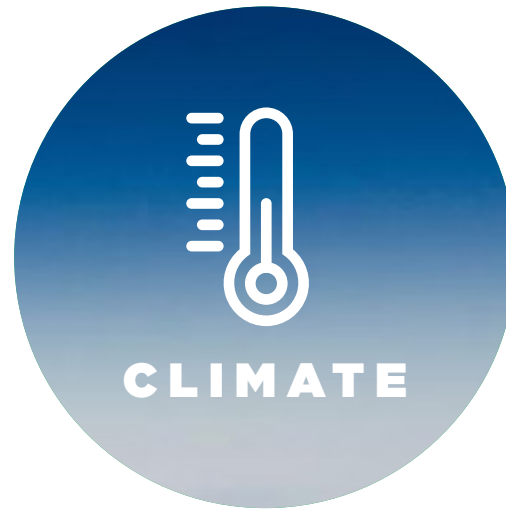


6TH GRADE
STEAM & SOCIAL STUDIES





IN THE 'ZONE

Driving Question:

How can items from nature be used to help improve air quality from polluting sources? How do various energy sources compare when it comes to air quality?

Materials Needed:

Sketchbook or science notebook, ozone samples from around town, schoenbein paper, filter materials such as coffee filters, sand, gravel and charcoal, paraffin candles, carbon dioxide probe

In this lesson, students will:

- compare the pros and cons of various energy sources. They will then create solutions to the detrimental air quality effects of some of the sources.

National Learning Standards:

Science: MS-ETS1-1; MS-ETS1-2; MS-ETS1-4; MS-LS2-4; MS-ESS3-3
 Social Studies: III,h; IX,d
 Art: Cr1.2.6a; Pr5.1.6a; Cn10.1.6a



SPINNING THE COCOON

Prior to beginning this lesson, take ozone samples at various places around town or in surrounding towns. One sample should be near some type of energy producing source, whether it is green energy or nonrenewable energy. Identify a city near you that has a coal-fired power plant as well as an area producing wind energy and find them on the American Lung Associations (ALA) “State of the Air” [map](#).

Ask students to name possible sources of energy production and write these sources on the board. Briefly discuss the pros and cons of each source such as availability, infrastructure required and sustainability. Ask students for ideas of other parameters which might be considered when choosing which energy sources a city uses. Show students the ALA air-quality data as well as the ozone tests for the two areas you selected, and ask them to hypothesize what causes the differences in air quality. Discuss how most renewable energy sources such as wind and solar emit almost no volatile organic compounds (VOCs) or measurable carbon, whereas as coal-generated plants, for example, do. Explain that other factors do come into play when it comes to air quality such as the location of the power plant.

Explain to students that many cities don’t necessarily have the budget to relocate a polluting power plant but can sometimes retrofit the facility with cleaners and scrubbers that help prevent the pollution from leaking out. These cleaners filter the air similar to the way that at-home water filters clean potable water further. As a class, read an article or watch a [video](#) that shows the materials used to make common water filters.

KERNEL OF KNOWLEDGE

Even though coal use is declining in the United States, it is still the second-largest source of greenhouse gas emissions, according to the Energy Information Administration, and coal ash is one of the largest waste streams in the country.

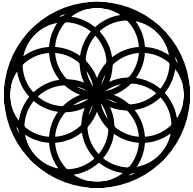


METAMORPHOSIS

In small groups, have students briefly research methods for water filtration and apply the data they found in their research to air quality. Students will use the information they researched to design at least three air filters on paper. While in the design phase, student groups must also consider the budget that would be required to make the filters on a larger scale. After designing their filters on paper, have each group create prototypes to test. Under the supervision of a parent or teacher, students can use paraffin candles in a vacuum with a CO₂ monitor to test their prototypes. Students should record the amount of carbon dioxide that gets through their filter or another method to test the success of their filters. At the end of the prototyping phase, student groups should get together and share their results. As a class, they should discuss what were the most successful materials and design based on their results. Students should also discuss the potential costs associated with building such a filter. Based on this discussion, the students will work as a peer community to design and create a prototype of what might be the ultimate air filter.

UPCYCLE

The students will use the information from the Metamorphosis section to build a cost analysis for building their ultimate air filter prototype on a scale large enough to function on a nearby polluting power plant. Students will interview officials at the power plant or research the dimensions needed and calculate the costs of building and implementing their filtration system. Student groups will then research the costs associated with installing green energy infrastructure such as a wind-powered plant and compare the costs associated with creating a new, green-energy plant with that of retrofitting existing polluting plants.



KALEIDOSCOPE

Facilitate a discussion with students exploring why technology drives the movement of people and economic sectors. Typically, where there are large concentrations of people a power plant is not far off. Discuss why this is so, including how people and businesses use power and how those uses have changed over time. Have students discuss how people have been impacted by climate. For example, the climate in Texas during the summer is hot while the climate in Alaska during winter is cold and without modern technology, like central air and heat people and businesses would not

choose to reside in these places. However, energy sources allow individuals the ability to live and work anywhere because of the availability of air conditioning and heating. This creates an air-quality problem due to the power plants that are needed to provide energy to the population.



THROUGH THE LENS

After placing students into groups of 2-5, have them brainstorm how they as citizens can address the air quality issue, which should include a proposal to a local lawmaker. Have them create a video explaining their ideas and upload it to Flipgrid.

Some questions to post on the board while they are working include:

1. How can we limit emissions and improve air quality?
2. What options will bring the greatest results?
3. Will any options bring immediate results?
4. What are some ideas that may help businesses save money in the long-run?
5. How can we gain support for these ideas?
6. Are there dire consequences of not doing anything? If so, explain.

Remind students that their video should be clear and concise to get their point across. Providing a time limit may also help.



eARTh

The Air Quality Index, or AQI, is the Environmental Protection Agency's (EPA) index for reporting the daily air quality. The EPA calculates AQI for five major air pollutants regulated by the Clean Air Act: ground-level ozone, particle pollution (also known as particulate matter), carbon monoxide, sulfur dioxide and nitrogen dioxide. For each of these pollutants, the EPA has established national air-quality standards to protect public health. Visit this [link](#) to see the colors associated with each level. Review these levels and the colors associated with them with your class, and make a list of the things that would cause both the least and greatest effects to the air-quality index.

Now, introduce your class to the definition of a triptych. A triptych is a group of three artworks that are meant to be displayed or appreciated together. The three works are joined by a relationship in subject matter or technique used. Next, talk about what a monochromatic artwork is. This is a piece of art that is created using different tones and shades of one color or hue.

Once the class has an understanding of monochromatic and triptych art, the students will create a triptych based on three different color levels of the Air Quality Control Index. For each color that they choose, they must also choose something that might be the cause, or one of the causes, for that level of air quality. For example, if they choose green, they might draw a picture of someone riding a bicycle. If they choose red, they might draw a freeway packed with cars emitting smoke. Each individual piece needs to be monochromatic, so the green piece with the bicycled would all be painted in shades and tones of green, whereas the one depicting traffic pollution would be created in only shades and tones of red.

Once the students have finished their triptychs, they should present them to the class and discuss the content of each piece, how it relates to the color that they chose, and how they have successfully created a triptych using monochromatic techniques. Display the pieces so other students, administrators and visitors can view them. This would be a great exhibit to create for an Earth Day celebration!

Community Garden

- Many of the cleaners that we use regularly are hazardous to the environment. Have students research the common ingredients found in everyday cleaners and discuss why these are bad for our environment. Luckily, there are many environmentally friendly alternatives that can be easily and safely made. Visit this [link](#) for some recipes for green cleaners. Have students choose some to make as a class and give them to other teachers to use at school. The students can also take some home for use, as well as produce some for local community organizations and agencies.

Optional Community Garden film extension

- As students make their biodegradable all-natural cleaning recipe, have them create a short (60-second) "How To" video of the process that can be shared with the class or on social media. Students should come up with a creative name for their product and video.



CAREER CONNECTION

Emergency Management Specialist - Emergency management specialists coordinate disaster response or crisis management activities, provide disaster preparedness training, and prepare emergency plans and procedures for natural (e.g., hurricanes, floods, earthquakes), wartime or technological (e.g., nuclear power plant emergencies, hazardous materials spills) disasters or hostage situations. This career requires a bachelor's degree or higher, experience and specialized certifications.

Economist - Economists study the ways a society uses scarce resources such as land, labor, raw materials and machinery to produce goods and services. They analyze the costs and benefits of distributing and consuming these goods and services. A master's degree is needed for this job.



CAREER HIGHLIGHT

In 1981, Hans Tholstrup and Larry Perkins became the first individuals to cross a continent in a solar-powered car that they built. Tholstrup is also the creator of the World Solar Challenge in Australia.



