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Humans can take actions to reduce climate change and its impacts.

The Guiding Principle for informed climate decisions

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Teaching about the role of human actions is supported by seven concepts:

- a. Climate information can be used to reduce vulnerabilities or enhance the resilience of communities and ecosystems affected by climate change. Continuing to improve scientific understanding of the climate system and the quality of reports to policy and decision-makers is crucial.
- b. Reducing human vulnerability to the impacts of climate change depends not only upon our ability to understand climate science, but also upon our ability to integrate that knowledge into human society. Decisions that involve Earth's climate must be made with an understanding of the complex interconnections among the physical and biological components of the Earth system as well as the consequences of such decisions on social, economic, and cultural systems.
- c. The impacts of climate change may affect the security of nations. Reduced availability of water, food, and land can lead to competition and conflict among humans, potentially resulting in large groups of climate refugees.
- d. Humans may be able to mitigate climate change or lessen its severity by reducing greenhouse gas concentrations through processes that move carbon out of the atmosphere or reduce greenhouse gas emissions.
- e. A combination of strategies is needed to reduce greenhouse gas emissions. The most immediate strategy is conservation of oil, gas, and coal, which we rely on as fuels for most of our transportation, heating, cooling, agriculture, and electricity. Short-term strategies involve switching from carbon-intensive to renewable energy sources, which also requires building new infrastructure for alternative energy sources. Long-term strategies involve innovative research and a fundamental change in the way humans use energy.
- f. Humans can adapt to climate change by reducing their vulnerability to its impacts. Actions such as moving to higher ground to avoid rising sea levels, planting new crops that will thrive under new climate conditions, or using new building technologies represent adaptation strategies. Adaptation often requires financial investment in new or enhanced research, technology, and infrastructure.
- g. Actions taken by individuals, communities, states, and countries all influence climate. Practices and policies followed in homes, schools, businesses, and governments can affect climate. Climate-related decisions made by one generation can provide opportunities as well as limit the range of possibilities open to the next generation. Steps toward reducing the impact of climate change may influence the present generation by providing other benefits such as improved public health infrastructure and sustainably built environments.

Humans cause climate change, and humans can address climate change too.

Climate change can be a tough topic to teach. But talking about the solutions can bring a hopeful message to the classroom and empower students. It's essential that students understand the types of actions we can take, and the scale at which these changes are necessary. Humans need to reduce emissions of heat-trapping gases, while also preparing for impacts, planning for resilient communities, and protecting the ecosystems that sustain us. Addressing climate change will be a monumental challenge, and no doubt some of today's students will be instrumental in designing and implementing future solutions.

It is vital that students understand solutions

Actions to address climate change are already happening all around us. The multifaceted nature of solutions and adaptations offer many avenues for exploring these topics in the classroom.

- Although human-caused climate change is a global problem, its root cause lies in the sum of our individual actions.
- Types of actions to reduce climate change can take many forms, such as emissions avoidance, land use changes, or sequestration of greenhouse gases.
- The scale of actions can range from an individual to a community, to a nation, or a grouping of nations.
- Climate and energy policies are currently being crafted by various nations and communities.
- All citizens, including students, can provide input into new policies; the resulting policies are likely to have an effect on all of us.
- Actions are not always driven by policy. Some corporations are taking actions to address climate change even without being required to do so.
- Actions can be spurred by policy, economic incentives, a sense of environmental or social responsibility, or a combination of each of these.

Some examples of *mitigating* climate change:

- Burn less fossil fuels; convert to carbon-free energy
- Use energy more efficiently
- Design cities, communities, and networks like food and transportation so they are less energy-intensive
- Create new energy infrastructure that can be responsive to smaller, more variable, and more numerous inputs of energy, such as from wind turbines and solar farms.
- Eat lower on the food chain
- Improve or restore the Earth's ability to store carbon, such as in soils, forests, or wetlands

Some examples of *adapting* to climate change:

- Plan communities that are resilient to changes
- Limit new construction in coastal and low-lying areas; adapt existing structures to withstand flooding
- Educate people in vulnerable areas for how to respond to extreme weather
- Learn more about crops that can be grown in a wider range of conditions
- Learn more about threatened ecosystems and species and take steps to protect them



Crews installing solar thermal collectors and photo voltaic panels on the roof of a zero-energy house built for Habitat for Humanity. Photo by Pete Beverly

**Helping students understand these ideas**

The climate and energy challenges that society must address in the coming years and decades can be overwhelming for many learners. The scientific findings of global change research can be alarming and discouraging even for seasoned scientists. Many students, even before they fully master the science, will want to know what they can do to make a difference. Teachers are finding that weaving together science with solutions is an important strategy to avoid depressing their students.

The enormous challenge of addressing climate change cannot be overestimated. "Easy solutions" to reduce our personal impact on Earth's climate, such as switching to efficient light bulbs, offer an excellent starting point when addressing energy use, however, real change will only happen with significant shifts in how we generate and use energy (example activity: [Stabilization Wedges Game](#)). Solutions always need to be evaluated in terms of their ability to scale up and be implemented in a meaningful and practical way. Educators can leverage the knowledge, values, and experiences of their students to keep them inspired and challenged.

Solutions are frequently interdisciplinary and span science, engineering, economics, and policy. Examining the realities of integrating solutions into our society are potent ways to teach these topics. That said, educators should exercise care with policy discussions and avoid political debates that can distract from the main goal of mastering the content.

Ultimately, if students are facile in their understanding of solutions, they will be able to evaluate choices on the basis of multiple factors, and can weigh advantages and tradeoffs. This type of critical thinking is essential for making informed decisions and solving complex problems - skills that all students will need as engaged citizens.



image of a thermostat

**Bringing these ideas into your classroom**

Our responses to climate change touch on many disciplines: earth science, biology, human health, engineering, technology, economics, and policy. Thus there are many places in the curriculum into which these topics can be woven. Students can engage in projects that focus on their own communities or on international case studies. Topics can involve lifestyle changes, innovative solutions, emerging technology, or policy negotiations. Subject areas can include energy, transportation, food, agriculture, commerce, or land use.

A pedagogic technique that is particularly effective is to have students take a quantitative approach to discover the scale of the problem and thus the scale of potential solutions. For example, how many light bulbs would need to be changed in order to offset rising carbon emissions? Is it possible to plant enough trees to soak up excess CO₂? (See activity [Atmospheric Carbon: Can We Offset the Increase?](#)) Often the best way for students to reach an understanding is to engage them in a problem-solving activity that allows them to discover answers for themselves.

Teaching materials from the CLEAN collection

More than many other aspects of climate literacy, many of these activities span several grade levels

Middle school

- [There's a Thief in My Kitchen](#) investigates energy use of different light bulbs. Students can pair that with a [Carbon calculator activity](#), and then do basic calculations to measure the effect if every student in the country took similar actions.
- [Plant for the Planet](#) offers an upbeat example of a young student who rallies his community and other children to plant millions of trees to offset emissions.
- The EPA's guide to [Technologies that Reduce Greenhouse Gases](#) offers a student-friendly summary of many different forms of renewable energy.
- In the [Renewable Energy Living Lab: Energy Priorities](#), students explore real data about renewable energy potential in their state using a mapping tool developed by National Renewable Energy Laboratory.
- The [Green Revolution](#) is a series of 10 short videos featuring scientists, research, and green technologies.



A booth at Earth Day 2007 at City College San Diego



High school

- There are several lesson plans that incorporate a renewable energy mapping tool from the National Renewable Energy Labs, called [Renewable Energy Living Lab](#). These lessons evaluate feasibility, cost, and environmental impacts of installing renewable energy, and they are a way to bring engineering and design into the subject.
- The [Stabilization Wedges Game](#) and the related [Carbon Wedges interactive](#) are helpful for illustrating the scale of changes needed to accomplish significant emissions reduction.
- This [Carbon Footprint](#) and [Carbon Calculator](#) activities use two different versions of EPA's carbon calculator.
- The [Energy Lab](#) is a simulator that allows students to meet projected energy demand while also minimizing atmospheric CO₂.
- Solutions to climate change are sometimes mis-characterized as something that is only relevant to "green" industries and people. Richard Alley's video illustrates the military's approach to the subject with [The Pentagon and Climate Change](#) and [Khaki Goes Green](#).
- [Four Generations of Green](#) offers a vignette of a family dairy that infuses sustainable practices throughout their operation.

Related Pedagogic Methods:

- - [Experience-Based Environmental Projects](#)
- - [Using Investigative Cases](#)
- - [Teaching Quantitative Literacy](#)
- - [Teaching about Energy using Quantitative Skills](#)

College

- The [The Lifestyle Project](#) is a widely-used conservation project that allows students to examine their resource use and make changes to their consumption patterns.
- In the [Greenhouse Emissions Reduction Role-Play Exercise](#) students take the roles politicians, scientists, environmentalists, and industry representatives working on legislation to reduce greenhouse gas emissions in the United States.
- Similar activities use an international approach to emissions reduction: [Simulation of international negotiations to reduce greenhouse gas emissions](#) and [World Climate: Climate Change Negotiations Game](#).
- China's role in global energy use is rapidly changing, as they are becoming the global leader in renewable energy. Educators would need to seek up-to-date figures, but this video can help set the stage for the topic: [China: In with the New](#).
- [Adapting to a Changing World](#) explores public opinions on climate change and identifies strategies to mitigate or adapt to climate change.

Find activities and visuals for teaching this topic

Search by grade level: [middle school](#) [high school](#) [intro college](#) [upper college](#) [search all grade levels](#)

References

[IPCC Report: Mitigation of Climate Change, 2007](#) - Includes a discussion of emissions trends, mitigation in the short-term (until 2030) and in the longer term, policies, measures and instruments to mitigate climate change, and sustainable development.

[Summary of climate actions taken by the Obama administration](#) illustrates different types of actions that government,

institutions, and corporations can take. The summary includes energy efficiency, clean energy, reductions in CO₂, methane, hydrofluorocarbons, and many other measures. Each action is linked to a fact sheet or further information.

A Plan to Keep Carbon in Check -this 2006 article by Robert H. Socolow and Stephen W. Pacala introduces the "wedges" approach to carbon mitigation. The article is available from [Scientific American](#) with a subscription, or from the Carbon Mitigation Initiative's [Articles and Videos](#) page.

[Climate Change Is Happening, Effects Will Be Severe, Now What Will It Cost to Fix It?](#) - by David Biello, Scientific American, May 2007

[Common Sense on Climate Change: Practical Solutions to Global Warming](#) by the Union of Concerned Scientists. This article describes five steps that are available today and can have an enormous impact.