

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!



## 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 energy from wind, water, and sunlight. **Your class will focus on wind energy produced from wind turbines.** 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 suggested 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 sources and your notes when writing your essay.

### Source Information:

- Source #1:**            **Article:** *Wind Basics* adapted from Energy Kids: Renewable Wind  
[https://www.eia.gov/kids/energy.cfm?page=wind\\_home-basics](https://www.eia.gov/kids/energy.cfm?page=wind_home-basics)
- Source #2:**            *Wind Energy: Pros and Cons* adapted from  
<http://energyinformative.org/wind-energy-pros-and-cons/>
- Source #3:**            **Video:** *Energy 101: Wind Turbines*, US Department of Energy (3:23)  
<https://youtu.be/EYYHfMCw-Fl>
- Source #4:**            AWEA Poster- *Wind Power and the Economy*,  
Source: <https://shar.es/1PRTIF>
- Source #5:**            **Career Video:** *Climbing Wind Turbines for a Living* (5:43)  
<https://youtu.be/xUjCD-fFU9k>



## Note-taking Template

Source	How Wind Energy Works	Pros of wind energy	Cons of wind energy
Source #1: Article - Energy Kids: Wind Basics			
Source #2: Reading: Wind Energy Pros and Cons			
Source #3: Video - Energy 101 Wind Turbines			



**Note-taking Template**

Source	Types of Jobs	Key qualifications	Benefits of working in this industry
Source #4: Infographic: Wind Energy and the Economy			
Source #5: Career Video			



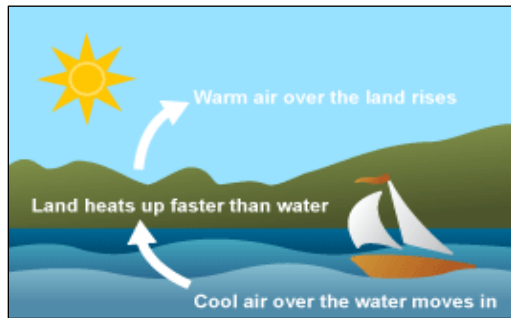
## Source #1: Article

### Wind Basics

*Wind Basics is adapted from the [Energy Information Administration, Energy Kids](#).*

#### Wind Basic #1: Wind creates energy from moving air

Wind is caused by uneven heating of the earth's surface by the sun. Because the earth's surface is made up of different types of land and water, it absorbs the sun's heat at different rates. One example of this uneven heating is the daily wind cycle.

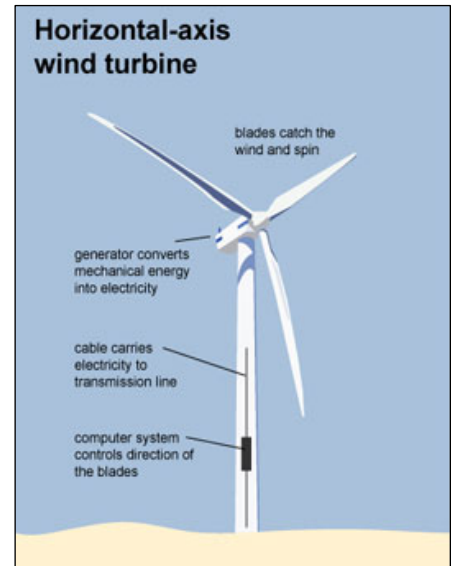


#### The Daily Wind Cycle

During the day, air above the land heats up faster than air over water. Warm air over land expands and rises, and heavier, cooler air rushes in to take its place, creating wind. At night, the winds are reversed because air cools more rapidly over land than it does over water. In the same way, the atmospheric winds that circle the earth are created because the land near the earth's equator is hotter than the land near the North Pole and the South Pole.

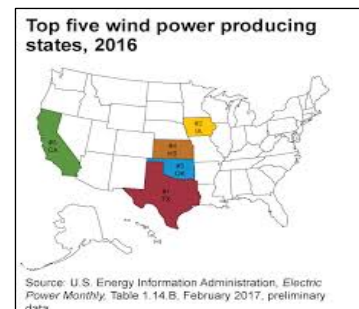
#### Wind Basic #2: How wind turbines work

Wind turbines use blades to collect the wind's kinetic energy. Wind flows over the blades creating lift (similar to the effect on airplane wings), which causes the blades to turn. The blades are connected to a drive shaft that turns an electric generator, which produces the electricity.



#### Wind Basic #3: Electricity generation from wind

In 2016, wind turbines in the United States were the source of nearly 6% of the total U.S. utility-scale electricity generation. The amount of electricity generated from wind has grown significantly since 2000. Electricity generation from wind in the United States increased from about 6 billion kilowatt hours (kWh) in 2000 to about 226 billion kWh in 2016. New technologies have decreased the cost of producing electricity from wind, and growth in wind power has been encouraged by government incentives.





## Performance Task: Renewable Energy - Wind



Wind power plants, or wind farms, are clusters of wind turbines that produce large amounts of electricity. A wind farm usually has many turbines scattered over a large area. One of the world's largest wind farms, the Horse Hollow Wind Energy Center in Texas, has 420 wind turbines spread over 47,000 acres. The project has a combined electricity generating capacity of about 735 megawatts (or 735,000 kilowatts). The largest project in Washington is the Wild Horse Wind Farm near Vantage. This site has 127 wind turbines generating electricity.



Wind Turbines at the WildHorse Wind Farm - Vantage, WA

### Wind Basic #4: Wind Energy and the Environment

**Wind is a renewable and emissions-free energy source.** Overall, using wind to produce energy has fewer environmental impacts than many other energy sources. Wind turbines do not release emissions that can pollute the air or water (with rare exceptions), and they do not require water for cooling. Wind turbines may also reduce the amount of electricity generated from fossil fuels, which reduces total air pollution and carbon dioxide emissions. An individual wind turbine has a relatively small physical footprint. Groups of wind turbines, sometimes called wind farms, are located on open land, on mountain ranges, or offshore in lakes or the ocean.

#### Wind turbines have some negative impacts on the environment

- Modern wind turbines are large machines, and they have a visual impact on the landscape.
- A small number of wind turbines have also caught fire, and some have leaked lubricating fluids, however these occurrences are rare.
- Some people do not like the sound that wind turbine blades make as they spin.
- Some types of wind turbines and wind projects cause bird and bat deaths. These deaths may contribute to declines in the population of species already affected by other human-related impacts. The wind energy industry and the U.S. government are researching ways to reduce the impact of wind turbines on birds and bats.
- Most wind power projects on land also require service roads that add to the physical impact on the environment.
- Producing the metals and other materials used to make wind turbines and the concrete used for their foundations requires energy that may have been produced by fossil fuels.

#### In spite of the challenges, wind remains a promising renewable energy resource.

Washington State is invested in producing clean energy from wind power, energy that does not release harmful gases into our environment. As you travel in Eastern Washington, be sure to take notice of the wind turbines that dot the landscape. Wind is free and available and can provide us with the electricity we need to run our homes and businesses.

Now you know the basics of Wind Energy!





# Performance Task: Renewable Energy - Wind



## Source #2: Wind Energy Pros and Cons

Advantages	Disadvantages
<p><b>Green</b> Wind energy is a green energy source. Harnessing wind energy does not pollute the environment; however, manufacturing, transportation and installation of wind turbines contributes to global warming slightly.</p>	<p><b>Unpredictable</b> Wind is unpredictable, and the availability of wind energy is not constant. Wind energy is therefore not well suited as a base load energy source. If we had cost-effective ways of storing wind energy the situation would be different. We can hope for breakthroughs in energy storage technologies in the future, but right now, wind turbines have to be used with other energy sources to meet our energy demand with consistency.</p>
<p><b>Potential</b> There is great potential for wind energy production. Researchers have concluded: The worldwide potential of wind power is more than 400 TW (terawatts). And harnessing wind energy can be done almost anywhere including both land and water.</p>	<p><b>Costs</b> The cost-competitiveness of wind power is highly debatable. Both utility-scale wind farms and small residential wind turbines typically rely heavily on financial incentives. This is to give wind power a fair chance in the fierce competition against already well-established energy sources such as fossil fuels and coal.</p>
<p><b>Renewable</b> Wind energy is a renewable source of energy. Wind is naturally occurring and there is no way we can run out of this energy resource. This is not the case for fossil fuels (e.g., oil and natural gas), which our society relies heavily on today.</p>	<p><b>Noise</b> Noise is a problem for some people that live in the proximity of wind turbines. Building wind turbines in urban environments should be avoided. Noise is not a problem with offshore wind turbines at all. New designs show significant improvements compared to older models and generate less noise.</p>
<p><b>Space-Efficient</b> The largest wind turbines can generate enough electricity to meet the energy demand of 600 average U.S. homes. The wind turbines can't be placed too close to each other, but the land in-between can be used for other things like agriculture. This is why many farms would benefit more from installing wind turbines as opposed to solar panels.</p>	<p><b>Threat to Wildlife</b> Birds, bats and other flying creatures have slim chances of surviving when taking a direct hit from a rotating wind turbine blade. Studies have estimated the number of annual bird fatalities by U.S. wind turbines from 10,000 all the way to 440,000. As a comparison, collisions with buildings may kill up to 976 million birds. The threat may not be as significant as some would believe, and scientists are taking actions to discourage birds from flying through wind turbines.</p>
<p><b>Rapid Growth</b> Although wind power only accounts for about 2.5% of total worldwide electricity production, the capacity is growing at an incredible rate of 25% per year (2010). This growth helps to reduce the costs of installing wind energy structures.</p>	<p><b>Impact on scenery</b> While many people may like how wind turbines look, there are some who don't. Wind turbines leave a smaller footprint on land compared to the majority of other energy sources (including solar, nuclear and coal).</p>
<p><b>Prices are Decreasing</b> Prices have decreased over 80% since 1980. Thanks to technological advancements and increased demand, prices are expected keep decreasing in the foreseeable future.</p>	
<p><b>Low Operational Costs</b> It is generally true that operational costs tend to be low once the turbines first have been manufactured and erected. However, not every wind turbine is created equal – some are more susceptible to maintenance than others.</p>	

Adapted from *Wind Energy Pros & Cons* by [Energy Informative](#). References: [1] *Inside Science*, [2] *National Geographic*, [3] *U.S. Energy Information Administration*, [4] *Arizona Energy*, [5] *U.S. Department of Energy*, [6] *PolitiFact*.



Source #4: Infographic

# WIND POWER

fosters economic development in all 50 states and



**71%** of all U.S. CONGRESSIONAL DISTRICTS have a wind-related manufacturing facility, an operating wind project, or both

WIND POWER BOLSTERS AMERICA'S ECONOMY and supports a manufacturing supply chain with more than

**550**

MANUFACTURING FACILITIES in 43 states



# WIND POWER JOBS

can be found in a wide variety of sectors, including **WELL-PAYING ENGINEERING, CONSTRUCTION, AND MANUFACTURING**



The wind fleet **CONSERVED 36.5 BILLION GALLONS OF WATER IN 2013**



jobs, and has supported up to **85,000** well-paying **JOBS**

Wind power has attracted **\$75 BILLION** in **PRIVATE INVESTMENT** TO OUR **ECONOMY** in the past 5 years

The record number of wind projects under construction could power the equivalent of

**4 MILLION** AMERICAN HOMES

or all the households in Iowa, Oklahoma and Kansas

Department of Energy data show **HOMEGROWN WIND POWER** is the

**5th** LARGEST ELECTRICITY SOURCE

in the U.S. providing electricity to power the equivalent of

**15.5** MILLION AVERAGE AMERICAN HOMES

**72%** of Americans want more wind power developed, according to a 2014 Navigant poll

**73%** of Americans support continuing incentives for wind power



Predictable, stable, pro-growth policy is vital if the U.S. wind energy industry is to keep developing more efficient technology, creating new U.S. manufacturing jobs, and attracting up to \$25 billion a year of private investment into the U.S. economy.













### PART 2: Field Experience

Arrange to take your students on a visit to a wind farm. Plan the field experience prior to the students writing their essays. Encourage the students to use information they learn about the benefits of using wind energy, including employment opportunities, in their essays.

#### Field Experience Note-taking Template

Site Visited:

Date and Time:

Benefits of hydroelectric energy:

Challenges we face using hydroelectric energy:

How are these challenges being addressed?

Career opportunities in the hydroelectric energy industry:



## PART 3: Essay Student Directions

You will review your notes and plan your argumentative essay. You may use notes from the resources and from the field experience to write your essay. You may also refer to the sources. 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 wind 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 wind energy production and include the following:

- Explain what wind 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 make the shift to wind energy as a valuable renewable resource. Consider access to wind energy, impact of wind energy on the environment, and potential employment opportunities.

Use the planning template to help you to 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
- Write your essay
- Revise and edit for a final draft





## Planning My Essay

### Essay Components:

Introduction: Capture the reader's interest!

Explain what wind energy is and how it is a renewable resource.

State the argument for wind energy, including at least three strong pros. Consider access to wind, impact on the environment, and employment opportunities.

1.

2.

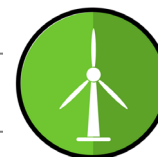
3.

Identify an important con of wind energy and provide a counter argument to this con:

Provide a persuasive conclusion:



# Performance Task: Renewable Energy - Wind



## Argumentative Writing Rubric (Grades 6–11) Scoring Version



Score	4	3	2	1
Statement of Purpose/Focus	<p>The response is fully sustained and consistently and purposefully focused:</p> <ul style="list-style-type: none"> <li>claim is introduced clearly communicated, and the focus is strongly maintained for the purpose, audience, and task</li> <li>alternate or opposing argument(s) are clearly acknowledged or addressed*</li> </ul>	<p>The response is adequately sustained and generally focused:</p> <ul style="list-style-type: none"> <li>claim is clear and the focus is mostly maintained for the purpose, audience, and task</li> <li>alternate and opposing argument(s) are adequately acknowledged or addressed*</li> </ul>	<p>The response is somewhat sustained and may have a minor drift in focus:</p> <ul style="list-style-type: none"> <li>claim may be somewhat unclear, or the focus may be insufficiently sustained for the purpose, audience, and task</li> <li>alternate and opposing argument(s) may be confusing or not acknowledged*</li> </ul>	<p>The response may be related to the purpose but may provide little or no focus:</p> <ul style="list-style-type: none"> <li>claim may be confusing or ambiguous; may be too brief or the focus may drift from the purpose, audience, or task</li> <li>alternate and opposing argument(s) may not be acknowledged*</li> </ul>
Organization	<p>The response has a clear and effective organizational structure, creating a sense of unity and completeness:</p> <ul style="list-style-type: none"> <li>consistent use of a variety of transitional strategies to clarify the relationships between and among ideas</li> <li>effective introduction and conclusion</li> <li>logical progression of ideas from beginning to end; strong connections between and among ideas with some syntactic variety</li> </ul>	<p>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:</p> <ul style="list-style-type: none"> <li>adequate use of transitional strategies with some variety to clarify relationships between and among ideas</li> <li>adequate introduction and conclusion</li> <li>adequate progression of ideas from beginning to end; adequate connections between ideas</li> </ul>	<p>The response has an inconsistent organizational structure, and flaws are evident:</p> <ul style="list-style-type: none"> <li>inconsistent use of transitional strategies and/or little variety</li> <li>introduction and conclusion, if present, may be weak</li> <li>uneven progression of ideas from beginning to end; and/or formulaic; inconsistent or unclear connections among ideas</li> </ul>	<p>The response has little or no discernible organizational structure:</p> <ul style="list-style-type: none"> <li>few or no transitional strategies are evident</li> <li>introduction and conclusion, if present, may be missing</li> <li>frequent extraneous ideas may be evident; ideas may be randomly ordered or have unclear progression</li> </ul>
Elaboration of Evidence	<p>The response provides thorough and convincing support/evidence for the argument(s) and claim that includes the effective use of sources (facts and details).</p> <ul style="list-style-type: none"> <li>comprehensive evidence from sources is integrated; references are relevant, and specific</li> <li>effective use of a variety of elaborative techniques**</li> </ul>	<p>The response provides adequate support/evidence for the argument(s) and claim that includes partial or uneven use of sources (facts and details).</p> <ul style="list-style-type: none"> <li>adequate evidence from sources is integrated; some references may be general</li> <li>adequate use of some elaborative techniques**</li> </ul>	<p>The response provides uneven, cursory support/evidence for the argument(s) and claim that includes partial or uneven use of sources (facts and details).</p> <ul style="list-style-type: none"> <li>some evidence from sources may be weakly integrated, imprecise, or repetitive; references may be vague</li> <li>weak or uneven use of elaborative techniques**; development may consist primarily of source summary or may rely on emotional appeal</li> </ul>	<p>The response provides minimal support/evidence for the argument(s) claim that includes little or no use of sources (facts and details).</p> <ul style="list-style-type: none"> <li>evidence from source material is minimal or irrelevant; references may be absent or incorrectly used</li> <li>minimal, if any, use of elaborative techniques**; emotional appeal may dominate</li> </ul>
Language	<p>The response clearly and effectively expresses ideas, using precise language:</p> <ul style="list-style-type: none"> <li>vocabulary is clearly appropriate for the audience and purpose</li> <li>effective, appropriate style enhances content</li> </ul>	<p>The response adequately expresses ideas, employing a mix of precise with more general language:</p> <ul style="list-style-type: none"> <li>vocabulary is generally appropriate for the audience and purpose</li> <li>generally appropriate style is evident</li> </ul>	<p>The response expresses ideas unevenly, using simplistic language:</p> <ul style="list-style-type: none"> <li>vocabulary use is uneven or somewhat ineffective for the audience and purpose</li> <li>inconsistent or weak attempt to create appropriate style</li> </ul>	<p>The response's expression of ideas is vague, lacks clarity, or is confusing:</p> <ul style="list-style-type: none"> <li>vocabulary is limited or ineffective for the audience and purpose</li> <li>little or no evidence of appropriate style</li> </ul>

Score	2	1	0
Conventions	<p>The response demonstrates a command of conventions:</p> <ul style="list-style-type: none"> <li>adequate use of correct sentence formation, punctuation, capitalization, grammar usage, and spelling</li> </ul>	<p>The response demonstrates partial command of conventions:</p> <ul style="list-style-type: none"> <li>limited use of correct sentence formation, punctuation, capitalization, grammar usage, and spelling</li> </ul>	<p>The response demonstrates little or no command of conventions:</p> <ul style="list-style-type: none"> <li>infrequent use of correct sentence formation, punctuation, capitalization, grammar usage, and spelling</li> </ul>

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).
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\* 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