

THE GREEN EARTH, GOOD LIFE, INNOVATION AND JOB CREATION, PRECAUTIONARY PRINCIPLE (HAPPY ATMOSPHERE) CHALLENGE RATIONALE

SUPPORT ENERGY INNOVATION AND JOB CREATION

Renewable Energy: Purchasing renewable energy for some or all of your home's energy needs is one of the most impactful personal choices you can make. Sending a clear signal to the market supports and drives innovation which is key to a speedy transformation of national energy infrastructure. Voluntary buy-in to EPA-certified green power has soared since 2004, and many utilities now offer a green power upgrade option. Coupling energy reduction strategies with a switch to renewable energy can make the change more affordable.

Efficient lighting: New LED light bulbs can give the same light for 15 percent the electricity. That adds up to more than \$100 in savings for most families each year.ⁱ

Rechargeable energy: With a modest upfront investment, switching to rechargeable batteries can save you money in the medium-term and save the energy required to produce and distribute new batteries while keeping additional pollution out of landfills.

Efficient appliances: Appliances use 20 percent of the energy in the average US home with the refrigerator and clothes dryer being two of the biggest energy-users (particularly pre-1993 models). When it's time to buy new appliances look for the most efficient Energy Star model you can find. Upgrading to a tankless or solar water heater can save 14 percent off your energy bill.

PV panels (extra points): Rooftop solar panels generate electricity without emitting air pollution, need only sunlight as an input, produce energy at the site of consumption avoiding losses during transmission, and can help utilities meet demand when connected to the grid (especially in summer when sun is stronger, days are longer, and electricity needs run high). Selling electricity back to the grid (net metering) can make solar financially feasible for homeowners, offsetting the electricity they buy at night or when the sun is not shining.

Invest in clean alternatives (extra points): As governments adopt policies to limit carbon pollution, innovation drives changing patterns of energy use, and consumers change behavior, the carbon resources that fossil fuel companies currently count as assets could shift to liabilities. Studies by the London School of Economics, the Aperio Group, HSBC, and Impact Asset Management report that fossil fuel companies may be overvalued by as much as 40 to 60 percent. Investing in a clean energy future could protect your assets and support companies driving innovation towards cleaner, renewable alternatives.

SAVE ENERGY AND MAKE SUPPORTING INNOVATION MORE AFFORDABLE:

Thermostat setting: According to the Union for Concerned Scientists, during the summer, a setting of 78 degrees Fahrenheit is optimal during the hours you are at home, and 85 degrees when you are away during the day. Recent research suggests that for each degree you turn down your thermostat over an eight-hour period, you can reduce your heating costs by 1 percent or more.ⁱ

Laundry in cold water: Clothes get clean using cold water with today's detergents and hot water washes use five times the energy. Washing in cold could save you nearly \$100 a year.ⁱ

Run appliances at night: Running your dishwasher and clothes dryer at night, during off-peak hours, reduces peak demand for electricity. Peak demand is strongly linked to the expansion of coal-fired power plants.ⁱⁱ

Dishwasher heat-dry cycle: If washed and left overnight, most dishes will be dry the next morning. Try adding rinse aid to the dishwasher to see if this affects drying (it does in many newer models).

Hot water heater temperature: Don't scald yourself when you wash the dishes. Paying to heat water and keep it hotter than you need just doesn't make sense.

Home air filter: Check your filter every month, especially during heavy use months (winter and summer). If the filter looks dirty, change it. At a minimum, change the filter every 3 months. A dirty filter will slow down air flow and make the system work harder – wasting energy.

Dryer balls: Using wool dryer balls can cut clothes drying time by 25-50 percent (confirmed). The balls circulate and separate clothing, moving warm dry air to the center of the laundry load. They are also said to soften your clothes (unconfirmed). Dryer balls last for years and you can buy or make your own, with many tutorials available online. Consider

line drying clothing to save even more energy.

Power strips: Many electronics draw energy when they're turned off. According to the Department of Energy, standby power accounts for about 8 percent of total household consumption. Keeping a laser printer turned on when not in use could cost as much as \$130 annually. Unplugging electronics or plugging them into a power strip (and switching it off) reduces this "phantom load" and decrease your electric bill. "Smart" power strips automatically cut power to devices when they go into standby mode. Most smart strips have at least one "always-on" outlet for devices such as digital video recorders, and some have adjustable sensitivity to detect standby power levels that are not much different than full power.ⁱ

Water-saving fixtures: Pumping water from the source, to the treatment plant, to storage, to distribution, back to the treatment plant requires enormous amounts of energy (just try carrying a pail full of water and you'll notice the weight). Whether you live somewhere with lots of water, or especially in conditions of drought, all efforts to reduce water consumption save energy. At home, the average American uses 98 gallons of water each day: 60 percent indoors (toilets, laundry, showers, faucets), 30 percent outside (watering of lawn, gardens, plants), 10 percent lost to leaks. Low-flush toilets can cut water use by 19 percent and water-efficient washing machines can cut another 17 percent.

Insulate hot water heater: Adding an insulating cover to your water heater can reduce heat loss by 24 to 45 percent.ⁱⁱ

Cleaning refrigerator coils: Turns out, not that important.

Home energy audit: Air leaks may account for 15 to 25 percent of the heat a furnace generates in winter or that a home gains in summer. If you pay \$1,100 a year to heat and cool your home, leaks may cost as much as \$275 annually.ⁱ A home energy audit should cover moisture and air leaks, indoor air quality, insulation, combustion safety, and durability of building components. Audits can be conducted by inspectors who specialize in private homes, or a number of utility companies offer free home energy audits through weatherization programs.

Attic insulation: Insulation is one of the most practical and cost-effective ways to make buildings more energy efficient both in new construction and through retrofitting older buildings. At relatively low cost, insulation results in lower utility bills, while keeping out moisture and improving air quality.

Ceiling fans: Install Energy Star ceiling fans in the rooms you use most often (or use a box fan). They'll help keep you cool in the summer while your AC works less or not at all. But don't bother running them in the winter. It turns out that counter-clockwise fan tip is an energy myth.

Programmable thermostat: Even basic programmable thermostats (costing as little as \$20) offer a high degree of customization, including multiple settings per day and multiple programs per week. This allows your heat and air conditioning – which together account for more than half of home energy use – to be automatically turned up or down based on your specific schedule. Nearly half of US homes already have a programmable thermostat. Use the manual to learn how to maximize the efficiency of your heating and cooling systems.ⁱⁱ Models that can be controlled via the Internet, or "learning" thermostats, use sensors to detect when you are at home and create a heating and cooling schedule based on your habits. While "smart" thermostats are more expensive, they can provide big energy savings in the long run.ⁱ

SUPPORT TRANSIT INNOVATION AND EFFICIENT CARS

Electric vehicle: Two-thirds of the world's oil consumption is used to fuel cars and trucks. Transport emissions are second only to electricity generation as a source of carbon dioxide, accounting for 23 percent of all emissions. Purchasing an electric car (if you must purchase a car at all!), like purchasing renewable energy for your home, drives innovation and provides an important signal to the market to speed the transformation of transportation options.

More efficient vehicle: Each gallon of gas you use is responsible for 25 pound of GHG emissions. Upgrading from a 20 mpg car to a 40 mpg car can save you 4,500 gallons of gasoline over the car's life span, a total savings of more than \$18,000 (at today's prices).ⁱ

Biking: 40 percent of urban car trips are less than two miles long. By building bike infrastructure rather than roads, taxpayers can realize \$400 billion in savings over 30 years and \$2.1 trillion in lifetime savings. Increasing the number of urban trips by bicycle from 5.5 to 7.5 percent globally by 2050 displaces 2.2 trillion passenger-miles traveled by conventional modes of transportation and avoids 2.3 gigatons of carbon dioxide emissions.ⁱⁱⁱ

SAVE MONEY AT THE PUMP / IN THE AIR

Additional weight in car: An extra 100 pounds can reduce fuel efficiency by up to 2%, so remove unnecessary weight including snow and ice in the winter.

Car maintenance: (from Ecodriver.org)ⁱⁱⁱ

- **Tire Pressure:** One tire under-inflated by 8 psi can increase fuel consumption by 4%, and reduce the life of the tire by 15,000km. Check the pressure once a month.
- **Motor Oil:** Using worn-out oil, or the wrong grade of oil, can increase fuel use by 2%. Change it regularly with the grade listed in your owners' manual. "Energy Conserving" brands can reduce friction, improving efficiency even more.
- **Air Filter:** Fuel use can increase up to 10% when the air filter is clogged, because not enough air makes it to the combustion chambers. Check it on the same schedule as you change the oil, or more often if you travel on dusty roads.
- **Tune Ups:** Keeping your vehicle in tune can reduce fuel consumption by up to 15% and smog causing emissions by even more. Follow the schedule in your owners' manual.ⁱⁱⁱ

Eco driving: Better gas mileage not only reduces emissions, but will also save you thousands of dollars at the pump over the life of a vehicle (Tips from Ecodriving.orgⁱⁱⁱ):

- For every 6 mph you go over 60, fuel efficiency drops by 10%. Driving 75 on the highway instead of 60 is like paying 20% extra for gas.
- Jackrabbit starts from one stoplight to the next save only 2.5 minutes per hour, but increase fuel consumption by 37%.
- On the highway, keeping a steady speed uses less fuel. Accelerate smoothly and avoid hard braking by leaving room between your car and the one in front.
- Just ten seconds of idling uses more fuel than restarting the engine. In ten minutes the average car will burn almost 1/3 of a quart of fuel.
- Today's cars shouldn't be idled to warm up, and too much idling can cause damage. Driving gently for the first few minutes lets your transmission, steering, and engine all warm up at once.
- Trips under 2 miles are the most polluting because the engine and the pollution control system never reach peak operating temperature. Combining several trips into one can cut fuel use and emissions by 20 to 50% (or consider taking your bike for shorter trips!).
- Using overdrive at high speeds saves fuel and reduces engine wear. With a manual transmission, shifting up gently but quickly to higher gears allows the engine to work more efficiently.
- If your car comes with a consumption computer, use it to get instant feedback on fuel use. Drivers who learn to adjust their habits have saved up to 10% this way. If your vehicle doesn't have one, they're easy to install.
- A loaded roof rack can increase fuel use by as much as 5% because of drag, and even empty racks add to drag, so take them off when not in use.
- Major electronics like TVs, seat warmers, and AC all add a drain on the battery and make the engine work harder. At city speeds you'll save fuel by rolling down the windows instead of using the AC (though on the highway open windows add enough drag to make the difference negligible.)
- Using cruise control on flat terrain improves fuel efficiency, because it helps you maintain a steady speed, and also prevents you from accidentally speeding. On hills though, it's best to turn it off

Reduce flying (extra points): More than 3 billion plane tickets were sold in 2013, air travel is growing faster than any transport mode, and flying currently accounts for at least 2.5 percent of global annual emissions.^{iv} Consider attending meetings virtually or using mass transit options such as the train.

SUPPORT FARMERS, SOIL MICRO-ORGANISMS, AND FORESTS

Storing carbon in the soil: Regenerative farming methods that use natural manure and compost for fertilizer store much more carbon in the soil (compared with chemically intensive farming practices) — keeping carbon out of the atmosphere.

Local or organic farming: The average American meal has been estimated to travel 1,500 miles from farm to plate. Food that is grown closer to home has fewer transportation emissions associated with it, is usually fresher, and supports local farmers. And as the distance food travels decreases, so does the need for processing and refrigeration to reduce spoilage. However, while there are many great reasons to buy locally grown food, 'food miles' make up a relatively small percentage of the overall carbon footprint of food — approximately 11% on average. How food is grown makes up a much larger percentage — roughly 83%. Chemical farming uses considerably more energy per unit of production than organic farms, which do not use these chemical inputs. In addition, the use of synthetic nitrogen fertilizers produces nitrous oxide, a greenhouse gas that is approximately 300 times more powerful than carbon dioxide in terms of warming.^v

Choosing to buy food that is organically grown can be a better choice for the climate. But food does not necessarily need to be certified organic to be low carbon. Your best bet is to get to know local growers through a farmers' market and

support those who are making moves towards less intensive practices. If you are shopping at a large grocery store, selecting organic when available and voting for non-intensive farming, which rebuilds soil fertility, is the most climate-friendly choice.

Composting: Organic matter (yard waste, banana peels, etc) decomposing in landfills generates methane, a potent greenhouse gas. Compost, on the other hand, takes that same waste, turns it into stable soil carbon, and makes it available to plants. Compost is a valuable fertilizer, retaining water and nutrients of the original waste matter and can aid soil carbon sequestration.

Tree planting: Standing trees are one of the most important carbon storage devices on earth. Planting (properly sited) trees near your home can reduce energy use in summer (reducing AC use from increased shading and reduction in outside temperatures) and in winter (trees lower wind speed). If you can't plant a tree in your own yard, consider volunteering or donating to plant trees in your community or elsewhere.

Tropical forest: Keeping tropical forests intact, and supporting their reforestation, are vital components in any effort to keep carbon on earth and out of the atmosphere. Tropical forest loss alone is responsible for 16 to 19 percent of GHG emissions caused by human activity. However, "the regrowth of tropical forests sequesters as much as six gigatons of carbon dioxide per year, equivalent to 11 percent of annual greenhouse gas emissions worldwide or all those emanating from the United States".^{iv}

REDUCE FOOD COSTS / AFFORD LOCAL, SOIL-FRIENDLY FOOD

Reducing meat consumption: Nearly 60% of the world's agricultural land is used for beef production (including land used to grow feed) and beef accounts for less than 2% of calories consumed worldwide. If cattle were their own nation, they would be the world's third-largest emitter of GHGs, accounting for nearly 15 percent of global GHGs emissions annually (by the most conservative estimates).^{iv} When cows and other ruminants digest food, they generate methane, energy used to grow livestock feed produces carbon dioxide, and manure and fertilizer emit nitrous oxide. Beef production in its current forms usually requires large tracts of land. As global demand for meat increases, much of the land for additional production comes from clearing tropical forests – a leading driver of deforestation and significant contributor to GHG emissions. Eating less meat reduces emissions and also tends to be healthier, leading to lower rates of chronic disease. Decreased meat consumption also protects freshwater resources and ecosystems. An average family of four that decides to cut their meat intake in half could avoid roughly three tons of emissions annually.ⁱ

Food waste: Uneaten food contributes about 8 percent of total GHG emissions each year.^{iv} In developed countries, food waste happens when retailers reject imperfect food (bruised, misshapen); restaurants order or serve too much; consumers reject imperfect produce, overestimate how much they will cook at home, misunderstand food 'best by' labels, toss out food that has not gone bad, serve large portions on large plates. Producing uneaten food wastes resources – water, energy, land, fertilizer, labor, and financial capital and generates GHGs at every stage, including methane when organic matter is buried in a landfill. (We will talk more about food waste during the challenge!)

USE STUFF UP – SUPPORT THE REUSE ECONOMY, RECYCLING JOBS, EFFICIENT MANUFACTURING, AND RECOVERY OF USABLE ASSETS

Re-use economy: To make a new product requires extracting/harvesting raw materials, fabrication, and distribution to wherever it will be sold, all which require significant energy. Reducing the quantity of new products you buy and choosing to use up what you already have or to buy used are effective ways to reduce your energy 'footprint' and save money. Clothing, as one example, has a significant carbon footprint. Emissions associated with clothing include the resources used in extraction, farming, harvesting, processing, manufacturing and shipping, the pesticides used in cotton farming, the dyes used in manufacturing, and the waste discarded clothing creates. It can take more than 5,000 gallons of water to manufacture a cotton T-shirt and a pair of jeans.

The good news: there are upscale (and downscale) consignment, re-use, upcycled, and thrift stores, community sharing banks, eBay, Craig's List, Freecycle, Thredup, and more. You can support small businesses giving existing products another life, share with your community, or sell things you no longer need or use.

Recycling: Converting waste into raw materials can save energy, reduce resource extraction, and minimize other pollutants. Recycling also creates jobs and significantly contributes to the economy. According to the United States EPA, on a national average, 1.57 jobs, \$76,030 in wages, and \$14,101 in tax revenues can be attributed to every 1,000 (US) tons of recyclables collected and recycled. In 2007, recycling and reuse activities in the United States accounted for 757,000 jobs, \$36.6 billion in wages, and \$6.7 billion in tax revenues. Understand your community's recycling guidelines, look for

facilities to recycle additional materials (cork, printer cartridges, water filters) and support recycling efforts by buying recycled when available.

SUPPORT HUMANITY

Family planning: 225 million women in lower-income countries want to be able to choose whether and when to become pregnant but lack access to contraception resulting in more than 70 million unintended pregnancies each year (and 45 percent of pregnancies in the US are unintended). Access to voluntary, high-quality family planning services around the world would have powerful positive impacts on the health, welfare, and life expectancy of women and their children. Without increased investment in family planning, currently just one percent of all overseas development assistance, the world population is likely to grow to almost 11 billion people by 2050 requiring more energy, building space, food, and transportation and generating more waste. Keeping global population to 9.7 billion people by 2050 could reduce future emissions by 123 gigatons of carbon.^{iv}

Education for girls: According to the Brookings Institution “The difference between a woman with no years of schooling and with 12 years of schooling is almost four to five children per woman.” A 2010 economic study shows that investment in educating girls is “highly cost competitive with almost all of the existing options for carbon emission abatement” perhaps just \$10 per ton of carbon dioxide. In addition, “educated girls realize higher wages and greater upward mobility, contributing to economic growth. Their rates of maternal mortality drop, as do mortality rates of their babies. They are less likely to marry as children or against their will. They have lower incidence of HIV/AIDS and malaria...Their agricultural plots are more productive and their families better nourished. They are more empowered at home, at work, and in society.”^{iv}

Share the challenge with a friend: More friends = more good done.

DEMERITS (just don't do it)

Disposal of refrigerators/air conditioners: When chemicals used as refrigerants (CFCs, HCFCs, and HFCs) are not disposed of properly, they escape into the atmosphere. The capacity of these chemicals to warm the atmosphere is one thousand to nine thousand times greater than that of carbon dioxide. Substitutes for these chemicals are available (and international agreements have phased out or are phasing out their use) but older appliances MUST be properly disposed of. With careful removal, refrigerants can be purified for reuse or transformed into other chemicals that do not cause warming.^{iv}

RESOURCES

Emissions calculator: If you would like to know your family's annual greenhouse gas emissions, Cool California has calculators at <http://www.coolcalifornia.org> for households and individuals, local government, schools, and small businesses. The site provides an excellent tool with many suggestions for how to make changes to reduce emissions.

ⁱ Union of Concerned Scientists “Ten Personal Solutions to Global Warming” Available at:

http://www.ucsusa.org/global_warming/what_you_can_do/ten-personal-solutions-to.html#.WTn1scbMyCR

ⁱⁱ Green American “10 Easiest Ways to Cut Your Energy Use in Half” Available at:

<http://www.greenamerica.org/pubs/greenamerican/articles/NovDec2010/10Ways.cfm#.WTMVA5yTxhg.email>

ⁱⁱⁱ <http://www.ecodriver.org/pages/Fuel-EfficientDriving.php>

^{iv} Hawken, Paul, editor. 2017. *Drawdown: the most comprehensive plan ever proposed to reverse global warming*. New York, New York: Penguin Books.

^v David Suzuki Foundation “Food and Climate Change” Available at: <http://www.davidsuzuki.org/what-you-can-do/food-and-our-planet/food-and-climate-change/>