India's power generation capacity also has not kept pace with growth. In cases when demand outstrips the power supply, the system of circuit breakers must be activated, often manually, to reduce some of the load in what are known as rolling blackouts. But if workers cannot trip those breakers fast enough, a failure could cascade into a much larger blackout.

Some experts attributed excessive demand in part to the lower levels of monsoon rains falling on India this year, which have reduced the capacity of hydroelectric power and forced many farmers to turn to electric pumps to draw water from underground.

Resource #3 (Photograph of a woman who ran her restaurant by candlelight during a blackout. Credit: Nic Bothma/European Pressphoto Agency):



Resource #4 (map of power grids around the world from <https://engineering.fb.com/2019/01/25/connectivity/electrical-grid-mapping/>):



20 minutes

Write down three details that stand out for them from each resource, two reactions that they have, and one question you want to ask.

This is an example of what you should do:

3 details that stand out

-In the map, I see that India has many power grids.
-Low Monsoons can cause blackouts
-Blackouts bring frustration and anger

2 Reactions

(i) I'm surprised by how much is affected by blackouts
(ii) The map has sparked my curiosity about the differences between countries

1 Question

I wonder if the situation in my community is similar to the one described in the article about India?

- Share what you wrote out loud.
- Besides the details that stood out for you in general about the resources, what are five adjectives or details (if it's an image) that the authors use to give you a vivid picture of what some people are experiencing because of weak power grids?

Below is an example on what to do:

	<p>Words:</p> <ul style="list-style-type: none"> -darkened -crippling -failure -everyone <p>Details:</p> <p>There is contrast between black and light in the picture.</p>
<p>15 minutes</p>	<p>In order to understand the scope of the problem of blackouts, and also understand some of the strategies that authors use to back their claims, find at least 3 numbers (data points) in these resources.</p> <p>For example, below are some questions you can consider:</p> <ul style="list-style-type: none"> ● How many people have been affected by recent blackouts in India, Nigeria, South Africa, Venezuela and/or the USA? ● How many homes and businesses have had their power interrupted in the last year? ● How much does demand for electricity outpaces supply in India? ● What are the economic costs of blackouts in South Africa? <p>Now you should identify what the author’s main points are about how black outs impact communities.</p> <p>You can draw a map showing 2-3 different sectors/areas of life affected by the blackouts.</p> <p>As we have seen, blackouts affect people and the environment in different ways. What are the criteria for a good solution to this problem? In this project, we will come up with a set of recommendations to solve this problem that are cost effective, sustainable, just, and scientifically sound.</p> <p>To get to this point, we will explore the following questions:</p> <ul style="list-style-type: none"> ● How would an electrical grid look like in your community and why? (Based on Powering Against Blackouts Part 1) ● What are the consequences of blackouts in your own community? ● What are the environmental costs of energy production? <p>After this exploration, you will have to give advice to local officers and community leaders to help them make good decisions around generating energy in a sustainable way.</p>

DAY 2

Today, we will begin to prepare the questions and interview a person to learn more about power outages.

Suggested Duration	Activity and Description				
<p>15 minutes</p>	<ol style="list-style-type: none"> 1. Imagine that you have been hired by their local newspaper to create a new article on power outages in your community. The article will spotlight the experience of someone in the community and how they have been affected by blackouts. <ol style="list-style-type: none"> a. You can choose to spotlight a family member, a neighbor or a close friend who has been affected by the blackouts. If you can't find anyone in their community, you can ask people about the potential consequences that a power outage would have for them. 2. Before you start interviewing, consider the following questions: <table border="1" data-bbox="565 953 1317 1308" style="margin: 10px auto;"> <tbody> <tr> <td data-bbox="565 953 971 1115">Whom would you profile and why?</td> <td data-bbox="971 953 1317 1115">What things would you try to collect evidence of?</td> </tr> <tr> <td data-bbox="565 1115 971 1308">What questions would you ask to know more about this person's experience?</td> <td data-bbox="971 1115 1317 1308">What questions would you ask to collect data to show the impact or scope of the problem?</td> </tr> </tbody> </table> <p>Develop your own "interview protocol." On a piece of paper, write down their set of 10 or so questions that are specific to your community.</p> <p>Here are a few examples of questions to get you started:</p> <ul style="list-style-type: none"> ● How have the power outages affected you? ● What do you do when there's a power outage? ● What would you want people in other communities across the world to understand about the impact of the energy cuts where you live? ● How well do you think local officials handle this problem? ● What are some potential solutions to this problem? 	Whom would you profile and why?	What things would you try to collect evidence of?	What questions would you ask to know more about this person's experience?	What questions would you ask to collect data to show the impact or scope of the problem?
Whom would you profile and why?	What things would you try to collect evidence of?				
What questions would you ask to know more about this person's experience?	What questions would you ask to collect data to show the impact or scope of the problem?				

<p>15 minutes</p>	<p>Reflect on your questions by thinking about the following:</p> <ul style="list-style-type: none"> • Are the questions clear enough for anyone to understand them? • Are there enough questions for a 10-15 minute conversation? Are there too many? Do you need to add or remove some questions? • To what extent are the questions allowing you to understand who the person is? • To what extent are the questions allowing you to understand their experience with blackouts? • To what extent are the questions allowing you to begin to think about solutions for this topic? <p>Rewrite the interview questions based on their reflection.</p>
<p>30 minutes</p>	<p>Interview one person in their community. The interview should take around 15 minutes. Make sure to ask permission if you plan to share the person’s name publicly.</p> <p>You can also do this virtually or remotely if locked down; you can call, text, mail or email respondents to interview them.</p> <p><i>It is important that you write down the answers and collect as much evidence as you can because you are going to use it to write the article on Day 4.</i></p>

DAY 3

Today, we will be writing a rough draft of the newspaper article.

<p>Suggested Duration</p>	<p>Activity and Description</p>
<p>10 minutes</p>	<p>1. You will begin by writing a thank you note for the person(s) you interviewed. You should include in the note their major takeaways from the interview. <i>This will help you reflect on what you learned from the interviews.</i></p> <p>For the writing process, you should have available their interview notes. Remember that you will be writing a newspaper article to be read by the people in their communities in which you will explain, through the experience of the person that you interviewed, how blackouts are affecting their community.</p>

<p>10 minutes</p>	<p>Brainstorm for 10 minutes and note ideas. At this point, the ideas do not have to be in complete sentences. (Ex: “A big problem,” “People find solutions,” “it affects businesses,” “candles are dangerous.”)</p>
<p>15 minutes</p>	<p>Once done, you should work to group your ideas. You should try to have three general categories <i>Ex: “A big problem,” “candles are dangerous,” and “it affects businesses” can be grouped under a heading of “Negative consequences.”</i></p>
<p>40 minutes</p>	<ol style="list-style-type: none"> 1. Write an outline from the main points from your brainstorming. Select the data, quotes, and details that will back your main points (the three general categories). You should try to use data from your interview, but you can also draw on the material you have engaged with on other days of the project. 2. Before you begin the writing process. Make sure that you fully understand each of the aspects that should be a part of your writing. <div style="border: 1px solid black; padding: 10px; margin-top: 20px;"> <p style="text-align: center;">Assessment criteria for Newspaper Article</p> <ul style="list-style-type: none"> ● Formatting <ul style="list-style-type: none"> ○ Include formatting (e.g., headings), illustrations, and multimedia when useful or possible to aid comprehension. ○ Between 200 and 400 words ● Explanation of ideas and information: <ul style="list-style-type: none"> ○ Uses details, quotations, and examples to support descriptions ○ Uses facts to support claims and arguments. ○ Use precise language and domain-specific vocabulary to inform about or explain the topic. ● Organization and structure: <ul style="list-style-type: none"> ○ States main idea and moves from one idea to the next in a logical order, emphasizing main points in a focused, coherent manner. ○ Has an effective introduction and conclusion. ○ Uses connectors to emphasize (“Specially,” “in particular”), contrast (“but,” “however”), express cause-effect relations (“therefore,” “as a result”), and illustrate ideas (“for example”) </div>

DAY 4

Today, we will be learning about sustainability.

EAA welcomes feedback on its projects in order to improve, please use this link:

<https://forms.gle/LGAP9k17fMyJrKJN7>

Suggested Duration	Activity and Description
20 minutes	<p>1. Think about sustainability and our current environmental concerns. Ask someone to tell you about it if you want more information. Brainstorm the meaning of “sustaining.”</p> <p>What are some ideas that this concept makes you think about? To sustain means “give support to”, “to hold up”, “to bear” or to “keep up”. So sustainable is an <i>adjective</i> - a descriptive word- for something that is able to be sustained, i.e, something that is “bearable” and “capable of being continued”.</p> <p>2. What do you think is something non-sustainable? The word describes a situation in which human consumption or activities exceeds the ability of the ecosystem to replenish or continue living over time.</p>
20 minutes	<p>1. What do you think is wrong with non-sustainability? Why is sustainability important for the environment?</p> <p>2. Go around their house, grab 5 objects, and think about “the history of the object”. For example, if you grab a banana, think about where and how that banana came from, how it was produced, how it was packaged, etc.</p> <div data-bbox="544 1165 1291 1365" style="text-align: center; margin: 20px 0;"> <p>Banana plantation in South America Supermarket Compost</p> <p>←—————→</p> <p>Production: Where did it come from? Sale/Distribution: How did it get to your place? Disposal: Where will it be disposed?</p> </div> <p>3. Consider the following sources of electricity: hydroelectric power, coal power, nuclear energy, wind, and solar power. Choose the source that interests you the most and draw/illustrate the steps of the process that you think/know can be used to generate electricity.</p> <p>a. If you worked on “Powering Against Blackouts- Part 1,” you will be familiar with some of the steps through which they generate electricity, otherwise, you can use this information to help:</p> <ul style="list-style-type: none"> ● <i>Water or hydroelectric power is created using dams and, obviously, water. Water that is stored up behind the dam causes high-powered turbines (engines) to spin which in turn</i>

	<p>creates electricity. Because rain and snow runoff continually fill the reservoir behind the dam with water, dams are considered a source of renewable energy.</p> <ul style="list-style-type: none"> ● In a coal power plant, coal is mined and then transported to a boiler where it is burned. The heat released from coal boils water to make steam, which then passes through a turbine (engine) to make electricity. Much research has been done to determine the effectiveness of using coal for energy. Coal is inexpensive to use. However, for a typical coal power plant, large amounts of toxic (bad for our health) things like sulfur dioxide, carbon dioxide and mercury are released into the air, causing acid rain, greenhouse gases and other side effects that are harmful to people and the environment. Another concern is what we will use for energy when we run out of coal — there is estimated to be between 100- and 300-years' worth of coal supply remaining in the Earth. ● Nuclear energy comes from enriched uranium and provides more energy than the same amount of gasoline. Nuclear power plants use the power stored in the nuclei (the center) of uranium atoms to heat up and boil water, and subsequently, to create steam. A steam turbine then generates electricity. There is not much pollution associated with nuclear power plants; however, the use of nuclear power is quite controversial, as there are risks to the environment and humans through the mining and transportation of uranium, as well as the storage of used uranium. ● Wind. Blowing wind turns enormous blades, which turns an electric motor and makes electricity. There is a disadvantage with wind turbines that is similar to solar energy. You need to store the electricity that is created because it is not guaranteed that the wind will blow (to turn the blades) precisely when the power is needed. With each of these three types of renewable energy sources, there is little pollution to worry about cleaning up afterwards. ● Solar power uses photovoltaic (PV) panels to change sunlight into electric current to create electricity. One difficulty associated with PV panels is that power is still needed when the sun is not shining (i.e., having your lights or other electrical devices on at night); therefore, the electricity needs to be stored during the day for use at night, which is often expensive.
--	---

20 minutes

Compare these resources based on their cost-effectiveness (how expensive - in terms of time, amount of resources, availability of the resources needed, infrastructure, technical requirements- it is to generate electricity using that source) and their sustainability. You may use this worksheet:

Type of Power Plant	Requirements (Ex: fuel, sunshine, etc.)	Cost (high or low)	How Sustainable is it? (sustainable, not very sustainable, etc.)
Hydroelectric			
Solar			
Wind Turbine			
Nuclear			
Coal			
Natural Gas			

What do think is most important:
 Providing inexpensive power that puts out emissions (pollution) that affect the environment and people's health but allows the community to have more reliable electric grids
or
 Focusing on the development of clean energy at the expense of other improvements.
 Provide a good reason for choosing each of the alternatives.

DAY 5

Today, we will be thinking of solutions to power outages and we will be giving recommendations to local officers.

Suggested Duration	Activity and Description
10 minutes	<ol style="list-style-type: none"> Rank in order the three most important consequences of blackouts in the community. Explain what is the criteria that you are using to say that one consequence is more important than the other one. <ol style="list-style-type: none"> For example, you might be using as you criteria "The community's economic well being" or "risks for the

	environment” or “it affects me and the people that I love the most.”.
20 minutes	<p>Begin to think about recommendations to solve these three consequences. Here are some questions to think about:</p> <ol style="list-style-type: none"> a. Based on your interviews and your learning so far, <ol style="list-style-type: none"> i. Where and when does the community have more demand for energy? ii. Based on this, are there ways that will help local officials balance supply and demand? What individual or group behaviors should be encouraged? iii. Are the blackouts affecting some people more than other ones? iv. Can everyone’s problem be addressed at the same time? v. Who should be prioritized in offering a solution? b. How can the power grid and power plants be sustainable? c. Can you think about alternative sources of energy in their community?
10 minutes	Write down 3 recommendations for local officers who are willing to solve blackouts in your community.
10 minutes	<p>Present to you family and/or classmates the recommendations and elicit feedback regarding:</p> <ol style="list-style-type: none"> a. In what ways are they cost-effective? b. In what ways are they sustainable? c. In what ways are they scientifically sound?
10 minutes	Use the feedback to polish the recommendations and, if possible, share the recommendations with local officials (they can present them, send them a message, etc.). Attach their newspaper article to back the recommendations.

ASSESSMENT CRITERIA

- Uses details and examples to support descriptions
- Uses facts to support claims and arguments.
- States main idea and moves from one idea to the next in a logical order, emphasizing main points in a focused, coherent manner.
- Has an effective introduction and conclusion.
- Uses connectors such as to emphasize (“Specially,” “in particular”), contrast (“but,” “however”), express cause-effect relations (“therefore,” “as a result”), and illustrate ideas (“for example”).

ADDITIONAL ENRICHMENT ACTIVITY

"Some 30 years ago, Buckminster Fuller came up with a plan to plug all the world's continents into the same electrical grid. The idea was to let power flow between countries. Energy companies then proceeded to build such a grid. To get the most use of their generation capacity and to maintain an emergency reserve, power companies found it efficient to connect their grids to their neighbor's, who then connected to their neighbor's.

"The result, according to Peter Meisen of the Global Energy Network Institute, is that the electricity grids of all the nations of North and South America should be interconnected within the next 10 years.

"...Once the [international] grid is fully functional, the only excuse for power shortages will be greed. When demand is high in one region, it's almost certain to be low in another. By making electric power as easily transferable as data, analysts expect a global grid to smooth the market spikes out of the world's most useful commodity."

What will be the advantages and disadvantages of such a system? Should we be concerned that "...the only excuse for power shortages will be greed"?