



Your planet, Your future

AN ENERGY EFFICIENCY HANDBOOK FOR STUDENTS AND PARENTS

**This handbook has useful
information for young adults about:**

- Being aware of energy use
- What a carbon footprint is
- How choices effect change
- Power Down Fridays
- Green jobs
- Internship opportunities

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Your planet, Your future

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Introduction

The world is changing quickly. That has become more evident in the past year. As we adapt to living in this changing world, it is important to become aware of how the things we do affect the planet. It is, after all, your future.

Some of these habits and behaviors are positive and constructive, but some have negative effects on the environment. We take showers that are too long. We leave lights on when we are not using them. We keep our homes too cool in the summer and too warm in the winter. All of these wasteful behaviors may seem inconsequential and are usually done without malicious intent. But they do carry consequences. Wasting energy also means wasting the natural resources that are used to make the energy and electricity we often take for granted.

So how do we begin to develop new habits and behaviors that can help prevent waste? Self-awareness is the first step, followed by education and action. It's easier said than done, however. This handbook is intended to help shed light on the importance of energy conservation and ways you can make your voice heard and help make a difference.

In addition to some information on energy conservation, you will also find information on jobs and careers in the "green energy" field as well as majors and areas of study to pursue in college.

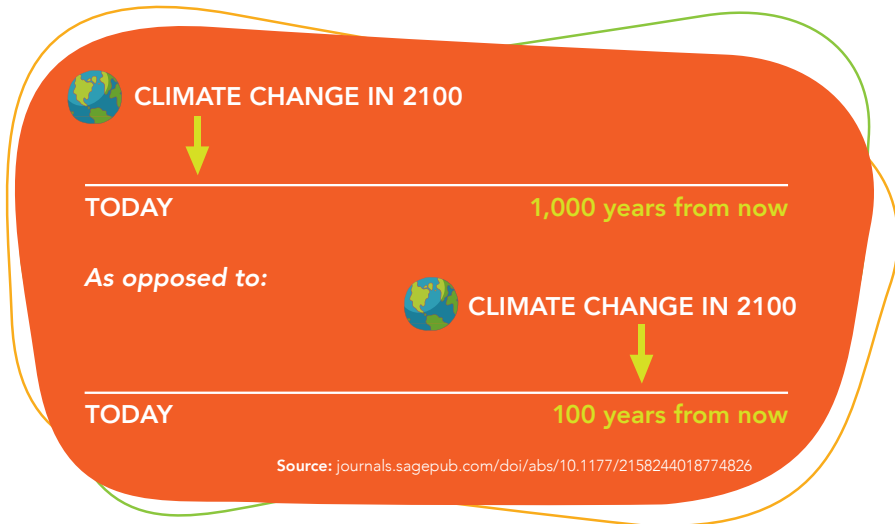


BE AWARE OF ENERGY USE

Simply becoming aware of your energy use can begin to mitigate climate change effects in the future. But there are psychological barriers that hinder people from engaging in sustainable behaviors. Climate change can be a daunting problem, in part because people have a hard time putting distant events in context.

Compounding this problem, people tend to perceive that the acts of any single individual seem too small to make a difference. Recognizing how these two factors can hinder environmental action can also suggest some possible solutions.

When discussing the seemingly far-off effects and implications of climate change, it can be useful to frame the events as short-term in actuality. This can be done by putting the next century within the context of the next thousand years. This has the effect of making the impacts of climate change more urgent and immediate, thus having a positive influence on behavior change. For example:



In addition, the more we can agree that enacting positive actions that benefit the environment is normal and that “everybody is doing it,” the more we can amplify the likelihood of making positive behavior changes regarding energy use and conservation.

BE AWARE OF ENERGY USE

Another reason changing household energy habits is hard is because we can't see energy. It's invisible. And it can be difficult to change behaviors around something that is largely unseen. Households account for a significant proportion of U.S. energy consumption – approximately 14%.

Given that cost-effective measures are available to improve home energy efficiency, there lies a challenge in raising homeowners' awareness of inefficiencies and motivating them to act. This challenge may partly be because energy is invisible. A householder may know terms associated with energy use but may have difficulty relating that to specific behaviors. Knowledge of energy use is predicated on what is experienced: light, heat and convenience rather than the amount of energy required to provide these benefits.

Visual images can be powerful.

Smoke sticks can be used to make drafts visible. A smoke stick is a device that emits a small stream of smoke that is susceptible to drafts and wind. It can be used to make invisible drafts visible in a house. Telling people that they are losing a percentage of heat through the cracks around the windows is one thing, but showing smoke pour out under doors and over window sills is far more compelling.



Source: journals.sagepub.com/doi/pdf/10.1177/0013916514546218

BE AWARE OF ENERGY USE

There are many psychological theories about how humans deal with change. One of the most influential psychologists in the discipline is James Prochaska, who developed the Transtheoretical Model of Behavior Change. It states that humans usually move through six different stages when dealing with change. The different stages are:

PRECONTEMPLATION

People do not intend to take action in the foreseeable future (six months).

CONTEMPLATION

People are intending to start the healthy behavior in the foreseeable future (within six months).

PREPARATION

People are ready to take action within the next 30 days.

ACTION

People have recently changed their behavior and intend to keep moving forward with that behavior change.

MAINTENANCE

People have sustained their behavior change for a while and intend to maintain the behavior change going forward.

TERMINATION


People have no desire to return to their unhealthy behaviors and are sure they will not relapse.

People rarely move through these stages in a straightforward fashion. Rather, they bounce back and forth or loop around repeatedly, sometimes slowly making progress, sometimes not. The theory is revolutionary because it gives a framework for dealing with change that can be used across psychological areas of discipline. This has helped psychiatrists, psychologists and therapists assist their patients in their progress.

WHAT A CARBON FOOTPRINT IS

Many of our daily activities cause emissions of **greenhouse gases**. For example, we produce greenhouse gas emissions by burning gasoline when we drive, burning oil or gas for home heating, or using electricity generated from coal, natural gas and oil. Adding together all the activities you do that result in the release of carbon dioxide into the atmosphere is called your **carbon footprint**. Greenhouse gas emissions vary among individuals depending on a person's location, habits and personal choices. Just like real footprints, your carbon footprint is probably a different size than someone else's.

For example:

- The greenhouse gas emissions from your home's electricity use depend on the **types of fuel** your power plant uses to generate the electricity and the amount you use.
 - The greenhouse gases emitted from your furnace and boiler depend on the **efficiency** of these appliances, the size and insulation of your house, and the amount and type of fuel used.
 - The emissions from your car or truck depend on **how you drive** (e.g., the amount of time spent idling in traffic).
 - In addition, the more you **recycle**, the more you reduce the amount of waste sent to **landfills**, as well as the greenhouse gas emissions that result from processing raw materials.
- 



Source: www.epa.gov/ghgemissions/household-carbon-footprint-calculator

WHAT A CARBON FOOTPRINT IS

Where do greenhouse gases come from?

Primary sources of greenhouse gas emissions in the United States:



- The **transportation sector** generates 27% of greenhouse gas emissions. These primarily come from burning fossil fuels for our cars, trucks, ships, trains and planes. Over 90% of the fuel used for transportation is petroleum based, which includes gasoline and diesel.



- **Electricity production** generates the second largest share – 25% – of greenhouse gas emissions. Approximately 68% of our electricity comes from burning fossil fuels, mostly coal and natural gas.



- Greenhouse gas emissions from the **industrial sector** – 24% – primarily come from burning fossil fuels for energy, as well as greenhouse gas emissions from certain chemical reactions necessary to produce goods from raw materials.



- Greenhouse gas emissions from **businesses and homes** – 13% – arise primarily from fossil fuels burned for heat, the use of certain products that contain greenhouse gases and the handling of waste.



- Greenhouse gas emissions from **agriculture** – 11% – come from livestock such as cows, agricultural soils and rice production.

Source: www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions

WHAT A CARBON FOOTPRINT IS

What You Can Do to Reduce Your Emissions

There are simple things you and your family can do to reduce the size of your carbon footprint.

ON THE ROAD

- Properly inflating tires can increase fuel efficiency by up to **3%**.
- Keeping your engine properly tuned can increase fuel efficiency by up to **4%**.
- Performing regular maintenance on your vehicles can increase fuel efficiency by up to **7%**.

AT HOME

- Turning down your heating thermostat 1 degree can mean up to **3%** energy savings.
- Turning up the thermostat for central air conditioning by 1 degree can mean up to **6%** savings.
- Enabling the sleep feature on your computer and monitor can mean **saving twice the energy as leaving it on most of the time**.
- Replacing 43-watt halogen lightbulbs with 13-watt LEDs results in up to **69%** energy savings.
- Replacing an old refrigerator with an ENERGY STAR® model can **reduce your energy use by up to half**.

Source: archive.epa.gov/epa/climatechange/assumptions-and-references-household-carbon-footprint-calculator.html

CHOICES EFFECT CHANGE

Two ways to make change happen are to **make your voice heard** and **get involved**. High school students have both a unique perspective on the world and the most at stake in its future. By choosing to take advantage of opportunities to communicate the importance of natural resources and energy conservation, students can begin to effect change. Starting at the most **local level**, home and school, students become aware of the prevalence of the problem and create innovative solutions unique to their communities. Starting a **green club** or other student-run organization dedicated to environmental awareness is a great way to get started on both goals.

Extending beyond the confines of the local community, students can begin preparing for post-high school life by exploring **college majors in environmental science** or seeking out jobs and careers in the expanding **green energy workforce**. Some of the fastest-growing and best-paying jobs in the world center on our need to make a more sustainable planet. There is a demand for green careers now and for the foreseeable future.

Using your voice to effect change can be nerve-racking for some, but once one person begins to create change, others will follow. Young adults have an opportunity and a responsibility to help shape our world in a way few generations have had in the past. The time is now to speak up and act.



CHOICES EFFECT CHANGE

Starting locally in your own school and finding ways to make it more energy efficient can have many benefits. Some of the benefits are:

REDUCED ENERGY COSTS

Schools spend approximately \$75 per student on natural gas bills and \$130 per student on electricity each year. By implementing energy efficiency measures, many K-12 schools have been able to reduce energy costs by as much as 30% in existing facilities.

IMPROVED STUDENT PERFORMANCE

Energy-efficient school building designs often use natural daylight to reduce the energy needed to light a building. Natural light has also been proven to have a positive effect on student performance.

INCREASED ATTENDANCE

An indirect benefit of energy efficiency measures in school buildings is an increase in school attendance rates. According to an analysis for the state of Washington, incorporating green building measures in school designs improves indoor air quality and can reduce absenteeism rates by as much as 15%.

ENHANCED EDUCATIONAL OPPORTUNITIES

Several K-12 schools have used energy efficiency improvements as opportunities to adapt academic curricula to promote awareness of energy and environmental issues. Some school districts have installed energy data kiosks in K-12 school buildings so students can monitor their school's energy consumption.

INCREASED SECURITY AND SAFETY

Improving energy efficiency in K-12 school buildings can have positive effects on school security and student safety. For example, energy-efficient exterior lighting can enhance security while reducing energy costs by providing effective and even light distribution.

Source: www.epa.gov/sites/production/files/2015-08/documents/k-12_guide.pdf

Power Down Fridays

Power Down Fridays are a way to **reduce energy use in buildings** (like schools) that are mostly unoccupied over the weekend. The practice has been in use at many businesses and some schools for years. It is a great way for interested students, or members of a school's green team, to work with custodial staff to make sure lights, computers and other electricity-hogging devices are powered down for the duration of the weekend.

Here's how it works: The **custodial staff**, along with **interested students**, sweep the school, going classroom by classroom to make sure the lights are turned off, computers are shut down and any power strips are clicked off. With an average high school having over **50 rooms**, the energy-saving potential of a Power Down Friday is enormous. This can not only **save the school money** on its utility bill, it also helps reduce our **reliance on the natural resources** it takes to make electricity.

Some things to consider if you are interested in starting a Power Down Friday action at your school:

- Coordinate with both the administration and the custodial staff at your school.
- Plan for how your team will progress through the school and what items will be turned off, powered down or put in "sleep" mode.
- Make sure you communicate your plan to all the students, staff and teachers at the school.
- Some people may have appliances or devices that are exempt from being shut off.
- Assign students and staff to begin the sweep after school every Friday.
- Some schools choose to put a sign on the door that reminds people that the room has been powered down.



Wind

According to the American Wind Energy Association, an estimated 85,000 Americans are currently employed in the wind power industry and related fields. Many workers, like electrical engineers, turbine technicians and construction workers, are found on wind farms, which are frequently located in the Midwest, Southwest and Northeast regions of the United States. Texas, Iowa and California are the leading states in wind power generating capacity, but many other states – including Illinois, Indiana, Oregon and Washington – are in the process of substantially increasing their wind-generating capacity.

Although some states are better known for wind power than others, there are wind energy jobs in almost every state in the country. Much wind turbine manufacturing is in traditional manufacturing areas in the Great Lakes and Midwest, as well as in the Southeastern United States.

Solar

The solar industry includes workers in science, engineering, manufacturing, construction and installation. Scientists, for example, are involved in the research and development of new and more efficient materials, and engineers design new systems and improve existing technologies. Manufacturing workers make the equipment used in solar power generation, such as mirrors and panels. Construction workers build solar power plants. Electricians, plumbers and solar photovoltaic technicians install residential and commercial solar projects. The Solar Foundation estimates that the largest growth in the solar industry will be in occupations in solar installation, including photovoltaic installers, electricians and roofers with experience in solar installation. The solar industry now employs more than 230,000 Americans.

Sources: www.bls.gov/green/wind_energy
www.bls.gov/green/solar_power

Geothermal

The Geothermal Energy Association (GEA) estimates that there are about 5,000 jobs directly related to geothermal power production and management. The GEA also estimates that developing a 50-megawatt geothermal plant requires between 697 and 862 workers. According to a report by the Western Governors Association (WGA), development of 5,600 MW of geothermal energy would result in the creation of almost 100,000 jobs.

There is potential for geothermal energy development throughout the United States. The most accessible geothermal sites are concentrated in the Western United States, where most geothermal development has already taken place. Jobs in geothermal energy are usually located near these sites.

Green Construction

Green construction is construction that is environmentally responsible and resource-efficient. As the size of the green construction industry grows, so will its workforce. According to a U.S. Green Building Council (USGBC) and Booz Allen Hamilton study, green construction supported more than 2.3 million workers in 2015. This estimate of the green construction workforce does not include employment for suppliers of green building materials and products, an industry that should also experience increased growth as demand for their goods rises. Although, in the United States, the green construction workforce is still much smaller than the general construction workforce – estimated at 7.1 million workers in 2018 – its growth has been considerable.

Sources: https://www.bls.gov/green/geothermal_energy/geothermal_energy.htm
www.bls.gov/green/construction

Wind Turbine Technicians

Wind turbine service technicians, also known as windtechs, install, maintain and repair wind turbines.

Wind turbine service technicians typically do the following:

- Inspect the exterior and physical integrity of wind turbine towers
- Climb wind turbine towers to inspect or repair wind turbine equipment
- Perform routine maintenance on wind turbines
- Test and troubleshoot electrical, mechanical and hydraulic components and systems
- Replace worn or malfunctioning components
- Collect turbine data for testing or research and analysis
- Service underground transmission systems, wind field substations or fiber optic sensing and control systems

Most windtechs learn their trade by attending technical schools or community colleges where they typically complete certificates in wind energy technology, although some workers choose to earn an associate's degree.

The median annual wage for wind turbine technicians was \$56,250 in May 2021. Employment of wind turbine service technicians is projected to grow 68% from 2020 to 2030, much faster than the average for all occupations.

Sources: www.bls.gov
www.onetonline.org

Solar Panel Installers

Solar photovoltaic (PV) installers assemble, install and maintain solar panel systems on rooftops or other structures.

PV installers typically do the following:

- Plan PV system configurations based on customer needs and site conditions
- Measure, cut and assemble the support structure for solar PV panels
- Install solar modules, panels and support structures in accordance with building codes and standards
- Connect PV panels to the electrical system
- Apply weather sealant to equipment being installed
- Activate and test PV systems
- Perform routine PV system maintenance

Most employers require PV installers to have a high school diploma. Some PV installers take courses at local community colleges or trade schools to learn about solar panel installation. Courses range from basic safety and PV knowledge to system design. Although course lengths vary by state and locality, most usually last a few days to several months.

The median annual wage for solar photovoltaic installers was \$47,670 in May 2021. Employment of PV installers is projected to grow 52% from 2020 to 2030, much faster than the average for all occupations.

Sources: www.bls.gov
www.onetonline.org

Environmental Scientists

Environmental scientists and specialists use their knowledge of the natural sciences to protect the environment and human health. They may clean up polluted areas, advise policymakers or work with industries to reduce waste.

Environmental scientists and specialists typically do the following:

- Determine data collection methods for research projects, investigations and surveys
- Collect and compile environmental data from samples of air, soil, water, food and other materials for scientific analysis
- Analyze samples, surveys and other information to identify and assess threats to the environment
- Develop plans to prevent, control or fix environmental problems, such as land or water pollution
- Provide information and guidance to government officials, businesses and the general public on possible environmental hazards and health risks
- Prepare technical reports and presentations that explain their research and findings

For most entry-level jobs, environmental scientists and specialists must have a bachelor's degree in environmental science or a science-related field, such as biology, chemistry, physics, geosciences or engineering. However, a master's degree may be needed for advancement.

The median annual wage for environmental scientists and specialists was \$76,530 in May 2021. Employment of environmental scientists and specialists is projected to grow 8% from 2020 to 2030, about as fast as the average for all occupations.

Sources: www.bls.gov
www.onetonline.org

Environmental Engineers

Environmental engineers use the principles of engineering, soil science, biology and chemistry to develop solutions to environmental problems. They address global issues such as unsafe drinking water, climate change and environmental sustainability.

Environmental engineers typically do the following:

- Prepare, review and update environmental investigation reports
- Design projects that lead to environmental protection, such as water reclamation facilities or air pollution control systems
- Obtain, update and maintain plans, permits and standard operating procedures
- Provide technical support for environmental remediation projects and for legal actions
- Analyze scientific data and do quality-control checks
- Monitor the progress of environmental improvement programs
- Inspect industrial and municipal facilities and programs to ensure compliance with environmental regulations
- Advise corporations and government agencies about procedures for cleaning up contaminated sites

Environmental engineers must have a bachelor's degree in environmental engineering or a related field such as civil, chemical or general engineering.

The median annual wage for environmental engineers was \$96,820 in May 2021. Employment of environmental engineers is projected to grow 4% from 2020 to 2030, slower than the average for all occupations.

Sources: www.bls.gov
www.onetonline.org

Electrical Engineers

Electrical engineers design, develop, test and supervise the manufacture of electrical equipment, such as electric motors, radar and navigation systems, communications systems or power generation equipment. Electrical engineers also design the electrical systems of automobiles and aircraft.

Electrical engineers typically do the following:

- Design new ways to use electrical power to develop or improve product
- Perform detailed calculations to develop manufacturing, construction and installation standards and specifications
- Direct the manufacture, installation and testing of electrical equipment to ensure that products meet specifications and codes
- Investigate complaints from customers or the public, evaluate problems and recommend solutions
- Work with project managers on production efforts to ensure that projects are completed satisfactorily, on time and within budget

Electrical and electronics engineers typically need a bachelor's degree in electrical engineering, electronics engineering or a related engineering field.

The median annual wage for electrical engineers was \$101,780 in May 2021. Employment of energy auditors is projected to grow 7% from 2020 to 2030, about as fast as the average for all occupations.

Sources: www.bls.gov
www.onetonline.org

Hydroelectric Plant Technicians

Hydroelectric plant technicians monitor and control activities associated with hydropower generation. They operate plant equipment, such as turbines, pumps, valves, gates, fans, electric control boards and battery banks.

Hydroelectric plant technicians typically do the following:

- Operate high-voltage switches or related devices in hydropower stations
- Identify or address malfunctions of hydroelectric plant operational equipment such as generators, transformers and turbines
- Inspect water-powered electric generators or auxiliary equipment in hydroelectric plants to verify proper operation or to determine maintenance or repair needs
- Implement load or switching orders in hydroelectric plants in accordance with specifications or instructions
- Start, adjust or stop generating units, operating valves, gates or auxiliary equipment in hydroelectric power generating plants

Most occupations in this zone require training in vocational schools, related on-the-job experience or an associate's degree.

The median annual wage for hydroelectric plant technicians was \$80,850 in May 2021. Employment of hydroelectric plant technicians is projected to grow 1% from 2020 to 2030, slower than average for all occupations.

Sources: www.bls.gov
www.onetonline.org

Clean Cities Coalition University Workforce Development Program

Clean Cities offers internships through the Clean Cities University Workforce Development Program. Internships with Clean Cities coalitions are available throughout the year for undergraduate (junior or senior) or graduate students studying communications, public relations, business, marketing, engineering or environmental sciences.

Each year, students in the program work with Clean Cities coalitions to increase awareness of alternative fuels and advanced vehicle technologies and their potential for petroleum reduction. Interns work with coordinators and stakeholders in the community to plan events, analyze data, research markets, design websites and promote initiatives through social media and public relations.



Community College Internship Program

The Community College Internship (CCI) program seeks to encourage community college students to enter technical careers relevant to the U.S. Department of Energy (DOE) mission by providing technical training experiences at the DOE laboratories. Selected students participate as interns appointed at a participating DOE laboratory. Under the guidance of laboratory staff scientists or engineers, they work on technologies, instrumentation projects or major research facilities that support the DOE's mission.

The participating DOE labs are:

Ames Laboratory – Ames, IA
Argonne National Laboratory – Argonne, IL
Brookhaven National Laboratory – Upton, NY
Fermi National Accelerator Laboratory – Batavia, IL
General Atomics / DIII-D Facility – San Diego, CA
Idaho National Laboratory – Idaho Falls, ID
Lawrence Berkeley National Laboratory – Berkeley, CA
Lawrence Livermore National Laboratory – Livermore, CA
Los Alamos National Laboratory – Los Alamos, NM
National Energy Technology Laboratory – OR, WV, PA
National Renewable Energy Laboratory – Golden, CO
Oak Ridge National Laboratory – Oak Ridge, TN
Pacific Northwest National Laboratory – Richland, WA
Princeton Plasma Physics Laboratory – Princeton, NJ
Sandia National Laboratories – Livermore, CA
Savannah River National Laboratory – Aiken, SC
SLAC National Accelerator Laboratory – Menlo Park, CA
Thomas Jefferson National Accelerator Facility – Newport News, VA
DOE Headquarters – Naval Reactors Internship – Washington, DC

Source: www.energy.gov
<https://science.osti.gov/wdts/ccl/How-to-Apply/Selecting-a-Host-DOE-Laboratory>

ADDITIONAL RESOURCES

The information in this handbook was collected from a number of useful sources. If you would like more information, visit these websites:

THE BUREAU OF LABOR STATISTICS

www.bls.gov

THE ENVIRONMENTAL PROTECTION AGENCY

www.epa.gov

THE ENVIRONMENTAL PROTECTION AGENCY ARCHIVES

archive.epa.gov

O-NET ONLINE OCCUPATION INFORMATION

www.onetonline.org

SAGE RESEARCH JOURNALS

journals.sagepub.com

THE U.S. DEPARTMENT OF ENERGY

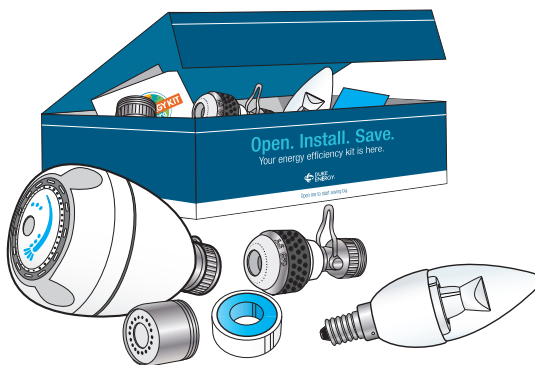
www.energy.gov



STUDENTS & FAMILIES

Participate in the My Energy Kit program and have the opportunity to earn rewards for you, your teachers and your school! You and your family can request a **FREE** kit and access more resources and activities by visiting

MyEnergyKit.org



Kilowatt Krush is an educational gaming app brought to you by Duke Energy containing a variety of energy-related mini games.

Kilowatt Krush is available at the App Store or Google Play!