

Energy conservation, air quality and climate change



The world's climate is changing due to increasing levels of greenhouse gases, especially carbon dioxide, in the atmosphere. Like windows in a greenhouse, carbon dioxide in the earth's atmosphere traps the sun's heat and insulates the planet. So, increasing levels of carbon dioxide in the atmosphere are warming the planet. Carbon dioxide comes primarily from the burning of fossil fuels, such as exhaust from vehicles and coal burned to generate electricity. Changes in the climate pose significant environmental and economic threats to communities in Minnesota and throughout the world.

In addition to greenhouse gases and climate change, Minnesota's air quality is impacted by a variety of air pollutants. Air pollution comes from many different sources that result from the combustion of coal, gasoline, diesel, wood and other fuels to run our vehicles and power our homes and businesses. Air pollution can have a variety of health impacts, with the biggest concern being impacts on respiratory and cardiovascular systems. Although Minnesota's air quality is generally good and has been improving for most pollutants, more can be done to reduce emissions and improve air quality.

Climate change

Shifts in climate have happened throughout Earth's history due to natural factors. Changes occur in temperature, precipitation patterns, snow and ice cover, and sea level. But what's different now is how fast these changes are happening. Almost all climate scientists agree that recent changes are primarily caused by human activities, with levels of carbon dioxide emissions having risen dramatically since late 1800s. Minnesota's carbon dioxide emissions have increased 37 percent over the past 20 years, according to the Minnesota Pollution Control Agency (MPCA).

Climate change is already observable. Animal and plant habitats are shifting, weather patterns are changing and severe storms and droughts are becoming more common. Minnesota has warmed an average of one degree Fahrenheit during the past century, according to the MPCA. Additionally, from 1958 to 2011 the Midwest region, including Minnesota, experienced an increase of heavy precipitation by 45 percent. If temperature readings and precipitation continue to increase over the next century, Minnesota might soon feel and look more like Missouri. Other impacts of climate change in Minnesota include the following:

- Changes in ecosystems and decline of forested areas by as much as 50 to 70 percent. This is concerning because temperature and moisture patterns will change faster than plant and animal communities can adapt.
- Groundwater resources, a major source of drinking water, may be reduced due to a drop in stream flow and lake levels.
- Weather patterns will become more extreme. The overall frequency of both flooding and droughts will increase.
- Changes in seasonal conditions, including frequency of poor air quality (smoggy) days in summer and less snow in the winter, which will decrease opportunities for winter recreation. Milder winters will also affect animal hibernation patterns, stressing food supplies and habitats.

Despite these changes, Minnesota will be less negatively impacted by climate change than many other areas of the country and the world. Minnesota may actually see some potential benefits, such as warmer nighttime temperatures in winter that would reduce heating costs and a longer growing season that would increase agricultural production (in years without drought).

What can you do?

- Drive less. Walk, bike, carpool or take public transit instead of driving.
- Understand your energy use by reviewing and tracking your energy bills.
- Reduce energy in home heating and cooling by sealing air leaks around windows and doors, turning down your thermostat in the winter and up in the summer, and installing a programmable thermostat.
- Install energy-efficient lighting.
- Turn off and unplug appliances and electronics when they are not in use.
- Use your refrigerator efficiently. Recommended temperatures are 30 to 40 degrees Fahrenheit for the refrigerator and five degrees Fahrenheit for the freezer.
- Switch to a low-flow showerhead and take shorter showers.
- Wash clothes in cold water. Line-dry clothing instead of using a dryer.
- Reduce, reuse and recycle.
- Purchase food grown locally to reduce the distance food travels.
- Purchase renewable energy. Many utility providers offer customers an option to purchase renewable energy.



Air quality

Although Minnesota is fortunate to have generally good air quality that has improved over the last decade for most pollutants, there is still a lot we can do to reduce air pollution.

The Minnesota Pollution Control Agency maintains the Air Quality Index, which reports daily air quality conditions. The Air Quality Index measures five air pollutants that are good indicators of daily air quality: fine particles (PM2.5), ground-level ozone (O3), sulfur dioxide (SO2), nitrogen dioxide (NO2), and carbon monoxide (CO).

An air pollution health advisory is issued when air pollution reaches levels that are considered unhealthy for sensitive groups, such as those with pre-existing respiratory or cardiovascular conditions, elderly, children, and people who are physically active.

Many factors can lead to poor air quality days. Air pollution in Minnesota come from many sources, including emissions from cars, equipment, homes, buildings and industries as well as pollution that is blown into Minnesota from surrounding areas.

Most poor air quality days are driven by changing weather conditions that increase the rate at which air pollutants are formed or accumulate in the air. For example, ozone pollution levels tend to rise on very hot and sunny days with little wind. Fine particle pollution can be elevated in weather conditions with high humidity, high pressure, strong overnight temperature inversions, or low wind speeds. This often occurs in Minnesota from November through March.

With more days topping 100 degrees Fahrenheit due to climate change, Minnesotans could experience more days with poor air quality.

Take the following actions to reduce air pollution, especially during air quality alert days:

- **Drive easy.** You can improve fuel efficiency by 10 percent or more by driving the speed limit, accelerating slowly and maintaining your vehicle.
- **Fuel up in the evening** when it's cooler, and don't top off the fuel tank beyond where the automatic nozzle clicks off. This forces vapors out of the tank and potentially leads to spills.
- **Take the bus** or check out rideshare or telework options at your work place.
- **Reduce small engine use.** Mow your grass less often, try an electric mower or push mower, or reduce total lawn area by planting native plants, rain gardens, or a vegetable garden.

- **Use less electricity.** Burning coal or natural gas for energy results in air emissions, so reducing energy use is an important way to improve air quality.
- **Reconsider the campfire.** Wood smoke contains toxins and harmful microscopic particles. Even an outdoor fire can impact the indoor air quality in your home. Always consider those living around you and the direction of the wind. If you decide to have a fire, be sure to burn dry wood. Don't burn wood during air pollution health alerts.
- **Sign up for air quality alerts** from the Minnesota Pollution Control Agency to find out when air quality is poor in Minnesota.



Resources:

- MPCA climate change factsheet: www.pca.state.mn.us/index.php/view-document.html?gid=11394
- MPCA climate change info: www.pca.state.mn.us/index.php/topics/climate-change/index.html
- Be Air Aware MN: www.beairawaremn.org
- Minnesota Pollution Control Agency's air quality index www.pca.state.mn.us/index.php/air/air-quality-and-pollutants/general-air-quality/air-quality-index/current-air-quality-index.html
- Minnesota Pollution Control Agency's wood smoke information www.pca.state.mn.us/index.php/air/air-quality-and-pollutants/general-air-quality/wood-smoke/index.html

A FEW DEGREES MATTER

Climate change is already noticeable in Minnesota. Animal and plant habitats are shifting, weather patterns are changing, and severe storms and droughts are becoming more common. Minnesota has warmed an average of 1 degree Fahrenheit during the past century according to the Minnesota Pollution Control Agency. Precipitation has increased by 20 percent since 1990, especially in southern Minnesota. If temperature readings and precipitation continue to increase within the next century, Minnesota might soon feel and look more like Missouri. In this activity, participants will create a visual representation of climate change impacts in Minnesota.

Outcome

Participants will increase their understanding of how climate change is affecting Minnesota and make a visual representation of how to make changes to address it.

Audience

Youth (ages 9+), adults

Time

30 - 60 minutes

Concepts

- Climate change affects Minnesota.
- People's activities contribute to climate change.
- There are things we can do to reduce our contribution to climate change.

Supplies

- Large sticky notes or half-sheets of paper and tape (4 or 5 per participant)
- Markers, crayons or colored pencils
- A board or large sheet of paper/newspaper
- Calculator (*optional*)
- Minnesota Environmental Quality Board's report "Minnesota and Climate Change: Our Tomorrow Starts Today" www.eqb.state.mn.us/content/climate-change (*optional*)



A FEW DEGREES MATTER

Preparation

Collect a poster board or large sheet of paper/newspaper. Put large sticky notes (or half-sheets of

paper) at each participant's place around a table or on the floor.

Procedure

- Discuss the terms climate change, global warming and greenhouse gases using information found in "Background Information" without talking about concrete effects of climate change or what individuals should change.

Part one:

- Ask participants to draw or write one way that climate change may negatively affect people, animals or nature in Minnesota on their sticky note or piece of paper. Younger participants may benefit from acting out, making a collage of or coloring in examples of the effects of climate change in Minnesota.
- Have participants post and describe their ideas one-by-one on the board or large piece of paper. Ask what some of the common ideas were. Correct inaccuracies. See information in "Background Information" for examples of the impacts of climate change in Minnesota.

Part two:

- Ask participants to draw or write ideas they have about how people can make changes to slow down the rate of climate change (one idea per post-it note).
- Have participants post and describe their ideas one-by-one on the board or large piece of paper, covering up the ways climate change will affect Minnesota. Ask what some of the common ideas were. Correct inaccuracies. Accurate examples include:
 - Drive less. Walk, ride a bike, carpool or take public transit instead of driving.
 - Plan your errands so you can take care of them in one trip to reduce the overall miles you drive.
 - Do a home energy audit to determine where energy is being wasted (e.g. drafty windows and doors).
 - Seal air leaks around windows and doors and add insulation to your home.
 - Turn down your thermostat in the winter and up in the summer, and install a programmable thermostat.
 - Install energy efficient lighting such as LEDs and compact fluorescents.

- Purchase energy efficient appliances and electronics by looking for the ENERGY STAR label.
- Don't keep your refrigerator or freezer too cold. Recommended temperatures are 30 to 40 degrees Fahrenheit for the fresh food compartment of the refrigerator and five degrees Fahrenheit for the freezer section. If you have a separate freezer for long-term storage, it should be kept at zero degrees Fahrenheit. Don't keep the refrigerator or freezer door open for a long time.
- Switch to a low-flow showerhead. Take shorter showers.
- Wash clothes in cold water. Line-dry clothing instead of using the dryer.
- Reduce, reuse and recycle. Teach your organization, classroom, school or workplace about the 3 R's.
- Purchase foods grown locally to reduce the distance food travels. Eat foods that are in season for our region. Support local, sustainable and organic farmers by purchasing their products directly through farmer's markets, community supported agriculture farms (CSAs), food co-ops, natural foods stores and local grocers.
- Purchase renewable energy. Many utility providers offer customers an option to purchase renewable energy, usually for an additional charge. Or learn about home installation or renewable energy, such as solar water heaters.
- Turn off the water while brushing teeth.
- Take shorter showers.
- Unplug game consoles, phone chargers, and other electronics when you are done using them.

Part three:

- Have participants commit to taking one or a few actions. Share and discuss progress in a follow-up meeting if possible.
- The wall or mural of energy-saving ideas could be left up as a reminder of what is possible. Have participants choose actions they will commit to do.

Discussion questions

- What did you learn that was new?
- How do you feel about the issues we talked about today?
- Why should we care about climate change?
- Looking at all of our ideas, what will you commit to do?
- Why doesn't everyone make the changes they could?
- Does climate change affect other parts of the country or world differently than Minnesota? (Yes, one example is that rising sea levels will affect coastal communities.)
- What did you learn that you want to share with someone else? Who will you share it with?
- What do you want to do about this issue?
- What do you want to learn more about?

Additional activity ideas

Take the Minnesota Energy Challenge (Minnesota Energy Challenge)

- Visit www.mnenergychallenge.org to calculate your carbon footprint and identify actions you can take to reduce it. When you commit to simple changes, the online system tells you how much carbon dioxide and money you will save. Youth can take the challenge with their families, school or classroom. Teams can compete with other families, classrooms or schools.
- The website also has free, online toolkits for communities and educators to involve groups in taking the challenge together and tracking your changes.

What defines Minnesota's biomes?

Credit: Climate Generation: A Will Steger Legacy

- Have participants research different biomes in Minnesota (prairie grassland, tallgrass aspen parkland, deciduous forest, coniferous forest) and expected shifts that may occur in Minnesota's biomes from climate change.
- Using tape, make the shape of the map of Minnesota on the floor (or use chalk if you are outside). Give each student a label of an animal or plant in Minnesota.
- Have the students arrange themselves on the map in the appropriate biome where the animal or plant belongs. Discuss effects climate change will have on animals and plants in each biome of Minnesota.

- Ask students why certain animals and vegetation are native to certain biomes in Minnesota (example: spruce trees in coniferous forest or coyote in prairie grassland) and have a discussion about climate influencing biomes.
- For more information, visit www.willstegerfoundation.org/curricula-resources.

Learn more about climate change

- Youth can visit websites like www.epa.gov/climatechange/kids/index.html for kid-friendly information on what climate change is and how kids can make a difference (or visit the library to look up information) and create a project or campaign to educate others.

What does the future look like?

- Older youth can research green technologies (e.g. wind, solar, geothermal, changing automobiles) and discuss/present how these technologies may influence lifestyles and jobs in the future.

Calculate your carbon footprint

- A carbon footprint is the amount of carbon dioxide that an individual, household, or business puts into the atmosphere every year. There are many resources available to help calculate a personal carbon footprint. Join the Minnesota Energy Challenge at www.mnenergychallenge.org or use the EPA's Personal Emissions Calculator at www.epa.gov/climatechange/emissions/ind_calculator.html. Ask youth to investigate their family's or organization's carbon footprint and to make suggestions for improvement.

Resources

- Minnesota Environmental Quality Board's report "Minnesota and Climate Change: Our Tomorrow Starts Today" www.eqb.state.mn.us/content/climate-change
- MPCA "Adapting to Climate Change" www.pca.state.mn.us/news/adapting-climate-change

LEARN ABOUT YOUR HOME ENERGY USE

Paying bills may not be any fun, but you can learn a lot about your home energy consumption from a home energy audit and your utility bill. A home energy audit can help you understand how you use energy in your home and identify ways you can save energy. Have members of your group audit their home energy use and set goals for the changes they plan to make.

Outcomes

Learn how to conserve energy in your home by conducting a home energy audit and understanding your utility bill.

Audience

Adults

Time

60 minutes

Concepts

- Understand how to conduct a home energy audit and find out where to conserve energy in your house.
- Understand how to read your utility bill to see where you can conserve energy and save money.
- Learn how to conserve energy within your home.

Supplies

- ENERGY STAR Home Energy Yardstick, www.energystar.gov, search: "energy yardstick"
- U.S. Department of Energy, www.energysavers.gov, search: "home energy audit"
- Home Energy Saver, www.hes.lbl.gov
- Examples of weatherizing materials such as caulk, weather-stripping, plastic for windows, etc



LEARN ABOUT YOUR HOME ENERGY USE

Preparation

- Home energy audit: Use the resources listed in supplies to help you conduct your own energy audit or contact your utility provider to set up a home energy audit (your utility provider has professional energy auditors that can conduct energy audits).
- Utility bill: ask participants to bring in their utility bill

Procedure

Home energy audit:

- For your own energy audit, start with a walk-through of your home and keep a checklist of areas you have inspected and problems you found.
- First, make a list of obvious air leaks, called drafts, which are often found along baseboards or the edge of flooring. Seal air leaks by caulking or applying weather-stripping.
- Heat loss can waste a lot of energy and money in your home. Check insulation and seal any gaps with an expanding foam caulk or other permanent sealant. Make sure vents are not blocked by insulation.
- Inspect heating and cooling equipment by checking filters and replacing them as needed. Consider replacing units 15 years or older.
- Examine light bulbs in your house and consider replacing light bulbs with more energy efficient bulbs such as compact fluorescent lamps (CFLs), or light-emitting diodes (LEDs).
- Consider strategies for reducing energy use of your appliances and electronics such as unplugging an item when it is not in use, using the items less often, or purchasing a new, more efficient product.

Utility bill

- Have participants analyze their utility bills. They can compare energy consumption among group members. Analyze how energy consumption changes during different times of the year.
- Consider tracking your group member's energy consumption over time.
- Make goals for reducing energy consumption.
- Discuss what factors affect energy use and encourage participants to share what steps they've taken to reduce energy consumption.

Discussion questions

- What did you learn from your home energy audit? What was surprising to you?
- Where did you find the most opportunities to conserve energy?
- Do you winterize your home when seasons change? Why or why not? What barriers stand in your way?
- What did you learn from analyzing your utility bill?
- Will you inspect your utility bill differently after this exercise?
- What goals did you make to reduce your energy consumption? How can this save you money?
- What more do you want to learn about energy conservation?

Additional activity ideas

Discuss alternatives to laundry dryer

- Clothes dryers are typically one of the top three energy-using appliances in the home. By air drying your clothes on the line or on drying racks, you can save energy and money. An average family spends \$80 to \$120 per year drying clothes. Other ways to conserve energy with laundry include using a drying rack, using cold water instead of hot or warm water and avoiding laundromats.
- Discussion questions:
 - Do you currently use a clothesline or a drying rack? Why or why not?
 - How do you feel about using a clothesline? Studies show that when people see others acting in certain ways, they are more likely to change their own behavior. Do you think you might influence others by simply using a clothesline? What message does it send?
 - Do you currently use cold water instead of hot or warm water? Why or why not? Did you know switching to cold water can save energy and money?
 - What are the biggest barriers to switching your laundry habits? Could they be easy to overcome?

Resources

- Department of Energy's Home Energy Audit checklist www.energy.gov/articles/energy-saver-101-infographic-home-energy-audits
- Clean Energy Resource Team's Right Light Guide www.cleanenergyresourceteams.org/sites/default/files/CERTs_RightLightGuide_2014.pdf

ENERGY VAMPIRES

Learn about the electricity consumption of your appliances and electronics by using an energy meter. Energy meters can help you identify high energy use appliances and electronics in your home, determine how much it costs to use appliances and identify “energy vampires” – appliances that use energy when switched off. One barrier people have with “energy vampires” is that they don’t think the energy costs are significant – but the average U.S. household spends \$100 each year to power devices when they are off or in standby mode.

Outcomes

- Understand that some electronics and appliances use energy even when they are not in use.
- Unplug electronics when you don’t need them.

Audience

Youth (ages 14+), adults

Time

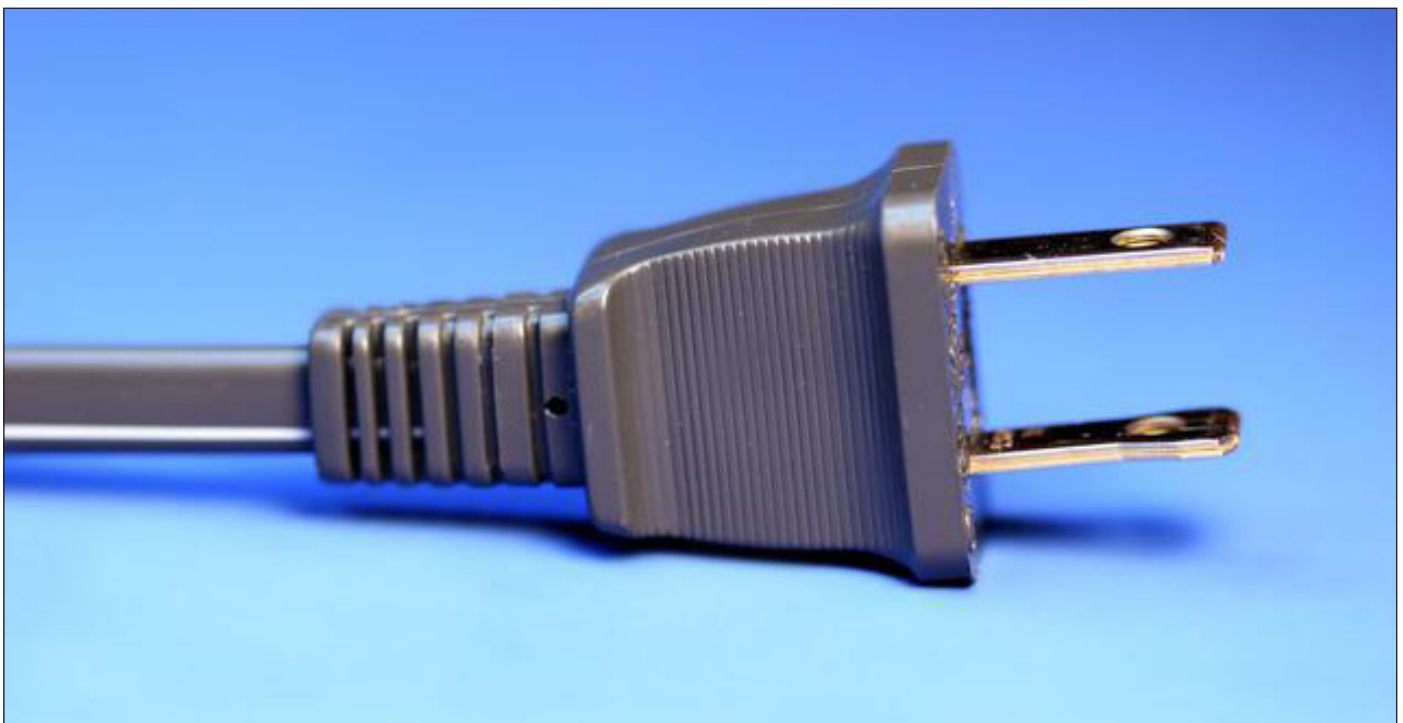
Variable

Concepts

- Energy vampires are electronics that use energy even when they are not in use.
- Energy vampires waste energy and money.
- Unplugging electronics conserves energy and saves money.

Supplies

- Energy meter – available for check-out at Hennepin County libraries. Visit www.hclib.org for more information. Energy meters can be purchased for about \$25. Check at hardware stores or search online.
- Electronics to sample if participants are not meeting in a home. Examples include a blow dryer, cell phone charger, gaming console, toaster or fan.



ENERGY VAMPIRES

Preparation

- Rent or buy an energy meter.
- Since you will most likely need to use a home for an example, have participants gather in a “sample” home to learn how to use the energy meter.

Procedure

- Choose an appliance to monitor with the energy meter. Remove the appliance’s power cord from the wall outlet. Plug in the energy meter and then connect the appliance’s power cord into the meter’s outlet.
- While the appliance is turned on, have participants observe the energy monitor to determine how much energy your appliance is consuming turned on and record the results.
- While the appliance is turned off, have participants observe the energy monitor to determine how much energy your appliance is consuming turned off and record the results.
- Most appliances use energy when they are plugged in, even if they are turned off. These are known as “energy vampires.”
- Use the chart below or create your own to track each item and the watts used when the item is turned on and off.
- Based on the results, ask participants to make goals for reducing energy consumption. Examples of goals include plugging electronics into a power strip that can be shut off when not in use or using high energy items less frequently.
- Encourage each participant to conduct the same energy meter test in their own home to find out which of their appliances are “energy vampires.”

Item	Watts used (on)	Watts used (off)
Example: toaster	1200 watts	200 watts

Discussion questions

- What did you learn from using an energy meter? What surprised you?
- What appliance or electronic used the most energy?
- What appliances or electronic items do you leave on all the time? Why?
- What other actions can you take to conserve energy in your house? (Turn your electronics off, set your computer to go on sleep mode, etc.)
- How can we reduce the amount of energy consumed by appliances and electronics?

Additional activity ideas

MN Energy Challenge (Center for Energy and Environment)

- Commit to energy efficiency with the MN Energy Challenge. Stay updated on energy saving tips and learn how to save on your energy bill, too. Learn more at www.mnenergychallenge.org.

TOLBY Program

- “Turn Off the Lights Behind You” for children in grades 1 through 5 to learn about energy efficiency.
- Program includes a 40 minute class visit and pre and post visit supporting activities.
- Learn more about the TOLBY program at www.mnenergychallenge.org/For-Teachers/About-A-Visit-From-Tolby.aspx.

CREATE A WINDSOCK AND WEATHER COLLAGE

One impact of climate change in Minnesota includes weather patterns changing. Weather patterns will become more extreme with increased frequency of both flooding and droughts. Heat waves could also increase, which could result in extremely hot summer days and an increase in incidence of heat-related illness and death. Milder winters with less snow will impact animal hibernation patterns, stressing food supplies and habitats. Learning about weather through creating a windsock or weather collage can help children understand its relationship to climate change and the predicted impacts in Minnesota.

Outcome

Parents and children will create a windsock or weather collage to learn about weather and understand how climate change will impact weather in Minnesota.

Audience

Youth (ages 4 - 8 years), parents and children

Time

30 minutes

Concepts

- Climate change will impact weather in Minnesota in many ways.
- Learn how weather and climate are connected.
- Windsocks are one way to observe and learn about weather.

Supplies

Windsock

- Construction paper
- Art supplies for decorating (tempera paint, crayons, colored pencils, etc.)
- Scraps of colorful ribbon cut to about 5 to 12 inches
- Tape, glue or staples
- Hole-punch, pen, needle, or small screw to punch holes in paper
- Yarn or string

Weather collage

- Old magazines and newspapers
- Scissors
- Tape or glue



CREATE A WINDSOCK AND WEATHER COLLAGE

Preparation

- Gather materials in advance.
- Make an example windsock.

Procedure

Windsock

- Have participants go outside or look out a window to observe the weather.
- Ask children to observe the wind, is it blowing hard or just barely? Discuss how wind is an aspect of weather.
- Have children decorate the construction paper with the art supplies how they desire. Some ideas: animals, plants, their favorite outdoor spot, different types of weather, etc.
- Roll the construction paper up from end to end and then tape, glue or staple the ends together.
- Glue strips of ribbon around the bottom inside of the windsock.
- Punch two holes in the top of the windsock, directly across from each other.
- Feed yarn or string through the two holes to create about a 6 inch loop and tie a knot at the end.
- Hang the windsock outside where parents and children can easily observe the wind moving through the windsock.

Weather collage

- Choose magazine pictures or photographs that depict different types of weather and impacts of climate change. Use scissors to cut the photos from the magazines or newspapers.
- Encourage youth to sort and organize the pictures.
- With tape or glue, make a mural of weather images by fastening the photos together. Make one for your group or make individual collages for the youth to take home.
- Discuss the different types of weather that can occur at different times of the year.

Additional activity ideas

Taking the temperature

- Encourage children to learn about the weather by going outdoors and observing the weather. Monitoring observations over time can also help children recognize patterns and trends in nature.
- Bring children outside with note pads and writing utensils for observations. Ask the children to describe how the temperature feels (hot or cold), is there is any wind, is the sun shining?
- If the group has access to binoculars, look for animals and plants nearby. How does weather impact animals and plants?
- If children are able to write, have them write or draw their observations on a notepad, or else have an adult take notes.
- If a thermometer is available, have children check the temperature.
- Bring the children outside to the same area daily or weekly so they can observe weather changes over time. Ask children what differences they have noticed outside. Ask what patterns and trends they noticed in the weather over time.

RENEWABLE ENERGY SCAVENGER HUNT

Increasing levels of greenhouse gases in the atmosphere are warming the planet. Carbon dioxide is the major greenhouse gas contributing to climate change. Carbon dioxide emissions from human activity come primarily from the burning of fossil fuels, such as gasoline and diesel used by vehicles and coal burned to generate electricity. Renewable energy, includes energy sources such as wind and solar power, geothermal, hydropower, and forms of biomass. In 2015, only 10 percent of total energy consumed in the United States came from renewable energy sources. These energy sources are considered renewable because they are continually replenished on the Earth, unlike fossil fuel sources which are finite. Learning about renewable energy can help familiarize people with the sources of renewable energy and how these sources can help mitigate climate change. In this activity, students will build awareness of biomass, wind, solar and other local sources of renewable energy.

Outcome

Understand sources of renewable energy and how these sources are an environmentally-friendly alternative to fossil fuels.

Audience

Youth (ages 12+), adults

Time

60+ minutes

Concepts

- Learn how renewable energy sources are more sustainable than fossil fuels.
- Explore the outdoors to find local sources of renewable energy such as biomass, wind and solar.

Supplies

- Energy Scavenger Hunt worksheet (1 sheet for every 2-3 students, located in Appendix)
- Writing utensils
- Clip board (*optional*)



RENEWABLE ENERGY SCAVENGER HUNT

Preparation

- Find an outdoor area around your school or organization that you can investigate.
- Instructor note: assign clear physical boundaries and behavior expectations. Be sure to clearly explain that all students must return to you when you give a signal

that the activity is finished (a whistle, yell, etc.). Some of the scavenger hunt items may not apply to your location - you may add or subtract items from the list at your discretion.

Procedure

- In the classroom, lead a discussion about renewable energy. Make sure your students understand what renewable energy is and examples of renewable energy (wind power, solar energy, etc.). Discuss why renewable energy is a good alternative to fossil fuels because there is an infinite amount of renewable resources.
- Walk around the area outside your school or organization to note any local energy sources such as trees/timber, plants, animals (which we use for energy in the source of food), the sun, wind, even the moon (the moon controls high and low tide and capturing tidal energy is being explored in some coastal regions).
- Ask the students to explain “if this is an energy source, then what is its purpose?” and “who does it give energy to? Where does it get its energy from?”
- Have students form groups of 2-3 for an energy scavenger hunt. The groups will go out looking for

items, find the items and return as fast as they can. This scavenger hunt is made to work for many school yards but can be freely customized to fit your unique situation. Most of the items to be hunted for do not need to be picked-up or otherwise collected; students simply need to record what they find by recording it on the Energy Scavenger Hunt worksheet in the Appendix. They could also take photos of the items.

- As the students return, reflect on what everyone found. What did they notice? What was the easiest to find? What was the hardest to find?
- Back in the classroom, record your energy observations on the board and in their notebooks. Then reflect on: how would we use these types of energy? How do other living things use them? How could we capture this energy to use instead of fossil fuels? How do you think these local sources of energy are already being used in this way?

Discussion questions

- Why is renewable energy important? Why is it important to have alternatives to fossil fuels?
- What types of local energy sources did you find on the scavenger hunt that could supply energy to people?
- Why do you think more fossil fuels are used to supply the world’s energy instead of renewable energy? How could we use more renewable energy?
- What else did you find on the scavenger hunt that was interesting?

Additional activity ideas

Renewable energy freeze tag

- Discuss forms of renewable energy, such as wind, solar, geothermal, etc. These are alternatives to fossil fuels like coal, oil and gas. Play a game similar to TV tag. One person is “it” and must try to tag others. A player is safe from being tagged if they call out a form of renewable energy before being tagged. If a youth is tagged, they become the new “it.”

Purchase renewable energy

- Many utility providers offer customers an option to purchase renewable energy, usually for an additional charge.
- Learn about home installations of renewable energy at www.energy.state.mn.us

Resources

- Energy activities and curriculum www.climategen.org/what-we-do/education/climate-change-and-energy-curricula.

ENCOURAGE BIKING AND WALKING

Biking and walking is a great alternative to driving your car because it helps reduce greenhouse gas emissions from vehicles. Biking and walking is also fun, great for your health and can save you money! Committing to biking or walking to work, the store or anywhere else can help mitigate climate change. Taking public transportation is also a great option, especially when combined with biking and walking. Getting familiar with local biking and walking routes, tuning up your bike, or biking with a friend or expert cyclist can help reduce your carbon footprint.

Outcomes

Reduce your carbon footprint by biking and walking more and driving less.

Audience

Youth (13+), adults, parents and children

Time

60+ minutes

Concepts

- Vehicles emit greenhouse gases, so biking and walking is a great alternative to driving.
- Get familiar with local biking and walking routes to encourage more biking and walking.
- Bike or walk with a friend or expert cyclist to help reduce your carbon footprint.

Supplies

- Bicycle and helmet
- Hardcopies of the Hennepin County Road & Bike Map (see Appendix)
- Tools for tuning up bicycles including a screwdriver or wrench (optional)
- Internet access to the Metro Commuter Challenge at www.mycommuterchallenge.org, Nice Ride bike rental at www.niceridemn.org or Bike Walk Twin Cities at www.bikewalktwincities.org (optional)



ENCOURAGE BIKING AND WALKING

Procedure

Bike tune-up party

- If you or someone you know is familiar with basic bicycle maintenance, offer to help others get their bikes out of the garage or basement and onto the road.
- Host a gathering of friends or neighbors in your backyard, alley, or driveway.
- Teach kids what they can do to help.
- Visit a local bike shop for more ideas and resources on basic bike tune ups.

Map your route

- Request free copies of the Hennepin County Road & Bike Map by calling 612-596-0352, or find it online at www.hennepin.us, search: bike map. Visit Metro Transit at www.metrotransit.org or call 612-373-3333 for bus and light rail maps.
- Bring these materials to the next meeting of your group and help people who are unfamiliar with bike trails and public transportation.
- Find options for getting to and from work, school, or other places they frequently drive.
- Visit www.bikewalktwincities.org for other resources and ideas.

Commuter captain

- If you or someone you know is a bike commuter, enlist them to bike with those new to commuting by bike. This can help people be more comfortable with the idea when they have encouragement and support from an experienced cyclist.
- Go over best practices, safety tips and map routes before commuting.

Bike or walk to _____ day

- Organize an event to bike or walk to your organization, school, event, work, etc.
- Coordinate meeting places for people to come together and ask for commitments to increase participation. Invite a bike ambassador who frequently bikes to teach members how to safely ride bikes in traffic.
- Make the event a weekly or monthly occurrence to encourage participants to bike or walk more often.
- Track the number of members who participate and follow up with a survey a few months later to see how many members have continued to bike and walk.

Discussion questions

- How familiar are you with nearby bike trails and public transportation routes?
- For what trips could you walk, bike or take public transportation?
- Are there any barriers that are stopping you? How could you overcome those barriers? How can you commit to biking to work? What do you need to bring with you so it can be part of your daily routine?
- How could you encourage your family and friends to increase the amount they bike?
- How is biking and walking related to climate change and energy conservation?

Resources

- Order the Hennepin County Road & Bike Map by calling 612-596-0352, or find it online at www.hennepin.us, search: bike map
- Bike Walk Twin Cities www.bikewalktwincities.org
- NiceRide www.niceridemn.org
- Transit for Livable Communities www.tlcmnnesota.org

ENERGY DEFINED IN A DAY

We all use energy every day in countless ways. Where does the energy come from? Learning about where energy comes from is important to conserving energy. This activity is from TOLBY (Turn Off the Lights Behind You) to help students learn about daily activities that use energy and brainstorm ways to incorporate energy conservation into their daily lives.

Outcomes

Learn about daily energy use and how to conserve energy.

Audience

Youth (ages 11+)

Time

30+ minutes

Concepts

- Understand that many daily activities use energy.
- Learn what energy is and where it comes from.
- Brainstorm ways to conserve energy every day.

Supplies

- Notebook paper
- Writing utensil
- Whiteboard, blackboard or large piece of paper for mind map



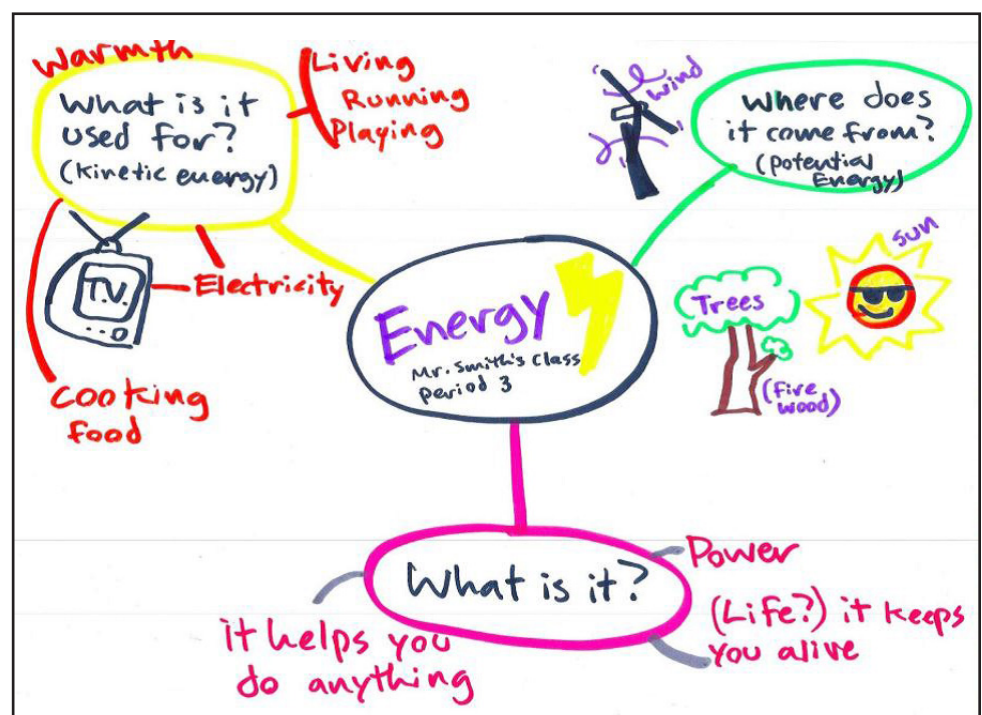
ENERGY DEFINED IN A DAY

Procedure

- Take about five minutes to have students make a list of everything they have done today since they woke up. Yes, everything.
- Then, ask the students to circle everything on the list that used energy. If students are having trouble brainstorming, make suggestions such as turning the lights on when they woke up, getting food from the refrigerator or riding the bus to school.
- Next, have the students share their lists with one another and then share a few examples with the large group.
- What is something they circled?
- In what ways does this activity use energy?
- Do all things use energy? What is something you did today that didn't use energy?
- Ask the class "what is energy?"
- As a class, use the whiteboard or blackboard or large piece of paper to make a mind map of energy. Use words, colors and images. If students run out of ideas, you can ask "how can we tell if something is using energy?" or "what sources of energy can you think of?"
- Ask students to think about the fundamental laws of energy. Add "energy is never created or destroyed" to the mind map. And ask, "If this is true, what happens to energy? Where does it go?" Answer: Energy is just a quantity that passes from system to system. When we think it is "gone" or for example, when our gas tank is empty, it's not because that energy has completely disappeared. Rather, it transferred into heat and motion to move your vehicle. The energy still exists; it has just transferred to a different system. Physicists know this as the Law of Conservation of Energy, the First Law of Thermodynamics.

Discussion questions

- Which daily activities do you think use the most energy?
- Why isn't energy created or destroyed? Where does energy go?
- Where can you conserve energy in your daily activities?
- Are there any barriers that are stopping you? How could you overcome those barriers? How can you commit to conserving energy? What do you need to make it part of your daily routine?
- How could you encourage your family and friends to conserve energy?



AIR QUALITY ALERTS AND ACTIONS

The Minnesota Pollution Control Agency (MPCA) issues air pollution health advisory alerts when air pollution levels are unhealthy. This occurs most often when weather conditions change the rate at which air pollutants are formed or accumulate in the air. For example, ozone pollution, or smog, tends to increase on hot and sunny days with little wind. And fine particle pollution is commonly elevated in winter when conditions include high humidity, high pressure, and strong overnight temperature inversions. Those at risk during air pollution advisories include those with pre-existing respiratory or cardiovascular conditions, elderly, children, and those participating in outdoor activities requiring extended or heavy exertion. But even individuals who are otherwise healthy may experience health effects when ozone levels increase.

In this activity, participants will sign up for air quality alerts from the MPCA to be notified when air pollution levels are unhealthy. They will also learn about actions they can take during an air quality alert to improve air quality and protect health.

Outcomes

Sign up for MPCA air quality alerts and understand actions to take during an air quality alert.

Audience

Adults

Time

20 - 40 minutes

Concepts

- People can experience health effects when air pollution levels are unhealthy during an air quality alert.
- Individuals can take specific actions during air quality alerts to improve air quality and protect health

Supplies

- Computer(s) with internet access
- Sticky notes
- Writing utensils



AIR QUALITY ALERTS AND ACTIONS

Preparation

- Familiarize yourself with the Be Air Aware website at www.beairaware.org.

Procedure

- Have participants visit the MPCA's air quality website at www.pca.state.mn.us/air/current-air-quality-index and look at the current air quality index for Minnesota. Ask participants what the air quality index might mean for health and the environment.
- Explain that alerts are sent when the air quality is poor in Minnesota so individuals can take appropriate actions to protect health and improve air quality.
- Have participants sign up for MPCA's air quality alerts at www.pca.state.mn.us/air/current-air-quality-index.
- Discuss the following actions that can be taken during air quality alerts. Have participants commit to one or more actions by creating a pledge with a sticky note. Have participants place their sticky notes on a wall or board to display their commitments.
 - Use less energy at home: Generating energy can create air pollution. Save energy, improve air quality and save money.
 - Limit recreational backyard fires. Burning firewood is among the major sources of air pollution. If you must burn, burn wisely by following the tips from the Environmental Protection Agency at www.epa.gov/burnwise.
 - Cars that burn gas make a lot of pollution. Walk, bike, carpool or take public transportation instead of driving.
 - Reduce unnecessary vehicle idling. Idling increases air pollution, and all you're doing is wasting gas and increasing air pollution. Most cars don't need to warm up for 5 to 10 minutes.
 - Use hand-powered or electric lawn and snow care equipment. Gasoline-powered engines like those on lawnmowers and snow blowers often have no pollution control devices.
 - Fill up your gas tank after dark. Gasoline emissions evaporate as you fill up your gas tank and contribute to the formation of ozone. In the summer, fill up after dark to keep the sun from turning these gases into air pollution.
 - Encourage colleagues to use alternative transportation such as bus, train or bike and, on air alert days, to work from home.
 - Volatile organic compounds (VOCs)—found in inks, solvents, paint, gasoline and other chemicals are a major component of ozone and smog. On air alert days, limit the use of products that contain VOCs.
 - Encourage your workplace to become an Air Aware Employer at www.beairawaremn.org. The Air Aware program gives employers tools to empower their employees to improve air quality and protect their health.
- Take a photo of the sticky note pledge on the wall and have participants keep their sticky note pledge to remember their commitment to improve air quality and protect their health.

Discussion questions

- What surprised you about the air quality index in Minnesota?
- What action(s) did you commit to during air quality alerts? What action(s) do you think are the most impactful? Why?
- Are there any barriers that are stopping you? How could you overcome those barriers?
- How could you encourage your family and friends to sign up for air quality alerts and take action when air quality is poor?
- How is air quality related to climate change and energy conservation?