

in Santa Monica from .4 to 1.2 “Today in Downtown LA, about six days per year exceed 95 °F temperatures. This number could increase to 22 days per year by mid-century and 54 days per year by end of century if there is no effort at greenhouse gas mitigation.”⁹

For more detailed information on this study, visit <https://www.kcet.org/climate-change-la>

MELTING ICE AND SEA LEVEL RISE

One result of rising temperatures is the melting of Arctic ice. Approximately 24% of the Earth’s land surface is permafrost, the upper ten feet of which store 1.7 trillion tons of CO₂.¹⁰ This is more than double what is in the atmosphere today.¹¹ As it melts, this CO₂ is released and can persist for hundreds of years in our atmosphere. The melting of ice also creates underground lakes where microbes eat up thawing organic matter and create methane bubbles that eventually make their way into the atmosphere. Methane (CH₄) has 20 times the heat-trapping effects of CO₂; the melting ice and resulting release of greenhouse gases contributes to a **positive feedback loop**.¹²

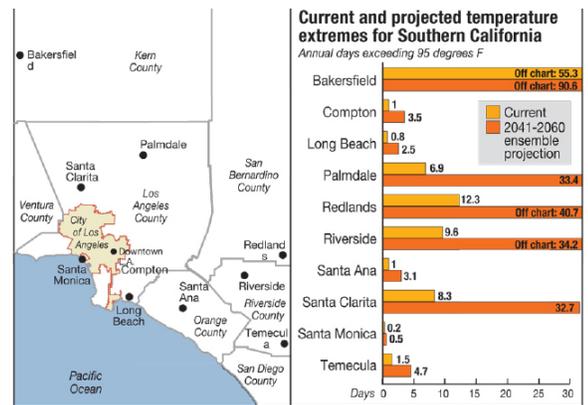
Sea level rise is a significant consequence of melting ice. The Intergovernmental Project on Climate Change (IPCC) estimates that sea level is likely to rise from one to three feet by 2100. The rise in sea levels could displace millions of people as flooding increases for coastal cities and islands.¹³ Low lying cities like Miami, New York, Venice and New Orleans will be especially effected. Several power plants in the U.S. lie below the three-foot threshold, as do a third of our gas processing and refining plants. The extreme weather associated with sea level rise and climate change threatens offshore drilling platforms and the vast infrastructure that delivers energy to our homes.¹⁴

Check out NOAA Coastal Services Center Level Rise and Coastal Flooding Impacts Viewer to see an interactive map of local sea level rise

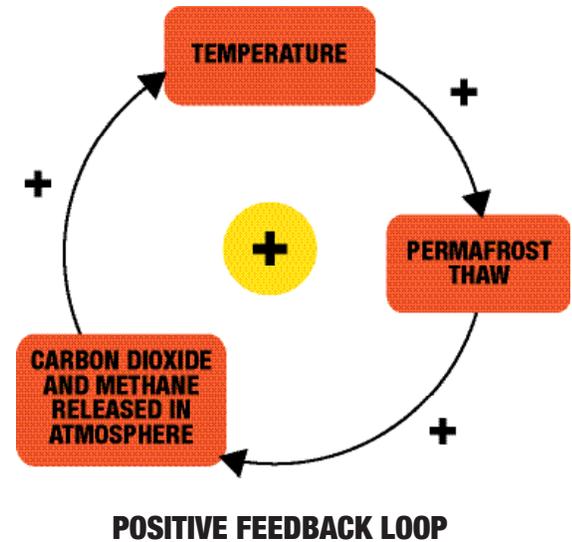


OCEAN ACIDIFICATION

The carbon dioxide released by humanity’s demand for energy also directly impacts the planet’s seas. Our oceans absorb excess CO₂, which reduces the ocean’s pH level, resulting in more acidic, corrosive waters. This process is called ocean acidification, a phenomenon scientists are only beginning to understand. Currently, the ocean is 30% more acidic than during pre-industrial times, and projections estimate there may be as much as a 150% change by the end of 2100 – a level of acidity our oceans have not experienced in 20 million years.¹⁵ Increasing acidity destroys coral reefs and threatens every level of the marine food chain by decreasing the presence of calcium carbonate, the building block of coral reefs and marine shells. This affects human sources of food.¹⁶ Already, the U.S. west coast is witnessing oyster die-offs in startling numbers.¹⁷



Source: UCLA LARC study, 2012; chart based on the mean/average projected by the 19 climate models



NATIONAL ENERGY NEEDS

After China, the United States is the second highest emitter of greenhouse gases on the planet. In 2019, about 61% of the electricity generated in the U.S. was from fossil fuel (coal, natural gas, and petroleum), with 23% attributed from coal. An estimated 20% came from nuclear power. Only 17% of electricity came from renewables.¹⁸

COAL

Around 1/4 of the United States’ electricity is generated by burning coal.¹⁹ Coal contains trace quantities of radioactive elements, which do not burn off and concentrate in the ash. This ash is released into the atmosphere by coal plants, and “carries into the surrounding environment 100 times more radiation than a nuclear power plant producing the same amount of energy.”²⁰ In addition to fly ash, over 110 million tons of waste is produced annually by the coal industry, some of the waste is funneled into products many of us come in contact with every day, like concrete and wallboard. Coal ash is the largest type of waste generated in the United States and in many other countries. Coal

ash contains a toxic stew of chemicals including lead, mercury, cadmium and arsenic and radioactive uranium.²¹ The rest of the coal waste is stored in unlined landfills, ponds, or underground mines which are not regulated by the EPA. The toxic substances found in coal waste are then leached into the groundwater, threatening the health of wildlife and the people who live nearby. In February 2014, a huge coal ash spill was discovered at the Duke Energy power plant in North Carolina that has caused significant damage to the Dan River. The spill was caused when a storm drain pipe that runs underneath the 27-acre containment pond sprung a leak and allowed 82,000 tons of ash mixed 27 million gallons to flow into the river. Witnesses described gray sludge two inches thick coating the riverbank for more than two miles.²² As a result of spills like this, the EPA signed the Disposal of Coal Combustion Residuals from Electric Utilities final rule on December 19, 2014, establishing nationally applicable minimum criteria for the safe disposal of CCR in landfills and surface impoundments.²³



Coal-burning power plants are the largest human-caused source of mercury emissions to the air in the United States, accounting for over 50 percent of all domestic human-caused mercury emissions. Mercury pollution has contaminated 17 million acres of lakes, estuaries, and wetlands in the U.S., and 1.2 million river miles.²⁴ All 50 states have issued warnings regarding mercury contamination in seafood. The EPA has created new standards as of May 2013 but these new standards affect only new coal- and oil-fired power plants that will be built in the future. The update does not change the final emission limits or other requirements for existing power plants.²⁵

Some coal is extracted through **mountain removal mining** a radical technique that involves shaving off up to 1,000 vertical feet of mountain peak – including ancient forests – to expose thin, but highly prized, seams of coal. Scientists argue that some of the oldest, most diverse forests in North America have been destroyed, along with 1,500 miles of Appalachian headwater streams.²⁶ Nearly 1.2 million acres of land has been surface mined for coal and more than 500 mountains across Kentucky, West Virginia, Virginia, and Tennessee have been severely impacted or destroyed by mountaintop removal coal mining. In some counties, such as Wise County, Va., surface mining has impacted nearly 40 percent of the land.²⁷

Although California is not a major producer of coal, as of 2014, Los Angeles was still getting 40% of its electricity from coal. In 2015, the city's Department of Water and Power, reduced its coal-generated power by 25% with the completed divestiture from the Navajo Generating Station. This not only directly impacts the communities adjacent to coal mines and plants, but also the entire planet in the form of CO2 emissions. Los Angeles will become the biggest U.S. city to abandon coal-fueled electricity by 2025 after the utility said it will support renewable sources, boost energy efficiency and build a new natural-gas fired plant.²⁸

NATURAL GAS

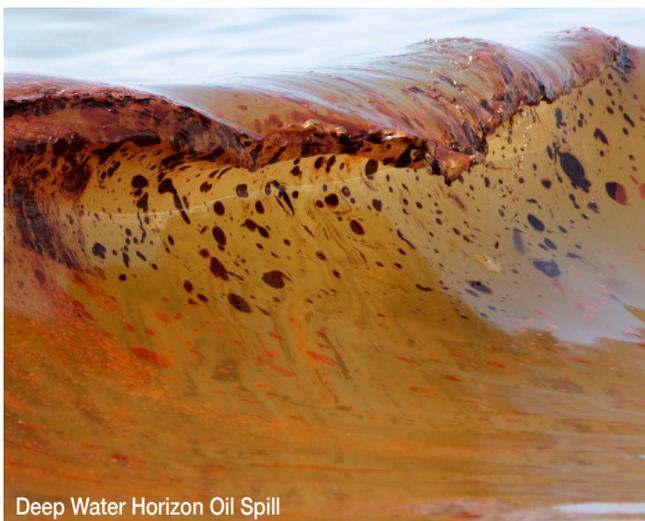
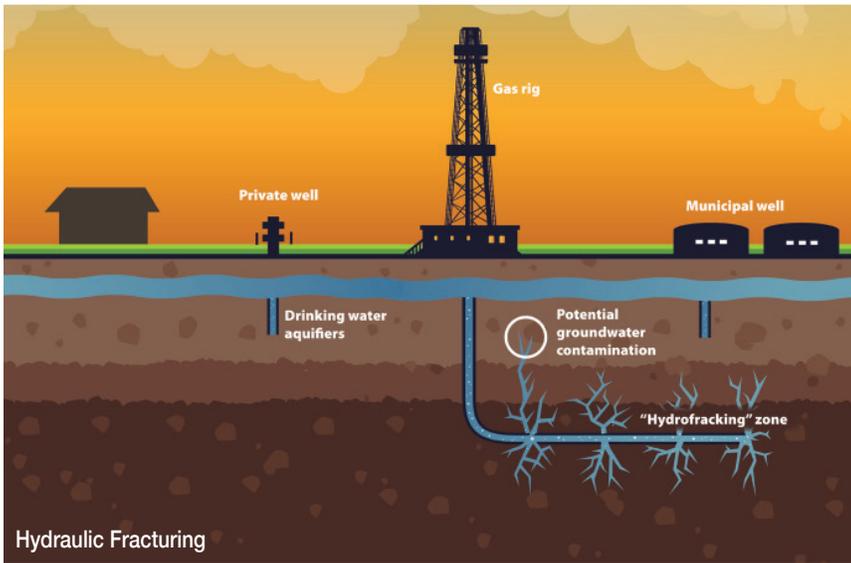
Hyddraulic fracturing or 'fracking' is a controversial drilling method used to extract natural gas from deposits deep below the Earth's surface. A mixture of toxic chemicals, sand and a tremendous amount of water is injected under high pressure into dense rock formations in order to crack the rock and release the natural gas. Accidents and leaks of this toxic mixture have polluted rivers, streams and drinking water supplies across the United States. Fracking is currently exempt from federal water and environmental protection regulations, and the rapid expansion of this new form of drilling is causing widespread environmental degradation.²⁹ Although many government and fossil fuel industry sources consider natural gas a "clean" energy option, increasing evidence



"Fracking" contaminated water

is showing that methane is leaking at at least twice the rate reported by the fracking industry.³⁰ This process is also associated with a rise in earthquakes near fracking operations: "Scientists from the US Geological Survey recently released a study saying the six-fold increase in earthquakes felt in Colorado, Oklahoma and Arkansas since the inception of drilling in the areas was 'almost certainly manmade.'"³¹ Los Angeles is not immune from the immediate dangers of fracking; in 2011, the Inglewood Oil Field in Culver City settled with residents after a toxic release of fumes forced citizens from their homes five years earlier. Given the link between fracking and earthquakes, the fact that the Inglewood site sits atop the Newport-Inglewood fault line, capable of a 7.4 magnitude earthquake, is downright chilling. As of October 2020, Culver City passed a resolution to slow drilling over the next five years.³²





OIL

The worst man made disaster in U.S. history came from the pursuit of oil. The BP Deepwater Horizon spill of 2010 is just one example of dozens of devastating outcomes of oil production. Lesser known is the phenomenon of tar sands, which are a combination of clay, sand, water, and bitumen (a heavy black half solid, half liquid oil). **Tar sands** can be mined and processed to extract the oil-rich bitumen, which is then refined into oil. The bitumen in tar sands cannot be pumped from the ground in its natural state; instead tar sand deposits are mined, usually using strip mining or open pit techniques, or the oil is extracted by underground heating. To produce one barrel of oil from surface mining, up to two tonnes of tar sands must be moved depending on the location, two to five barrels of water used and an estimated 35 kg of carbon dioxide are emitted.³³ “Tar sands-derived fuels cause 17% more greenhouse gas emissions than conventionally sourced-fuels over their full life-cycle from extraction through burning”³⁴ The only large-scale producer of oil from tar sands, Canada, supplies the U.S. with approximately 20% of our crude oil, much of which comes from tar sand refining.³⁵ Utah has tar sand reserves capable of producing an estimated 180 million barrels of oil³⁶ Oil production from tar sands has been called “the most destructive project on earth.”³⁷

Action Items

What the City of Santa Monica is Doing:

Reducing Emissions and Adapting to Climate Change

The challenge of climate change is not new, and addressing it has long been a priority for our community. For 25 years, Santa Monica's Sustainable City Plan has guided programs and policies that enhance our resources, prevent harm to the natural environment and human health, and improve the social and economic well-being of the community for the sake of current and future generations. Emission-reducing programs and policies have also been included in various plans and initiatives across the City, including the Urban Forest Master Plan, Bike Action Plan, Water Self Sufficiency Plan, EV Action Plan, Zero Waste Strategic Plan and the Land Use and Circulation Element of the General Plan. Early action is required to avoid significant cost and social and environmental risks to our community.

The Plan provides a roadmap to advance the goals across programmatic and departmental lines. In many cases, the actions described also require new community and regional partnerships to develop and test new strategies that will build on Santa Monica's leadership role in sustainability and innovation. These key actions identify what can be accomplished within the next decade to continue progress toward the goal of achieving carbon neutrality by 2050 or sooner.

STATE POLICIES 50% of total reductions

- Renewable Portfolio Standard
- Low Carbon Fuel Standard
- Building Energy Standards

ZERO NET CARBON BUILDINGS 21% of total reductions

- Achieve 100% renewable grid electricity
- Install 100 MW of local solar energy
- Reduce fossil fuel use 20% in existing buildings
- Discourage fossil fuels in new buildings

ZERO WASTE 3% of total reductions

- Divert 95% of materials from landfills

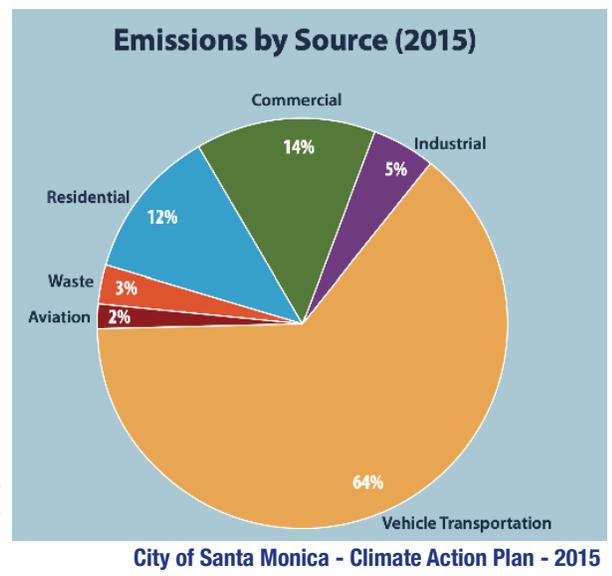
SUSTAINABLE MOBILITY 26% of total reductions

- Convert 50% of local trips to foot, bike, scooter & skateboard
- Convert 25% of commuter trips to transit
- Convert 50% of vehicles to electric or zero emission

The Plan lays out a framework for enhancing Santa Monica's resilience to climate change through four sectors. The Plan identifies areas in local government, community building and support to augment by including climate change considerations and adaptation measures.

CLIMATE READY COMMUNITY

- Increase community resilience to climate change
- Protect vulnerable groups from impacts Integrate climate change impacts into City planning, operations & infrastructure projects.



COASTAL FLOODING PREPAREDNESS

- Enhance natural systems to prevent damage from coastal flooding Increase resilience of public and private assets in coastal flood zone

LOW CARBON FOOD & ECOSYSTEMS

- Increase self-reliance through local food production
- Reduce or sequester carbon emissions from food production, consumption, waste and landscape management and natural processes

WATER SELF-SUFFICIENCY

- Achieve water self-sufficiency by 2023

DO YOU EVER...

- * WALK OUT OF A ROOM AND LEAVE THE LIGHTS ON?
- * USE INCANDESCENT LIGHT BULBS?
- * BUY APPLIANCES REGARDLESS OF THEIR ENERGY EFFICIENCY?
- * TURN ON THE HEAT INSTEAD OF PUTTING ON A SWEATER?
- * LEAVE YOUR COMPUTER OR OTHER APPLIANCES ON WHEN YOU LEAVE THE HOUSE?

NOW YOU CAN...

1. REPLACE YOUR INCANDESCENT BULBS WITH MORE ENERGY EFFICIENT LEDS.

Lighting accounts for about 12% of home electricity use. By installing **Light Emitting Diodes** (LEDs), your home will consume less energy, emit less carbon dioxide, and reduce mercury emissions. You will also save money on your monthly energy bill.

- * LEDs use 80% less energy and last 25 longer
- * LEDs Use 3-13 watts to replace a 75-100 watt incandescent bulb.³⁸
- * LED's Last upwards of 50,000 hours. That's 8 hours a day for ten years!³⁹

In 2017, the City of Santa Monica retrofitted over 1,200 streetlights with LED lights. The project saves an annual 755,000 kWh and \$38,000 in utility costs.⁴⁰

Download the free mobile phone app Light bulb Finder to get information on switching from conventional light bulbs to energy-saving equivalents with the right fit, style and light quality: lightbulbfinder.net.

2. INCREASE THE ENERGY EFFICIENCY OF YOUR APPLIANCES.

"Every step you take to reduce electricity use in your home has up to three times the impact that you might imagine For every unit of electricity that you use in your home, as many as three units of primary energy are consumed by the power system."⁴¹

-  Upgrade to new, more energy efficient appliances.
 - * When purchasing a new appliance, look for the **Energy Star** label to make the most energy efficient choice.

Rebates available through SCE, SoCalGas and SoCalWaterSmart

-  Lower the temperature setting on your water heater.
 - * Turn down your water heater down to 120°F degrees. For every 10° reduction, you save from 3-5% on energy costs. This also slows mineral buildup and corrosion in your water heater and pipes, helping your water heater last longer and operate at its maximum efficiency.



INSTRUCTIONS FOR CLEANING UP A BROKEN CFL:

When handled correctly, the very small amount of mercury contained in CFL bulbs poses little risk. However, if a CFL breaks in your home you should follow these steps carefully to minimize risks to you and your family:

1. Have people and pets leave the room, and avoid the breakage area on the way out.
2. Open a window or door to the outdoors and leave the room for 5-10 minutes.
3. Shut off the central forced-air heating/air conditioning system, if you have one.
4. DO NOT VACUUM! Carefully scoop up glass fragments and powder using stiff paper or cardboard and place debris and paper/cardboard in a glass jar with a metal lid. If a glass jar is not available, use a sealable plastic bag. (NOTE: Since a plastic bag will not prevent the mercury vapor from escaping, remove the plastic bag(s) from the home after cleanup.)
5. Use sticky tape, such as duct tape, to pick up any remaining small glass fragments and powder. Place the used tape in the glass jar or plastic bag.
6. Wipe the area clean with damp paper towels or disposable wet wipes. Place the towels in the glass jar or plastic bag.
7. Wash your hands.
8. Keep the forced-air heating/air conditioning off and continue to air out the room for several

□ Adjust your refrigerator temperature, and perform regular maintenance.

- * Your refrigerator functions most efficiently between 38° to 41°F, while the freezer works best at 0° to 5°F. Keeping them cooler than this unnecessarily raises your energy bills.
- * Clean the refrigerator coils on its back or bottom-front. Dirty coils make your fridge work harder than necessary, making it more expensive to run and shortening its lifespan. Check and vacuum them at least twice a year, and make sure airflow reaches the coils unobstructed. A 4" gap at the top or side of the refrigerator is sufficient space.
- * Check refrigerator for leaks. Close the door on the middle of a crisp dollar bill, and then slowly pull the bill out. There should be a slight friction and a squeaky sound. If there's no resistance, the door may need adjusting or the seal may need replacing.
- * Refrigerators older than 10 years should be replaced. For rebate info visit www.sce.com. Fridge recycling is also available through SCE. For refrigerator pick up visit www.sce.com/pickup
- * Find out how much your old refrigerator or freezer costs to operate and how much you can save by flipping it to Energy Star.

For more information visit: www.energystar.gov/flipyourfridge

- * Don't use a 2nd refrigerator in your garage
- * Keep your freezer well stocked. A filled freezer cools more efficiently.

To find out how much your old refrigerator is costing you, visit energystar.gov/index.cfm?fuseaction=refrig.calculator. When entering the model number you may need to drop off the last few letters or numbers until the calculator finds a match. You can also use the age, size, and type of refrigerator if you can't find the model number.



□ Use your dishwasher, washing machine, and dryer wisely.

- * Washing a full load of dishes in the dishwasher actually uses less water and energy than washing them in the sink. Use the short cycle to clean the dishes in a dishwasher. Turn off the dishwasher before the drying cycle, open the door and let the dishes air dry naturally for extra energy savings.
- * By using cold water to wash your clothing, you can save about 90% of the energy consumed as compared to hot water washing.⁴² Plus, your clothes will last longer.
- * Line-dry items whenever possible. You can save \$60 and 1150 lbs of CO2 from entering the atmosphere by line drying you clothes just six months out of the year. That is equal to the work of 23 trees.⁴³ The savings double if you do it year round!
- * Clean the lint filter before each load. If lint is allowed to collect, drying time and energy consumption increase. Dry full laundry loads, but be careful not to overload the dryer. Overdrying clothes wastes energy and sets wrinkles. By drying continuously when doing laundry, you waste less energy by not allowing the dryer to cool.
- * Finally, dryer balls are a simple step to help dry clothes faster and reduce need



for fabric softener, which can have chemicals like phthalates and formaldehyde.

3. PAY ATTENTION TO HEATING AND COOLING IN YOUR HOME.

- ❑ Clean your heater and air conditioner filters throughout the year.
 - * Check your heater or air conditioner filters every month and clean or replace them at least every few months. Energy loss and energy costs can be due to clogged filters keeping the air from circulating freely.
- ❑ Monitor your thermostat.
 - * Set the furnace thermostat at 68 degrees or lower in winter, and keep the air-conditioner thermostat at 78 degrees or higher in summer. Visit the Support Tools to find out the kWh used by all your household appliances, including the air conditioner.
- ❑ Participate in SCE's Summer Discount Plan
 - * When you participate in the Summer Discount Plan, you save by voluntarily allowing SCE to shut down your A/C for up to 6 hours a day during "energy events" periods of high electricity demand, or emergencies. SCE supply and install a device on your home or central-A/C unit to remotely shut it off during energy events. You can choose your level of participation from 4 options

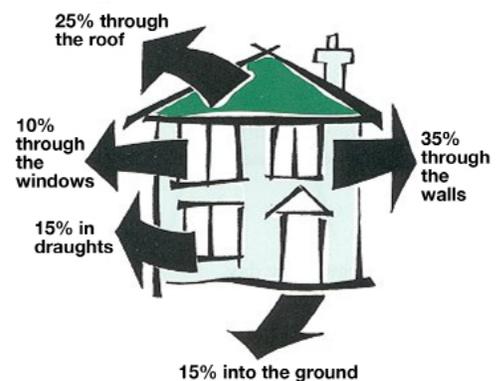
For more information visit: sce.com and type 'Summer Discount Plan' into the search bar.
- ❑ Use window treatments to regulate the temperature in your home or office.
 - * During the winter, allow sunlight through all your south and west facing windows to warm the rooms. In the summer, keep shades and curtains drawn to keep the heat of the sun out.
- ❑ Use a fan. The use of a household fan can "take the edge off" an overly warm home and keep you from running the costly compressor motor of the air conditioner. When you leave the house, open the window and let in fresh air instead of turning on your AC.
- ❑ Use electric space heaters sparingly, if at all. Electricity uses up to three times the source energy at a power plant over the energy of natural gas used at a home for heating purposes.
- ❑ Turn off the pilot light on wall furnaces during warmer months (have the gas company do it for free).

4. MAKE YOUR HOME MORE ENERGY EFFICIENT THROUGH RETROFITS.

- ❑ Find out what incentives your state offers for renewable energy and efficiency by visiting www.dsireusa.org. Energy Upgrade California offers homeowners rebates and incentives for home energy improvements, made by participating contractors.

Property-Assessed Clean Energy (PACE) can help you finance thousands of energy and water efficiency products with no money down! This financing solution is helping lower utility bills, reduce carbon emissions and create new jobs every day. For a list of PACE providers, please visit www.sustainablesm.org/energy

- ❑ Take the following steps around your home:
 - * Add insulation to walls and attic, caulk leaking doors and windows, or go the next step and replace older windows with energy efficient windows. You can also wrap your water heater in an insulating **hot water heater blanket** and your pipes with **insulating pipe wrap**. Actions that reduce up to 400 lbs. of CO2 annually save about 5% in water heating costs.⁴⁴ WATTZOn, wattzon.com, has even more valuable information, tools, and guidance on how to conserve energy, save money, and reduce your carbon footprint.



- ❑ Take Advantage of Rebates through SCE's Quality Maintenance Program (QM):

- * More efficiency means more savings. Lower your electric bill by saving energy, improve the air quality in your home, and make sure your A/C is in top working order through Southern California Edison's Quality Maintenance Program. They offer two ways to save with this energy efficiency program

For more information visit: www.hvacoptimization.com/programs/quality-maintenance

For a list of contractors in your area visit: www.hvacoptimization.com/contractors

5. CHANGE YOUR BEHAVIOR.

☐ Turn off lights when you leave rooms.

- * In almost all cases it is best to turn off lights if leaving a room for more than a couple minutes. Not only will you save energy, your light bulbs will last longer.

☐ Put on a sweater instead of turning up the heater.

- * The common sense measure of adding or subtracting layers to maintain comfort is often overlooked, and has substantial energy savings.

☐ In general, unplug unused appliances and mobile devices and use a power strip.

- * Switching off your TV and other household electronics does not really stop the power drain, it just places the devices on standby, ready to spring to life. The amount of electricity these devices devour while napping is staggering. Studies have found DVD players draw 93% of their total power usage while inactive.⁴⁵ The federal government does not require manufacturers to label standby power usage on their appliances, but there is a website listing devices that draw less than 1 watt of standby power standby.lbl.gov/.

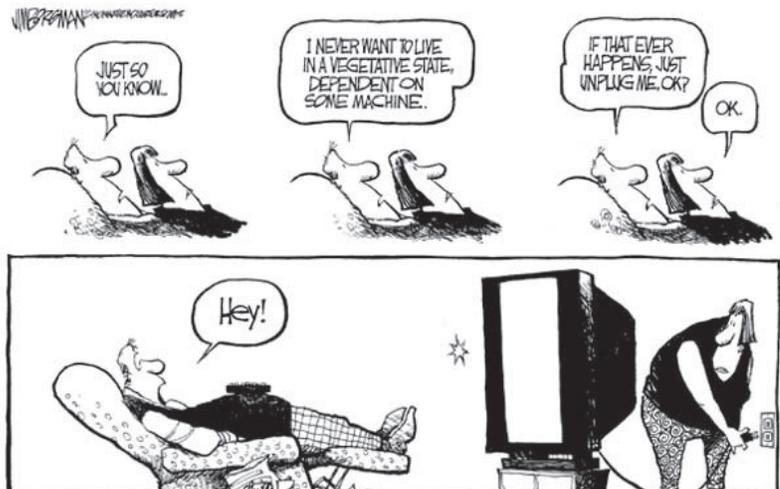
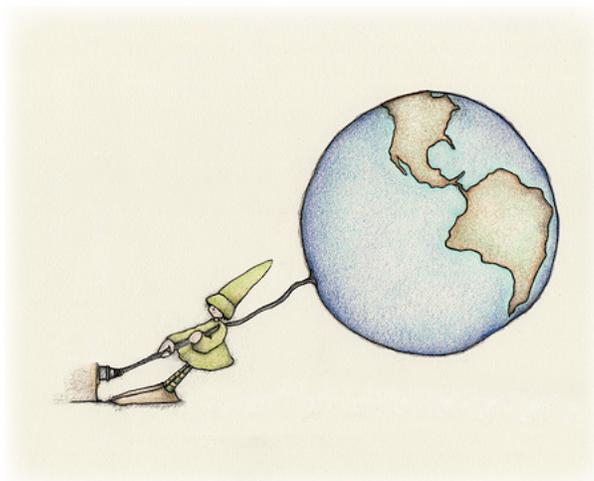
- * Participate in SCE's Time-Of-Use Plan. Through this plan you can take advantage of lower rates during certain times or days. Currently there are three Time-Of-Use Programs to choose from.

For more information visit: sce.com and type 'Time-Of-Use Rate Plans' into the search bar.



☐ Set your computer to automatically go into sleep mode when it isn't in use.

- * This reduces energy consumption by up to 70 percent. If everyone did this, the EPA estimates, we could save enough electricity each year to power Vermont, New Hampshire, and Maine; cut electric bills by \$2 billion; and reduce carbon dioxide emissions by the equivalent of 5 million cars.⁴⁶



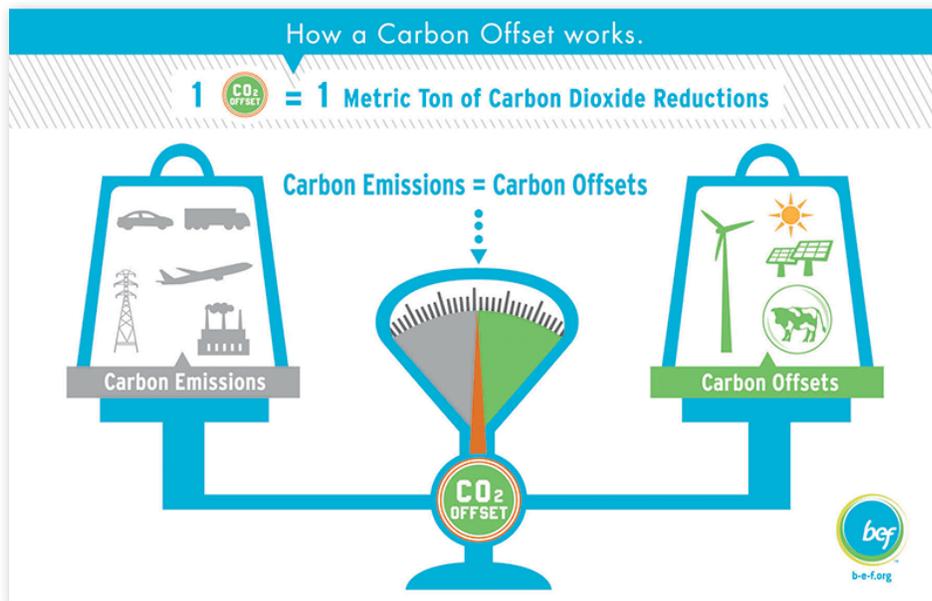
6. PURCHASE GREEN POWER CREDITS TO OFFSET CARBON-BASED POWER.

Purchasing renewable energy for your electricity needs can significantly reduce your carbon footprint.

In 2019, 29 cities and the counties of Los Angeles and Ventura made the switch to the Clean Power Alliance of Southern California (CPA) for their electricity needs. CPA buys and sells electricity from renewable energy sources, which is transmitted to customers through SCE's transmission and distribution grid.

Customers can choose between three tiers of renewable and carbon-free energy:

- * 100% Green Power – sourced exclusively from solar and wind power sources
- * 50% Clean Power – sourced from solar, wind and hydroelectric power sources
- * 36% Lean Power – sourced from solar, wind and hydroelectric power sources



- * To learn more about CPA and your options, visit cleanpoweralliance.org.

7. PLANT TREES TO PROVIDE SHADE AND COOLING.

Use trees, awnings, and overhangs to provide shade around the outside of your home.

- * This is especially effective on the south and west sides, where the summer heat gain is greatest. Well-placed deciduous trees and shrubs increase the value of your home, improve its appearance, and cut your energy bills. Plus, they remove CO₂ from the atmosphere! Make sure you get the right tree for the right place, one that will provide adequate shade while not interfering with overhead wires or underground pipes, and one that is appropriate for your watershed (a low maintenance, drought tolerant native tree is best). If you are planning to install a solar energy system, choose wisely: too tall of a tree may shade the panels and reduce its production efficiency. Shade trees on the west and south sides of a house in a hot part of California can reduce a homeowner's summertime electric bill by about \$25 a year.⁴⁷ For more information, call the LADWP and ask for a copy of "The Los Angeles Home Tree Guide."

8. INSTALL AN ALTERNATIVE-TYPE WATER HEATER.

Why upgrade to a new water heater?

- * Water heating is the second-largest energy expenditure in most households.
- * On demand water heaters can be 24%–34% more energy efficient than conventional storage tank water heaters. ENERGY STAR® estimates that a typical family can save \$100 or more per year with an ENERGY STAR qualified tankless water heater.⁵⁷ For information on water heater types, criteria for selection, a source list, reading list and related websites check out: <http://energy.gov>.

gov/energysaver/water-heating

Below is a short description of several options available to you.

Tankless water heaters.

- * These water heaters instantly heat water as it flows through the device, and do not retain any water internally except for what is in the heat exchanger coil. These versions are not recommended for large families or high volume use sinks or showers.

Heat pump water heaters.

- * Heat pump water heater (HPWH) technology uses electricity to move heat from one place to another instead of generating heat directly. To understand the concept of heat pumps, imagine a refrigerator working in reverse. While a refrigerator removes heat from an enclosed box and expels that heat to the surrounding air, a HPWH takes the heat from surrounding air and transfers it to water in an enclosed tank.

Gas condensing water heaters.

- * These heaters utilize an enhanced design to cut water heating expenses by about 30%, while also delivering superior performance. They are 95% efficient. They work much like regular gas water heaters: a large, insulated tank of water is heated by a gas burner.

Solar water heaters.

- * Sunshine is free, imagine using it to heat your water! ENERGY STAR qualified solar water heaters can cut your water heating bills in half and reduce your carbon footprint.



This house is in Golden, CO features a solar water heating system.

9. BUY OR LEASE SOLAR PHOTOVOLTAIC (PV) PANELS FOR YOUR HOME.

“0.6 percent of America’s total land area or 1,948 square feet per person” is all the land we’d need to power all of US on solar power.⁴⁵

If in Santa Monica, check out the City program called Solar Santa Monica solarsantamonica.org. There you will learn about the available State rebates and the Federal tax incentives.

- * Southern California Edison incentives on web site California solar Initiative <https://www.sce.com/gosolar>
- * PACE financing is available for solar.

10. GET ACTIVE!

“Citizens and their governments hold tremendous power to change our patterns of consumption and support sustainable ways of using energy resources...By encouraging energy efficiency and clean, renewable or efficient energy supply strategies, communities foster local self-reliance and economic diversification. This is not science fiction – these are “off-the-shelf” technologies and techniques that are available today. All that is required is public and political will.”⁴⁶

Volunteer opportunities:

- * Coalition for Clean Air
- * Clean Air Now
- * Climate Action Santa Monica
- * Grid Alternatives – become part of a volunteer team that installs a photovoltaic system in a low income residence!
- * Sustainable Works
- * Solar Santa Monica

Write to a local institution or your favorite business and ask them to consider solar photovoltaic for their building.



- ☐ Encourage your city or state to purchase green energy – Santa Monica was the first city in the nation to do this; tell others to follow their lead!

- ☐ Participate in the following thematic events:
 - * Earth Day – April 22nd
 - * Earth Hour - Worldwide, annually towards the end of March
 - * National Arbor Day – Last Friday in April
 - * National Energy Awareness Month – October
 - * Summer Solstice – longest day of the year (leave that light off!)
 - * Zero Emissions Day - September 21st

- ☐ Attend Santa Monica's AltCar and AltBuild Expositions.

- ☐ Consider a Green Job, or find ways to make your current job more sustainable.



GREEN JOBS – ENERGY

ENERGY EFFICIENCY

- * **Energy Conservation Representative** – Inspects homes of utility customers to identify conditions that cause energy waste and suggests actions to reduce waste. A HS diploma or GED is a minimum education requirement. As more standards are adopted the demand for Energy Conservation Reps will greatly increase. Salaries range from \$20 - \$32 an hour.
- * **Energy Efficiency Finance Manager** – Project-management role in energy efficiency projects and policies, also conducts relevant market analysis and research. Employers will look for a Bachelor's degree in Accounting, Finance or Business Administration. Areas of recommended college course work include Economics, Environmental Studies, Public Policy, Finance and Accounting. There is huge potential for growth as the energy efficiency sector expands. Estimated salary is \$90,000/year.
- * **Climate Action Planner** - Conduct analysis on greenhouse gas emission sources, develop cross-cutting policies, plans and projects to reduce ghg, engage the public to educate and encourage low-carbon lifestyles



RENEWABLE ENERGY

Solar Power and Photovoltaic (PV) Systems

- * **Solar Installer** – The demand for solar energy is increasing, fast. Consequently, there is an influx of job opportunities to mount and electrically wire solar panels for both residential and commercial use. Excellent candidates include those with a background in the plumbing, electric and construction fields and an interest in solar energy. An Associate's Degree, Trade School or Apprenticeship is desired.
- * **Solar Energy Engineer** – Perform site-specific engineering analysis and evaluation of energy efficiency and solar projects involving residential, commercial and industrial customers by utilizing building simulation software. Minimum education requirement is a Bachelor's Degree in Engineering. Certification as a Professional Engineer, Engineer-in-training and/or Certified Energy Manager is desired. In 2013, California ranked 1st in the country in installed solar capacity. A salary of about \$90,000/year can be expected.
 - Visit findsolar.com to find information on and to contact employers in the solar field.



Wind Power

- * **Wind Farm Technician** – Wind energy technology is a lucratively emerging field with many opportunities for positions operating and maintaining wind farms and wind related facilities. Predominantly, wind farm technicians implement operating procedures and conduct operational duties, ensuring performance efficiency and compliance with all legal regulatory requirements. You'll need an Associate's degree in engineering or related science plus 2 to 8 years' experience in power operation, transmission, or substation electrical systems, preferably specific to wind energy.
- * **Wind Resource Analyst** – This type of job will have you outside making site visits to determine terrain, roughness, and obstructions for potential wind farms. You'll produce and analyze meteorological data, conduct modeling studies, estimate wind project output, and produce final layouts using software.

Employers want to see a minimum of a bachelor's degree in physical science, atmospheric sciences, engineering, or physics. Some employers may require a master's degree.

- Visit windturbine technicians.com for more information on pursuing a career in wind technology.



Hydro-Electric Power

- * **Hydro-Electric Component Machinist** – Make precision metal or plastic parts, use computer numerically controlled machine tools and set up and operate all of the basic machine tools for hydro-electric power generation. Completion of Trade school or apprenticeship is a minimum requirement with recommended college course work in metal working, drafting, Math and computer courses. The Economic Development Department projects 3,500 new machinist jobs on California by 2016. Salaries range from \$12 -\$21 an hour.
- * **Hydro-Electric Electrical Engineer** – Responsible for design, development and testing of all aspects of electrical components and equipment of hydro-electric power generation facilities. A bachelor's degree in electrical engineering is required. Five years of job experience is needed. Jobs in this field can be found in private firms, government, power plants and power facilities. There is great potential for job growth in this field. You can expect to earn about \$90,000 or more/year.
 - Visit hydro.org/ for more information on hydro-electric power and jobs.



Geothermal Power

- * **Geothermal Plant Efficiency Operator** – Responsible for maintaining and monitoring plant equipment for efficient and safe plant operations and planning and handling all hazardous materials and wastes in a safe and environmentally friendly manner. HS Diploma or GED is a minimum requirement as well as Hazmat certification. As efficiency becomes a concern of more and more businesses this position will see tremendous growth. Salaries can be expected to range from \$26 to \$30/hr.
- * **Geothermal Operations Engineer** – Collects and processes information on well-field and plant performance, diagnoses well problems and designs procedures to fix them. Employers will look for a bachelor's degree or higher in engineering. Areas of recommended college course work include Resource/Petroleum Engineering and computer programming. The Geothermal industry is expected to have higher growth rate than some other renewable power sectors. You can expect to earn \$70,000 to \$80,000/year.
 - Visit geo-energy.org/ for more information on geothermal energy and jobs.



Biomass Power

- * **Biomass Collection, Separation and Sorting** – Collects, hauls, sorts and processes biomass waste for distribution to biomass facilities. A HS Diploma or GED is required as well as a commercial driver's license. Recommended College course work includes Resource/Engineering and computer programming. The Economic Development Department projects 1,000 new materials collection jobs by 2016. You can expect to earn between \$9 and \$14/ hr.
- * **Bioenergy Process Engineer** - Aspiring engineers should look into a career in Biomass technology upon completion of their master's degree in engineering and professional license. Bioenergy Engineers will be crucial to the development of crop residues into composites for alternative fuel. Due to abundant funding, there are many opportunities for careers in bioenergy.
 - The National Association of Wheat Growers (NAWG) and the National Corn Growers Association (NCGA) provide ingresses toward a career in bioenergy.
 - Visit wheatworld.org or ncga.com for more information.
 - For more information on Biomass power visit usabiomass.org/.



Additional Green Jobs related to Energy

- * Climate Change Adaptation and Climate Studies
 - Climatologist
 - Greenhouse Gas Emissions Permitting Consultant
- * Carbon Markets Trading
 - Carbon Emissions Specialist
 - Economist

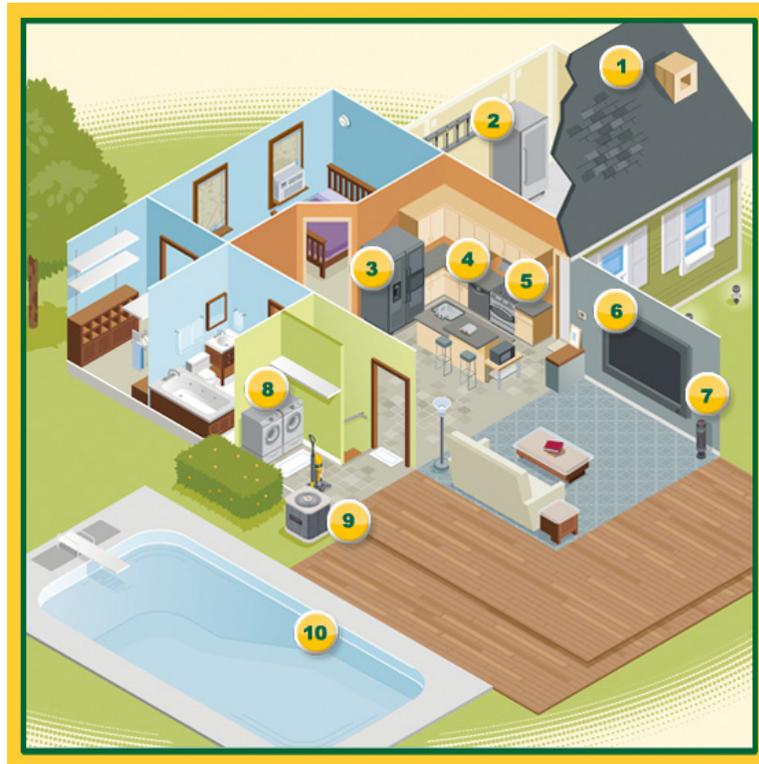
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SUPPORT TOOLS



Top 10 Energy Guzzlers



#1 Evaporative Cooler

#2 Freezer

#3 Refrigerator

#4 Dishwasher

#5 Electric Stove

#6 Flat Screen TV

#7 Portable Heater

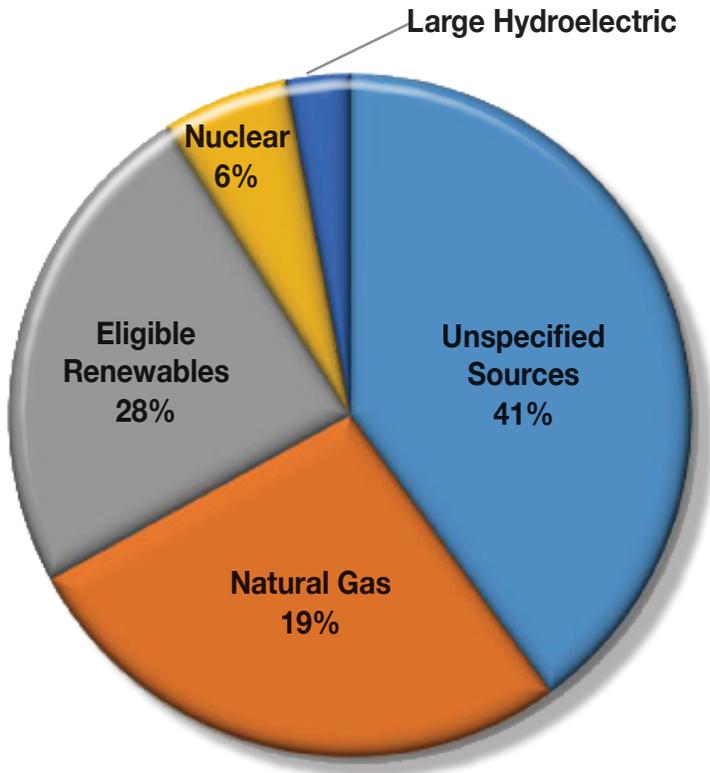
#8 Clothes Dryer

#9 Central Air Conditioner

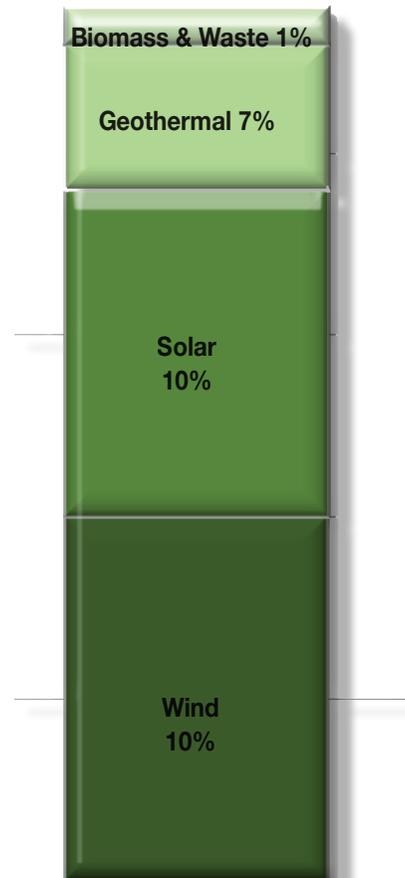
#10 Pool Pump

2016 Power Sources

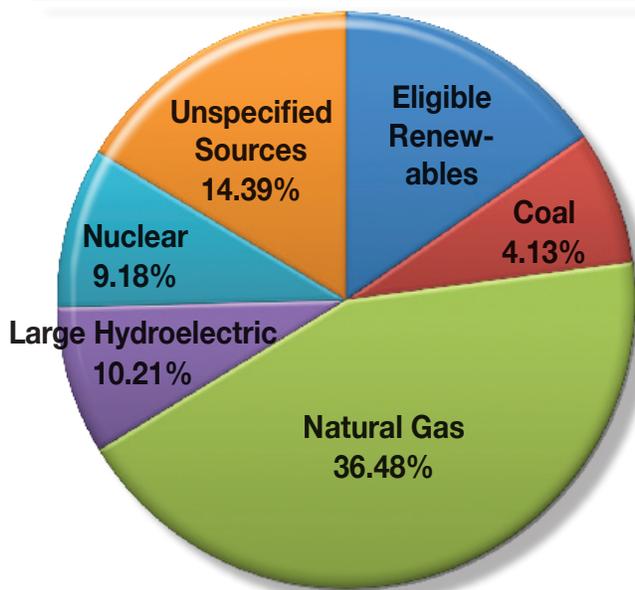
SOUTHERN CALIFORNIA EDISON



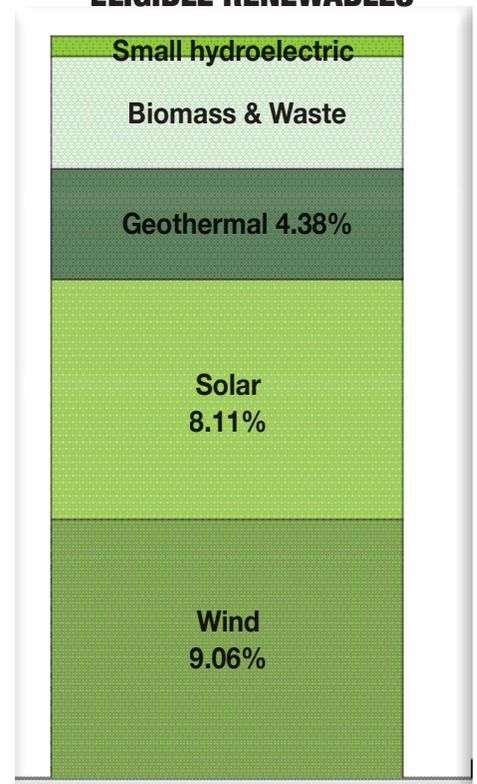
ELIGIBLE RENEWABLES



CALIFORNIA



ELIGIBLE RENEWABLES



NOTES

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Renewable Energies: Pros and Cons

| | PROS | CONS |
|------------|--|---|
| Solar | <ul style="list-style-type: none"> • Zero emissions during operation • Completely quiet • Ability to create electricity in remote locations that are not linked to a national grid • A way to lock in energy prices since utility rates are constantly rising • Federal, state, and utility tax incentives and/or rebates make solar more affordable • Roof top solar makes use of wasted space without habitat disruption | <ul style="list-style-type: none"> • Initial cost may be high • Energy is only generated during daylight and on sunny days • Considerable amount of space is needed for large installations. Causes disruption of desert habitat for utility scale installations. |
| Wind | <ul style="list-style-type: none"> • Does not produce any pollution • One of the cheapest forms of energy available today • Power failures are close to non-existent in locations that rely on wind power • A renewable source of energy as long as wind is present | <ul style="list-style-type: none"> • Energy generation is heavily dependent on the weather • Wind turbines are a constant source of noise pollution • Wind turbines get damaged during thunderstorms • Wind turbines cause problems with local television reception and can harm birds. |
| Geothermal | <ul style="list-style-type: none"> • Geothermal energy operates virtually emission free • Geothermal vents even offset sulfur emissions that would have naturally occurred • Geothermal plants are inexpensive to operate • Has the smallest land-use requirement of major power generation technology | <ul style="list-style-type: none"> • Only specific regions have access to geothermal energy • Start-up costs are considerable and the process can get quite complicated • It is uncertain if current and future sites of geothermal energy production will be consistent sources of heat |

| | PROS | CONS |
|---------|--|--|
| Nuclear | <ul style="list-style-type: none"> • Nuclear power generation emits low amounts of CO2 • Use of nuclear energy could offset over 700 million metric tons of CO2 per year • Nuclear waste can be recycled and refinded, allowing for reuse and further energy production • The Nuclear Energy Agency estimates that fuel supplies can last for over 200 years | <ul style="list-style-type: none"> • Even with recycling and reuse, the problem of disposing of radioactive waste remains unsolved • Catastrophic accidents can happen and it is impossible to build a plant that is 100% secure • Nuclear power plants take considerable planning and require 10-20 years of prep time before construction begins • The energy needed to build nuclear plants, operate them, and mine and process the uranium can be so large as to cause a net energy loss |
| Hydro | <ul style="list-style-type: none"> • Hydropower is cost-effective after the initial expense of constructing the dam is overcome • Simpler dam designs result in low maintenance and repair costs • Since water is not lost or destroyed when going through the dam, hydropower is a renewable energy source | <ul style="list-style-type: none"> • Projects can damage ecosystems, such as salmon migration, hurt biological diversity, or worsen water quality. They can also cause socio-economic damage by moving local inhabitants • Hydroelectric dams are extremely expensive to construct • Potential for massive damage is quite high if the dam breaks • Man-made reservoirs convert CO2 in the atmosphere into methane. Methane's effect on global warming is 21 times stronger than carbon dioxide. |
| Biomass | <ul style="list-style-type: none"> • Due to recent advancements such as the use of switch grass instead of corn, energy yields from biomass have significantly improved • The majority of scientists believe that we are receiving a positive energy return from biomass • Otherwise unproductive land can be used to create fuel from growing switch grass • Forest and agricultural waste can be used as fuel instead of being burned. | <ul style="list-style-type: none"> • Has a lower energy content than to gasoline • Corn based ethanol, which has been shown to be ineffective and carbon intensive, is still heavily subsidized in the United States. • Biomass requires both water and land to grow. With increased level of production, more water and land will be required. |

<http://www.triplepundit.com/topic/energy-options-pros-and-cons/>

GLOSSARY OF KEY TERMS

Anthropogenic: Caused or produced by humans.

Carbon Dioxide is a greenhouse gas that contributes to global warming CO₂. A colorless, odorless, non-toxic, noncombustible gas that is slightly more than 1.5 times as dense as air; becomes a solid (dry ice) below -78.5°C. It is present in the atmosphere as a result of the decay of organic material and the respiration of living organisms, and it represents about 0.033% of the air. Carbon dioxide is produced by the burning of wood, coal, coke, oil, natural gas, or other fuels containing carbon, by the action of an acid on a carbonate mineral, or naturally from springs and wells.

Compact Fluorescent Light (CFL) Bulb Basics: a compact fluorescent light bulb is a small-diameter fluorescent lamp, folded for compactness. A round adapter allows it to screw into common electrical sockets, making it an ideal replacement for incandescent bulbs. The adapter is actually a ballast which starts the lamp and maintains its operation. Therefore the lamp and ballast are two components of the compact fluorescent system. There are several reasons for using compact fluorescent lamps:

- * Energy Savings - By using a compact fluorescent lamp, you can save 75 percent of the energy that standard incandescent bulbs require. A 15 to 18-watt compact fluorescent system can supply the same amount of light as a 60-watt incandescent lamp.
- * Quality of Light - The quality of light produced by a compact fluorescent is comparable to that of the incandescent lamp. It ranges from cool white to warm. And there is no flicker or hum - the annoying characteristics that are generally associated with fluorescent lamps.
- * Lifetime - The lamps last nine to thirteen times longer than standard incandescent bulbs.
- * Applications - Compact fluorescents can replace the two common types of incandescent lamps: the pear-shaped bulb and the flood lamp. Various wattages are available, comparable in light output to 25, 40, 60, 75 and 100-watt incandescent bulbs.
- * Cost - A compact fluorescent system usually costs between \$10 and \$28, depending on the large range of features. (See the "Specifications" section below.) The relatively high initial cost is recovered after only one year of operation (when used 8 hours every day), and further savings are achieved over its lifetime. (NESIP)

Efficiency is the capacity to produce desired results with a minimum expenditure of energy, time and resources. (Warwick)

ENERGY STAR® labels: ENERGY STAR is the symbol on appliances indicating energy efficiency. ENERGY STAR labeled products use less energy than other products, may save you money on utility bills, and help protect the environment. Look for the ENERGY STAR label on household appliances, home electronics, and office equipment, heating and cooling equipment, windows, residential light fixtures, and other products. ENERGY STAR products are made by many major manufacturers and are widely available.

Fossil Fuels are incompletely oxidized, decayed animal and vegetable materials, specifically coal, peat, lignite, petroleum and natural gas.

Fuel Efficient is the use of fuel with minimal waste or emissions.

Green Power see renewable energy

Greenhouse Effect: The rise in temperature that the Earth experiences because certain gases in the atmosphere (water vapor, carbon dioxide, nitrous oxide and methane, among others) trap energy from the sun. Without these gases, heat would escape back into space and Earth's average temperature would be about 60 degrees colder. The greenhouse effect is a good thing and necessary to support life on earth, however, the increase of greenhouse gases in the atmosphere due to human activity is causing Earth to become too warm and is threatening life on the planet

Hot Water Heater Blanket a water heater blanket is made of insulation contained in sheet plastic so that it can be attached to the water heater. Blankets are rated based on their 'R' value just like other insulation. A blanket with R-11 is recommended. Almost all heaters have at least some minimal level of insulation to help keep the heat inside the tank. Newer models, especially those built in the last ten years, have more insulation than older models.

Hydraulic Fracturing: This process, also known as 'fracking' is a means of natural gas extraction employed in deep natural gas well drilling. Once a well is drilled, millions of gallons of water, sand and chemicals are injected, under high pressure, into a well. The pressure fractures the layers of earth and rock and opens fissures that enable natural gas to flow more freely out of the well. This process can also create openings that allow the chemicals and natural gas to reach ground water supplies, causing it to become contaminated and highly toxic to people.

Hydroelectric is the generating of electricity by conversion of the energy of running water. It is the principal source of electric power for more than 30 countries, and provides about a fifth of the world's electricity. According to the 1990 U.S. Geological Survey, the United States converted 3,290,000 gallons of water into 299,000 kilowatts per hour each day. Over 1000 hydroelectric plants provide the United States with 15% of the nation's electric generating capacity. The largest facilities are located in Washington, Oregon, California, New York and Tennessee. The Pacific Northwest alone produces 142,000 kilowatts per hour of the nation's 299,000 kilowatts per hour.

Insulation (for hot water pipes) is any material that restricts heat flow. Pipe insulation comes in different forms: closed-cell flexible foam tubes (R-3 to R-5); rigid foam (R-7); and fiberglass batts. (R-2 to R-3).

A great deal of energy and water is wasted while waiting for the hot water to reach the tap. Insulating your hot water pipes will reduce heat losses as the hot water flows to your faucet, and it will reduce standby losses when the tap is turned on more than once within

insulated.

If your home meets any of the following criteria, it is a good candidate for pipe insulation: you use water frequently throughout the day; the water pipe runs are long; or the pipes pass through an uninsulated crawl space or basement. Except for the first few feet of cold water pipe at the top of the water heater, it is only necessary to wrap hot water pipes.

KWh-Kilowatt Hour a unit of energy equal to the work done by a power of 1000 watts in one hour.

Mountain Top Removal Mining: The process of using explosives to blast away the tops of mountains to get to the thin layers of coal inside them. This process permanently destroys the ecosystem and habitat on the mountain tops. It can also threaten ecosystems and waterways in the mountain valleys because the excess rock and soil from the mountain is pushed down into the valleys below.

Ocean Acidification: The name given to ongoing decrease in the pH of the Earth's oceans, caused by the uptake of carbon dioxide (CO₂) from the atmosphere.

Positive Feedback Loop: A chain of cause and effect where a variable of a system has a feedback loop influencing its own rate of change.

Renewable Energy is energy that is replaced rapidly by natural processes (e.g. solar energy, hydrothermal energy, geothermal energy and wind energy).

- * **Solar Energy-Photovoltaic (PV) Cells** work by converting the sun's light directly into electricity without creating pollution. Most PV solar cells are made of specially treated silicon that harnesses energy from sunlight. According to PG&E "Solar calculators, clocks, garden lights, billboard lights, remote sensors, communications systems and buildings use solar panels of PV cells to generate power. Energy can be stored in batteries to provide a constant source of power, even during prolonged cloudy weather and at night." PV cells are perfectly suited for rooftop electricity generation for the following reasons:

Small and modular, PV cells can be 'right-sized' to meet specific needs.

Flexible in application, PV cells are suitable for use in a wide range of locations and situations.

Clean, silent and with no moving parts, PV cells are the least intrusive energy production technology.

High-tech and popular, PV projects are an excellent way to connect with others in your community. (EDF Newsletter, vol. XXVIII, no. 2, April 1997)

- * **Passive Solar Energy Systems** use the building itself to collect and store solar heat. Large windows act as solar collectors and thick walls or floors store some of the heat for later use. Sun spaces that collect solar energy for the main living area are one of the most popular passive systems. (US Dept. of Energy)

Tar Sands: Also referred to as oil sands or bituminous sands,

are a type of unconventional petroleum deposit. The oil sands are loose sand or partially consolidated sandstone containing naturally occurring mixtures of sand, clay, and water, saturated with a dense and extremely viscous form of petroleum technically referred to as bitumen.

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