Teacher Information
Renewable Energy Performance Tasks

PEI created performance tasks designed to introduce middle school students to renewable and non-renewable energy resources. To date, these tasks include the following:

Renewable and Non-renewable Energy
Renewable Energy: Wind
Renewable Energy: Solar
Renewable Energy: Hydropower
Renewable Energy: Geothermal
Renewable Energy: Biomass

The tasks are designed to provide basic background knowledge about renewable energy including what it is, how it works and the advantages and disadvantages for the environment. Each task focuses on a type of renewable energy, including basic background knowledge, career information, and a variety of print and video resources. Students practice the research skills of locating information, selecting the best information, and having enough information to explain or persuade.

The first task, ***Renewable and Non-renewable Energy,*** culminates in a speech. Teachers are provided with the SBAC Speech rubric for scoring the student presentations. A template is provided for planning speeches. Teachers may adapt these materials as desired.

The Wind, Solar, Hydropower, Biomass, and Geothermal energy tasks are written to culminate in an argumentative essay. Students present a strong argument for the renewable energy source researched, including providing at least one counter argument with rebuttal. Each task includes an essay organizer to support students in writing an argumentative essay. The SBAC Argumentative rubric is included for scoring student work.

Teachers may want to assign additional research for the students prior to writing their essays. Otherwise, students can draw from the information provided in the performance task.

Each task includes a suggested field experience so that students may learn firsthand about the various renewable energy resources. If you are unable to conduct the field experience, you may want to create a virtual experience for the students where they investigate how the renewable energy resource is affecting their local communities.

Field Investigations are being developed for each task. These will be posted on the PEI website as they are created. The field investigations will focus on the science behind energy production and align with the NGSS standards.

Teachers should implement the performance tasks in a time frame that works best for them. The original model from SBAC has students completing Part 1 on day 1 and Part 2 on day 2. This may be inadequate for diving deeply into the research materials and ELA skills. Most likely, each performance task will fit into a three to five-day time period.

The main purpose of these tasks is to integrate ELA skills, including reading, writing, listening, and speaking, with science content. Think of the tasks as a gateway into a more in-depth study of renewable energy and an opportunity to practice and apply a wide variety of ELA skills. Make the materials work for you and for your students. And do feel free to contact PEI for additional support!

Performance Task: Renewable Energy - Hydropower

PART 1: Research
Student Directions

Your Assignment:

Your County Council is investigating renewable energy options for the future. The Council has asked middle school students to research the pros and cons of different types of renewable energy including wind, water, and sunlight. **Your class will focus on hydroelectric energy produced from rivers and dams.** You will research this type of energy, determine the pros and cons, and share your findings with the Council in the form of an argumentative essay.

Steps you will follow:

To plan and compose your essay, you will do the following:

1. Read an article, view an infographic, read a pros and cons list, and watch two videos.
2. Answer three questions about the sources.
3. Participate in a hydropower field experience.
4. Write your essay.

Directions for beginning:

You will read the article, view the infographic, read the pros and cons list, and watch two videos, taking notes with the template provided. You may refer to the media sources and your notes when writing your essay.

Sources:

Source #1:	Article: *What is Hydropower? Let's Explore the Basics!* Adapted from U.S. Energy Information Administration Energy Kids Renewable Hydro Power. Source Link: https://www.eia.gov/kids/energy.cfm?page=hydropower_home-basics
Source #2:	Infographic: *Inside a Hydropower Plant,* Infographic, 2001 HowStuffWorks https://science.howstuffworks.com/environmental/energy/hydropower-plant1.htm
Source #3:	*Hydroelectric Energy: Pros and Cons* Source link: http://energyinformative.org/hydroelectric-energy-pros-and-cons/
Source #4:	*Energy 101: Hydroelectric Power* (3:50) https://youtu.be/tpigNNTQix8
Source #5:	Career Video: *Apprenticeship Program* (4:33) https://www.youtube.com/watch?v=-n7vqH5_f74

Performance Task: Renewable Energy - Hydropower

Note-taking Template

Source	How Hydroelectric Energy works	Pros of Hydroelectric Energy	Cons of Hydroelectric Energy
Source #1: Article- What is Hydropower? Let's Explore the Basics!			
Source #2: Infographic - Inside a Hydropower Plant			

Source	How Hydroelectric Energy works	Pros of Hydroelectric Energy	Cons of Hydroelectric Energy
Source #3: Hydroelectric Energy Pros and Cons			
Source #4: Video- Hydroelectric Power			

Career Video Note-taking Tool

Source	Types of Jobs	Key qualifications	Benefits of working in this industry
Source #5: Career Video - Apprenticeship Program			

Performance Task: Renewable Energy - Hydropower

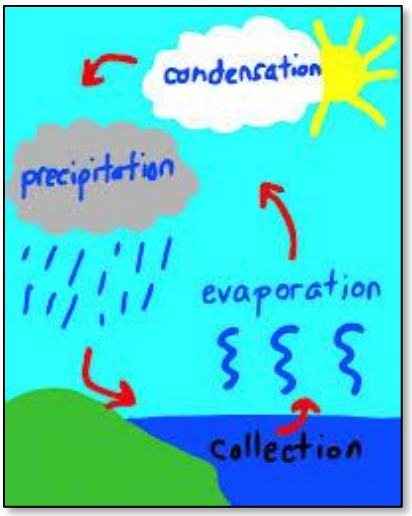
Source #1: Article

What is Hydropower? Let's explore the basics!

Adapted from U.S. Energy Information Administration Energy Kids Renewable Hydro Power.

Hydropower is energy created from moving water: rivers, streams, and even ocean waves! It's the largest source of renewable energy in the United States and accounts for 6.5% of all energy generated, including renewable and non-renewable energy sources. Washington State produces more energy from hydropower than any other state in the union - 29% of the total electricity generated.

Hydropower depends on water! The water cycle helps us understand where the water comes from to make hydropower work. Let's review!



Evaporation: Heat from the sun causes water on Earth (in oceans, lakes, etc.) to evaporate (liquid to gas) and rise into the atmosphere. This water vapor collects in the atmosphere in the form of clouds.

Condensation: As water vapor in the atmosphere cools down it becomes a cloud. This process is called condensation.

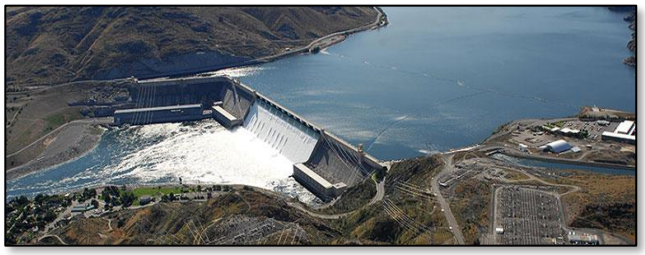
Precipitation: Water falls from the atmosphere in the form of rain, snow, hail, or sleet. This process is called precipitation.

Collection: Precipitation collects in streams and rivers, which empty into oceans and lakes, where it evaporates and begins the cycle again. The amount of precipitation that drains into rivers and streams determines the amount of water available to produce hydropower.

Now let's explore how hydropower is produced.

First, hydropower relies on moving water. The volume of the water flow and the change in elevation (or fall) from one point to another determine the amount of available energy in moving water. High flow rate equals more power. For example, the large volume of water in the Columbia River carries a great deal of energy in its flow.

Second, hydropower is produced at plants that harness the energy from the moving water. These plants are connected to dams that can slow down or speed up the rate of flow.



Grand Coulee Dam. Image Credit: Dept of the Interior

Water from the river is stored in a reservoir behind the dam. This water is released to create electricity. The water turns a turbine that is connected to a generator. The generator is the source of electricity.

Third, hydropower is transformed at the powerhouse into electricity. This electricity is released to the "grid" or power lines that take the electricity to businesses and homes.

Performance Task: Renewable Energy - Hydropower

Hydropower and the Environment

Hydropower is a renewable energy source and is low cost once the structures, including the dams, are built. Hydropower generators produce clean electricity. They do not directly emit air pollutants. However, there are environmental concerns. These include the following:

Dams affect fish migration. Spawning salmon, for example, need to travel a long way from the ocean up a river or stream to lay their eggs for the next generation of fish. Dams block the waterways where they are built. Without human help, these fish would be unable to complete their life cycle.

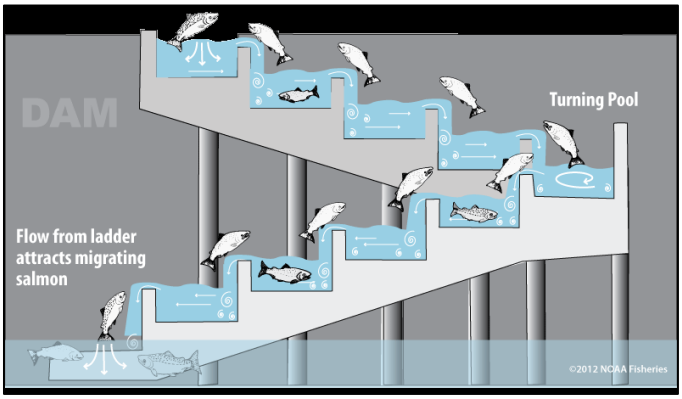
Dams affect the ecology of the river where they are built. Reservoirs result in changing water temperature and even water chemistry. Water flow is also affected. More silt (soil particles) can be brought downstream, affecting the physical characteristics of the river. These changes may have negative effects on native plants and animals that rely on the river.

Dam reservoirs can affect other interests. For example, reservoirs may cover important natural areas, agricultural land or archeological sites.

Dam construction leaves a carbon footprint. The construction process and materials used for building a hydroelectric power plant and dam do produce carbon and other pollutants.

What can we do to make hydropower even better for the environment?

Probably the greatest environmental challenge, created from dam construction is the effect on fish migration. Many species of fish, such as salmon and steelhead, swim up rivers and streams from the sea to reproduce in their spawning grounds in the beds of rivers and streams. Dams can block their way. Fortunately, engineers have designed fish ladders and fish elevators that assist the fish in their migration. These structures allow the fish to move around or over dams to the spawning grounds.



Fish ladder. Image credit: NOAA

Building a dam and power plant is an investment in the future. While there may be carbon emissions in the construction of a hydroelectric power plant, these structures are designed to last 50 to 100 years. The emissions from construction are offset by emission-free hydroelectricity. And in our state we have ample water to produce large quantities of electricity. **Now you know the basics!**

Source #2: Infographic

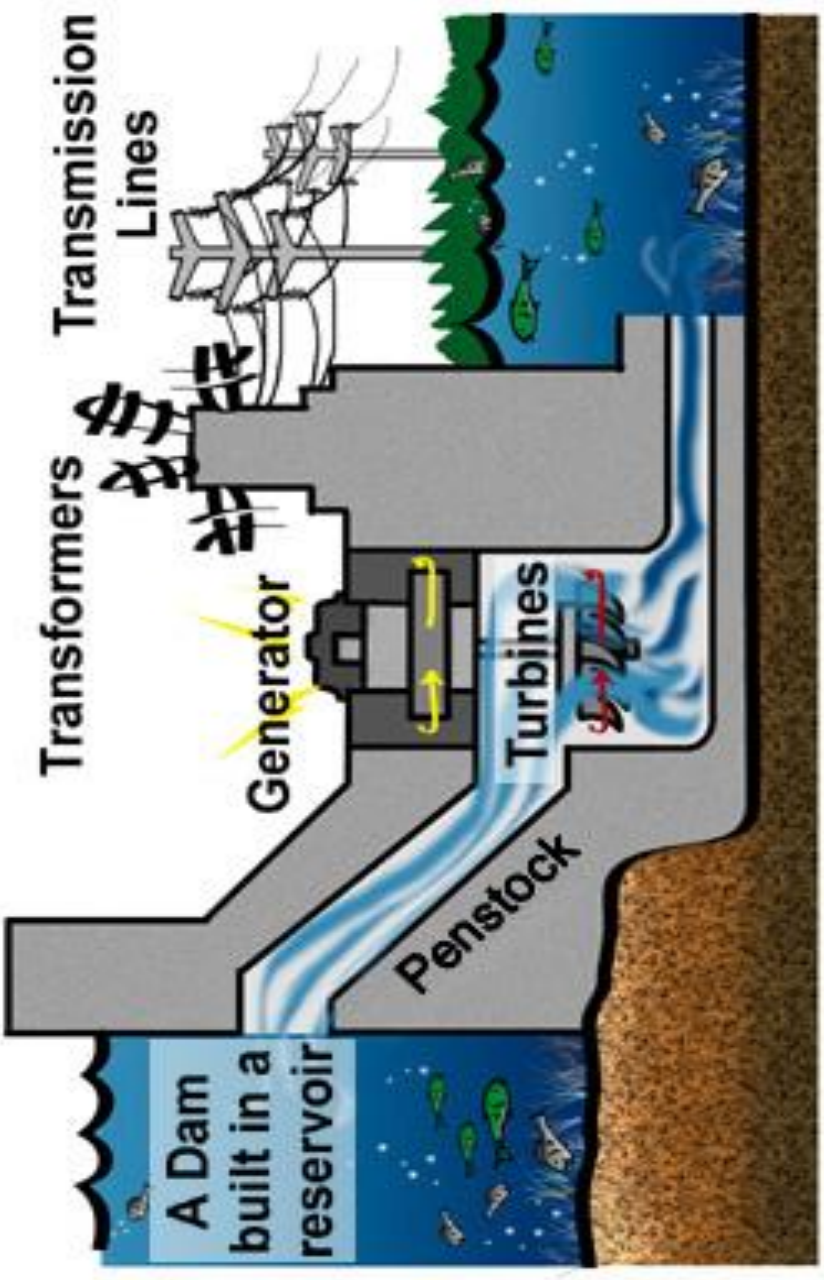


Image credit PSE&G

Source #3: Pros and Cons

Hydroelectric Energy Pros and Cons

Advantages of Hydroelectric Energy

1. Renewable

Hydroelectric energy is renewable. This means that we cannot use it up.

2. Green.

Generating electricity with hydro energy does not contribute to pollution. The only pollution occurs during the construction of these massive power plants.

3. Reliable.

Hydroelectricity is very reliable energy. States like Washington that have large river systems use hydroelectricity as a primary energy source. If there is adequate water available, electricity can be generated.

4. Flexible.

Adjusting water flow and output of electricity is easy. At times when power consumption is low, water flow is reduced. The water levels are being conserved for times when power consumption is high.

5. Safe.

Compared to fossil fuels and nuclear energy, hydroelectricity is much safer.

Disadvantages of Hydroelectric Energy

1. Environmental Impacts

Environmental impacts from hydroelectricity are created due to the damming of water, changed water flow and the construction of roads and power lines.

Hydroelectric power plants affect the migration of fish trying to reach spawning grounds. Fish can't make their way past a dam without the help of fish ladders or other engineered solutions.

2. Expensive

Building power plants of all types is expensive. Hydroelectric power plants are not an exception to this. On the other hand, these plants do not require a lot of workers, after they are built, and maintenance costs are usually low.

3. Droughts

Electricity generation and energy prices are directly related to how much water is available. A drought could potentially affect the amount of electricity that can be generated.

4. Limited Reservoirs

There are a limited number of suitable sites where hydroelectric power plants can be built and even less places where such projects are profitable.

References: [1] NASA, [2] U.S. Department of Energy, [3] National Renewable Energy Laboratory (NREL), [4] U.S. Energy Information Administration (EIA), [5] European Union.

Performance Task: Renewable Energy - Hydropower

Research Questions:

1. Explain what we mean by hydroelectric energy and name two benefits. Use information from two of the sources. Name your sources. *(ELA Research Target 2: Locating Information)*

2. Which source is the most helpful in explaining the value of hydroelectric energy for our environment: the video describing how hydroelectric energy works, the pros and cons list, or the article? Explain your choice with at least two reasons. Be sure to compare the source you choose to the other choices. *(ELA Research Target 3: Selecting the best information)*

3. Would you consider a career in hydroelectric energy? Explain your response using at least two supporting reasons. You may use information from any of the sources to explain your response. Be sure to name your sources. *(ELA Research Target 4: Having enough information)*

Part 2: Field Investigation

Arrange to take your students on a visit to a hydroelectric plant or dam. Plan the field investigation prior to the students writing their essays. Encourage the students to use information they learn about the benefits of using hydroelectric energy, including employment opportunities, in their essays.

Hydroelectric Field Investigation
Note-taking Template

Date:

Brief description of experience:

Benefits of hydroelectric energy:

Challenges we face using hydroelectric energy:

How are these challenges being addressed?

Career opportunities in the hydroelectric energy industry:

Performance Task: Renewable Energy - Hydropower

PART 3: Essay

Student Directions:

You will review your notes and plan your argumentative essay. You may use notes from the sources and from the field experience to write your essay. You may also refer to the sources, if needed. Read your assignment and the information about how your essay will be scored. Then begin your work.

Your assignment:

You have been asked by the County Council to research the pros and cons of hydroelectric energy and to make a case for continuing to use and expand this type of renewable energy. Your essay should persuade your reader to support hydroelectric energy production and include the following:

- Explain what hydroelectric energy is and why it is considered renewable.
- Identify at least three important pros and one significant con, providing a counter argument to the con.
- Convince the reader why it is important to use hydroelectric energy as a valuable renewable resource. Consider access to rivers, impact on the environment, and potential employment opportunities.

Use the planning template to help you compose your essay.

How your essay will be scored:

1. *Statement of Purpose/Focus* – how well you clearly state and maintain your claim including addressing counter arguments.
2. *Organization* – how well the ideas progress from the introduction to the conclusion using effective transitions and how well you stay on topic throughout the essay.
3. *Elaboration of Evidence* – how well you provide evidence from source about your claim and elaborate with specific information.
4. *Language and Vocabulary* – how well you effectively express ideas using precise language that is appropriate for your audience and purpose.
5. *Conventions* – how well you follow the rules of usage, punctuation, capitalization, and spelling.

Now begin work on your essay

- Review your notes
- Plan your essay using the template provided
- Write your essay
- Revise and edit for a final draft

Performance Task: Renewable Energy - Hydropower

Planning My Essay

Essay Components:
Introduction: Capture the reader's interest!
Explain what hydroelectric energy is and how it is a renewable resource.
State the argument for hydroelectric energy, including at least three strong pros. Consider access to rivers, impact on the environment, and employment opportunities. 1. 2. 3.
Identify an important con of hydroelectric energy and provide a counter argument to this con:
Provide a persuasive conclusion:

Argumentative Writing Rubric (Grades 6–11)
Scoring Version

Score	4	3	2	1
Statement of Purpose/Focus	**The response is fully sustained and consistently and purposefully focused:** • claim is introduced clearly communicated, and the focus is strongly maintained for the purpose, audience, and task • alternate or opposing argument(s) are clearly acknowledged or addressed*	**The response is adequately sustained and generally focused:** • claim is clear and the focus is mostly maintained for the purpose, audience, and task • alternate and opposing argument(s) are adequately acknowledged or addressed*	**The response is somewhat sustained and may have a minor drift in focus:** • claim may be somewhat unclear, or the focus may be insufficiently sustained for the purpose, audience, and task • alternate and opposing argument(s) may be confusing or not acknowledged*	**The response may be related to the purpose but may provide little or no focus:** • claim may be confusing or ambiguous; may be too brief or the focus may drift from the purpose, audience, or task • alternate and opposing argument(s) may not be acknowledged*
Organization	**The response has a clear and effective organizational structure, creating a sense of unity and completeness:** • consistent use of a variety of transitional strategies to clarify the relationships between and among ideas • effective introduction and conclusion • logical progression of ideas from beginning to end; strong connections between and among ideas with some syntactic variety	**The response has an evident organizational structure and a sense of completeness, though there may be minor flaws and some ideas may be loosely connected:** • adequate use of transitional strategies with some variety to clarify relationships between and among ideas • adequate introduction and conclusion • adequate progression of ideas from beginning to end; adequate connections between ideas	**The response has an inconsistent organizational structure, and flaws are evident:** • inconsistent use of transitional strategies and/or little variety • introduction and conclusion, if present, may be weak • uneven progression of ideas from beginning to end; and/or formulaic; inconsistent or unclear connections among ideas	**The response has little or no discernible organizational structure:** • few or no transitional strategies are evident • introduction and conclusion, if present, may be missing • frequent extraneous ideas may be evident; ideas may be randomly ordered or have unclear progression
Elaboration of Evidence	**The response provides thorough and convincing support/evidence for the argument(s) and claim that includes the effective use of sources (facts and details).** • comprehensive evidence from sources is integrated; references are relevant, and specific • effective use of a variety of elaborative techniques**	**The response provides adequate support/evidence for the argument(s) and claim that includes partial or uneven use of sources (facts and details).** • adequate evidence from sources is integrated; some references may be general • adequate use of some elaborative techniques**	**The response provides uneven, cursory support/evidence for the argument(s) and claim that includes partial or uneven use of sources (facts and details).** • some evidence from sources may be weakly integrated, imprecise, or repetitive; references may be vague • weak or uneven use of elaborative techniques**; development may consist primarily of source summary or may rely on emotional appeal	**The response provides minimal support/evidence for the argument(s) claim that includes little or no use of sources (facts and details).** • evidence from source material is minimal or irrelevant; references may be absent or incorrectly used • minimal, if any, use of elaborative techniques**; emotional appeal may dominate
Language	**The response clearly and effectively expresses ideas, using precise language:** • vocabulary is clearly appropriate for the audience and purpose • effective, appropriate style enhances content	**The response adequately expresses ideas, employing a mix of precise with more general language:** • vocabulary is generally appropriate for the audience and purpose • generally appropriate style is evident	**The response expresses ideas unevenly, using simplistic language:** • vocabulary use is uneven or somewhat ineffective for the audience and purpose • inconsistent or weak attempt to create appropriate style	**The response's expression of ideas is vague, lacks clarity, or is confusing**: • vocabulary is limited or ineffective for the audience and purpose • little or no evidence of appropriate style

Score	2	1	0
Conventions	**The response demonstrates a command of conventions:** • adequate use of correct sentence formation, punctuation, capitalization, grammar usage, and spelling	**The response demonstrates partial command of conventions:** • limited use of correct sentence formation, punctuation, capitalization, grammar usage, and spelling	**The response demonstrates little or no command of conventions:** • infrequent use of correct sentence formation, punctuation, capitalization, grammar usage, and spelling

NS	**Unintelligible, in a language other than English, off-topic, insufficient evidence (incomplete) or copied text. (Off-purpose writing will still receive a score in Conventions).**

* Acknowledging and/or addressing the opposing point of view begins at grade 7
** Elaborative techniques may include the use of personal experiences that support the controlling idea