

# Engineering for Our Environment

## AT A GLANCE

Students will use the Engineering Design Cycle to create a prototype of a wearable device that can help conserve Earth's valuable resources and fight climate change.

## OBJECTIVES

Students will:

- Identify two causes of climate change which they can affect.
- Develop a prototype of wearable technology to assist or track their efforts.
- Show evidence of the engineering process in their journals.
- (optional) Present their prototype, including a critique of their device.

## SUGGESTED GRADE LEVELS

4th through 12th

## NEXT GENERATION SCIENCE STANDARDS

Science and Engineering Practices:

- Asking questions and defining problems
- Developing and using models
- Planning and carrying out investigations
- Analyzing and interpreting data
- Using mathematics and computational thinking

- Constructing explanations and designing solutions
- Engaging in argument from evidence
- Obtaining, evaluating and communicating information

Disciplinary Core Ideas:

- PS3: Energy
- ETS 1: Engineering Design
- ETS 2: Links among engineering, technology, science and society

Elementary School:

<https://ngss.nsta.org/DisplayStandard.aspx?view=topic&id=14>

Middle School:

<https://ngss.nsta.org/DisplayStandard.aspx?view=topic&id=37>

High School:

<https://ngss.nsta.org/DisplayStandard.aspx?view=topic&id=53>

## WHAT YOU NEED TO KNOW

Climate change is happening and it is up to us to help to stop the spread. Human activity consumes Earth's finite resources. Human dependency on fossil fuels (oil, gas, coal) means that there are more greenhouse gases in our atmosphere now than ever before in human history. Climate change is impacting plant and animal life as well. Many species of plants and animals are becoming extinct

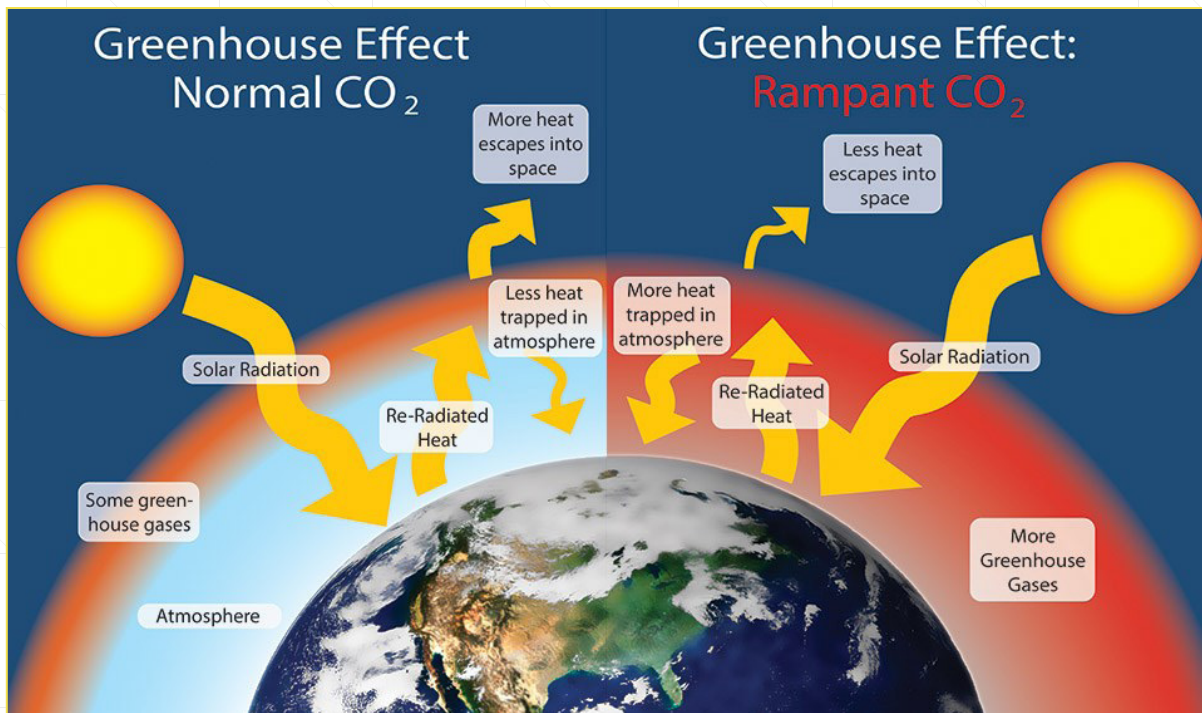
because their habitat is being negatively affected by climate change.

Climate change is the term scientists use to describe the ongoing, long term, changes in global weather patterns, ocean acidification and melting ice sheets at the poles. It causes droughts, storms, intense heat waves, rising sea levels, and warmer oceans. Climate change is also referred to as global warming because of the increased greenhouse gases trapped in earth's atmosphere that cause global temperatures to rise over time.

Greenhouse emissions are gases like carbon dioxide, methane and nitrous oxide that trap the heat from Earth in our atmosphere and stop it

from escaping. Greenhouse gases stay in the atmosphere for a long time. For example, plants absorb carbon dioxide but they can't keep up with all the extra carbon dioxide that humans have been releasing by burning fossil fuels. We need some of these gases in our atmosphere, but having too much of them can cause continued warming. This is commonly known as the Greenhouse Effect, maybe a better term would be the Human Enhanced Greenhouse Effect.

Climate change is happening right now and it is very important that we take the proper steps to help protect and preserve our beautiful planet.



Source: National Park Service <https://www.nps.gov/goga/learn/nature/climate-change-causes.htm>

## KEY VOCABULARY

**Atmosphere:** The layer of gases surrounding the Earth or another planet

**Climate Change:** A long-term (over decades) change in weather patterns, oceans, land surfaces and ice sheets.

**Engineer:** Problem solvers who improve our lives by designing and building complex products, machines, systems and/or structures.

**Engineering Design Cycle (EDC):** A method of problem solving used by engineers.

**Environmental Engineer:** Professionals who use the principles of engineering, soil science, biology and chemistry to develop solutions to environmental problems.

**Global Warming:** A long-term increase in the average temperature of Earth. A major component of climate change.

**Greenhouse Gases:** Gases in our atmosphere that trap heat from the sun. Examples that promote excessive heat capture are: carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O).

**Greenhouse Effect:** When heat from the Earth's surface is trapped in our atmosphere. Necessary to sustaining life on our planet— but in excess causes increased warming linked to global climate change.

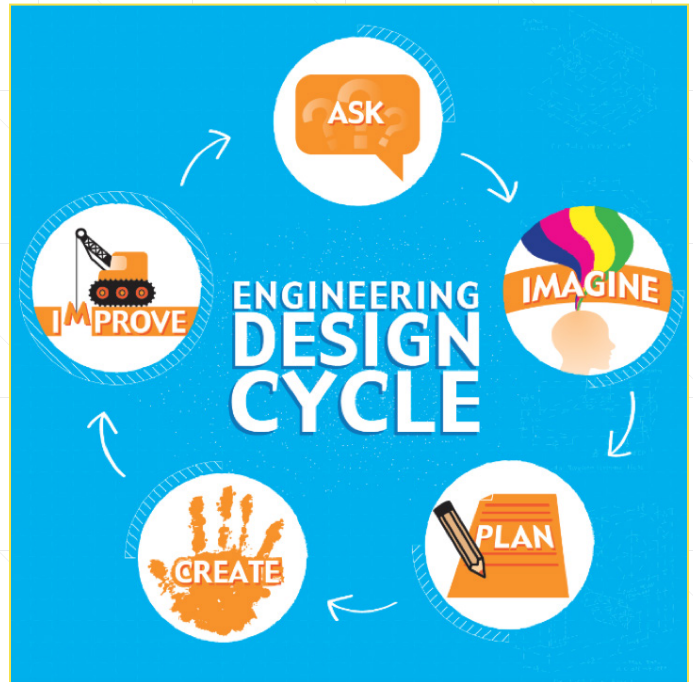
**Scientific Data:** Facts or information gathered while conducting a scientific investigation.

**Scientific Investigation:** The process scientists use to answer questions about the world around us. Involves making observations, asking questions, performing experiments and/or gathering data.

**Weather:** A short-term pattern in atmospheric conditions.

## ENGINEERING DESIGN CYCLE (EDC)

The engineering design process is a series of steps that engineers follow to come up with a solution to a problem.



**Ask:** What is the problem? How have others approached it? What are your constraints?

**Imagine:** What are some solutions? Brainstorm ideas. Choose the best one.

**Plan:** Draw a diagram. Make lists of materials you will need.

**Create:** Follow your plan and create something. Test it out!

**Improve:** What works? What doesn't? What could work better? Modify your design!

**Start Over!:** Ask how your design addresses the problem. What else could work?

## **PROBLEM/SCENARIO :** **THINK ABOUT THE FUTURE**

You are an engineer tasked to design a prototype of a wearable device that can improve your daily way of living as well as save the Earth. Think of ideas for wearable technology that can:

- Clean the environment
- Reduce trash production
- Limit the amount of water you use
- Predict or monitor CO2 usage
- Reduce food waste

As an engineer, you must have a global awareness in the design process and an understanding of how your decision can impact global climate change.

We recommend keeping a journal to document your process. This way you can keep a record of what you have done. Engineers often change or modify their design several times before they are satisfied with the final product. (This is the “improve” step.)

For an added challenge, only use recycled or repurposed material for your design.

## **PROJECT TIME FRAME**

In groups or individually, use the Engineering Design Cycle in these ways.

### **One Class Period**

- Focus on ask, imagine and plan.
- Keep an engineering journal.
- Students can identify an area of climate change for their design, then research, brainstorm and start planning their device.

### **One Week of Class**

- Focus on plan, create and improve.
- Keep an engineering journal.
- Identify an area of climate change to design for and follow the Engineering Design Cycle to make prototype.
- Present their work to the class and discuss data gathered (if any).

### **Long-Term Assignment (In or out of class)**

- Keep an engineering journal.
- Identify an area of climate change for their design and follow the Engineering Design Cycle to make prototype.
- Gather data and write a paper on their process and findings.
- Present work to the class.

## **RESOURCES**

[Climate Change Videos for Students](#)

[NASA Global Climate Change](#)

[Carbon Footprint Calculator](#)

[NASA Climate Kids](#)

[Wearable Technology for a Better Environment](#)

[Wearable Technology: Sustainable and Eco-Friendly](#)

[Wearable Technology News](#)