Menlo Spark Green Renovations Guide

By Camilla Visconti for Menlo Spark

Introduction

Summary

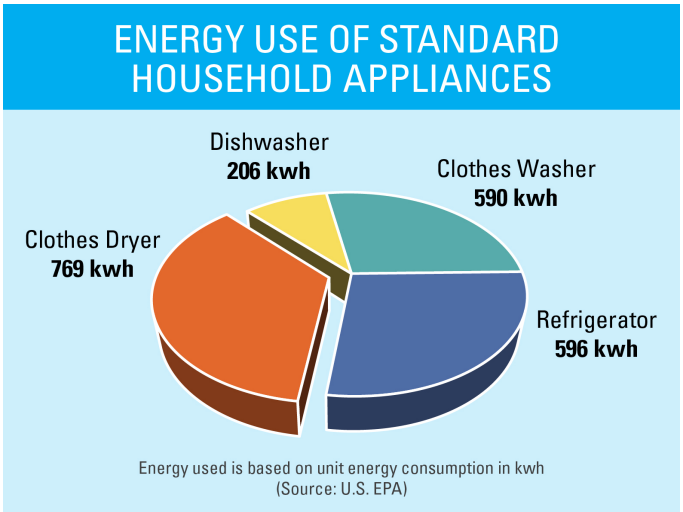
There are three important aspects to know when one begins to save money on energy costs. First, understanding your utility bill and where the most amount of money is being spent; second, choosing the level of effort and savings you strive to achieve; and third, pick which options work best for you. Our goal is to help you make an easy transition to a carbon-neutral lifestyle, and a more energy efficient home. This document will help guide you towards making smart and effective energy saving steps in your home.

How can I save energy/money?

There are many ways to save energy and money. One of the most helpful practices is to know and understand your home's energy usage patterns. PG&E collects electric and gas usage data by the hour of your home, which you can access online.[1]

The money we spend on utility bills has been estimated to be about 10% of a middle class family household budget, according to ClearPath[xi]. The chart below shows the average energy use of a typical American household, but does not include heating and cooling. Considering that Menlo Park has a very mild climate, very different from the majority of the US, it is good to understand that most of your energy usage and money is spent on water heating.

There are so many ways to save money. First and foremost, it is extremely important to make sure that you are not wasting energy. ClearPath estimates that every one in three dollars is wasted on unused or misused energy[xi]. The first thing you can do is to understand your energy patterns. Online energy calculators are helpful tools to get a general understanding of where you spend the most amounts of energy, and in turn where you can save on energy.[2]



This guide is designed to help homeowners interested in reducing green house gas emissions. It provides zero-cost solutions and low-cost opportunities to reach that goal.

If you are interested in saving energy and considering other environmental measures but need some help getting started, you can turn to a company called *Domino*[3], "a concierge service that's here to help millions of Americans switch to clean energy and save money at the same time." This service is free for homeowners.

What can I do at zero-cost to reduce my power bill?

Behavior Changes That Make a Big Difference

A few simple changes to typical household habits can eliminate a large portion off the utility bill. For example, washing laundry with cold water can save around $100 annually, and lowering your water heater temperature by 10 degrees (which will not change your showering experience) saves an estimated $40 annually. Here is a list of ideas to keep in mind at home, and the estimated savings per year.

Savings: $90 /year, average of 20%, 0.45 tons of CO_2

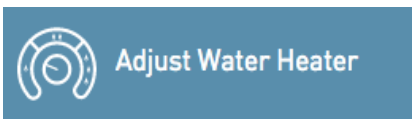
- 8° F down in the winter and 4° F up in the summer
- Close curtains/blinds in the summer and open them in the winter

Savings: $5 /year, 50 pounds of CO_2

- Dry your dishes without heat

Savings: $5* - $150 /year, 50 – 1,500 pounds of CO_2

- Set your refrigerator between 35° – 38° F
- Don't leave the door open for longer than 10 seconds
- Keep your freezer full; it uses less energy that way
- Reorganize and eliminate a refrigerator if you have two ($150 savings)



Savings: $180* /year, 0.9 tons of CO_2

- Switch to cold water when washing clothes
- Set your water heater at 120° F

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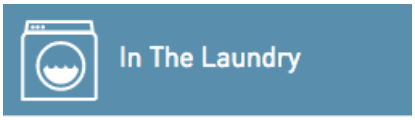
* clearpath.org & coolcalifornia.org estimates *average*

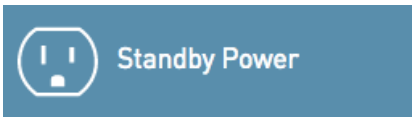
Savings: $50 /year, 265 pounds of CO_2

- Turn off the lights.



Savings: $50 /year*, 265 pounds of CO_2

- Consider air-drying, which makes your cloths last longer.



Savings: $33 /year, 330 pounds of CO_2

- Unplug devices and switch off power strips
- Dim the TV at night

(Source: clearpath.org and coolcalifornia.org)

What are some low-cost options to reduce my power bill?

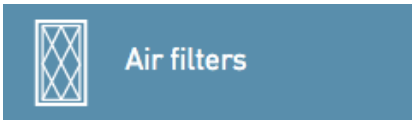
Quick Wins: Give A Little $ now Gain A Lot $$ over time

These solutions require some investment upfront, but they each pay for themselves quickly and cut overall energy spending. With just a small amount of effort you can make big changes. Another smart idea is to have an energy audit done to your home to get an expert's opinion on where your home has room for efficiency improvements (more information about energy audits below). For larger projects (like getting new energy efficient appliances) where you want to talk to a professional, getting in touch with a consultation agency can be very helpful (more information on where to find consultation in the area below).

Investment: $175

Savings: $180 /year, 0.9 tons of CO_2

- Install a smart thermostat (info below) and use only the energy needed to stay comfortable



Investment: $45

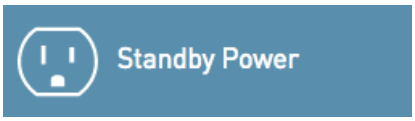
Savings: $160 /year, 0.8 tons of CO_2

- Changing air filters every three months to work at maximum efficiency

Investment: $100

Savings: $170 /year, 0.85 tons of CO_2

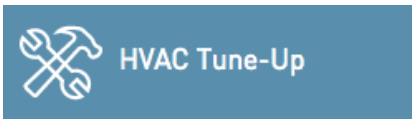
- Replace incandescent bulbs with LED



Investment: $50

Savings: $100 /year, 0.5 tons of CO_2

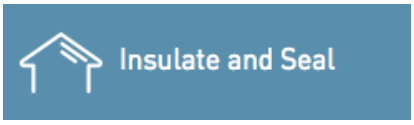
- Advanced power strips (info below) ensure no power is being drawn when appliances are off



Investment: $120

Savings: $150 /year, 0.75 tons of CO_2

- Annual check-ups can help improve system's efficiency
- Prolongs the lifetime of the system



Investment: $700

Savings: $430, 2.2 tons of CO_2

- All air leaks added up in a typical home is like having a window open every day

Investment: $1000

Savings: *depends on how old current appliances are*

- Upgrade to the most efficient appliances
- Keep in mind money spent on the appliance and money spent to run it

Look under *Cooling* for more details

- Summer: shades should be lowered where sunlight enters
- Winter: shades on south-facing windows should be raised during the day
- Dual Solar Shades: highly reflective on one side and heat absorbing on the other

(Source: clearpath.org)

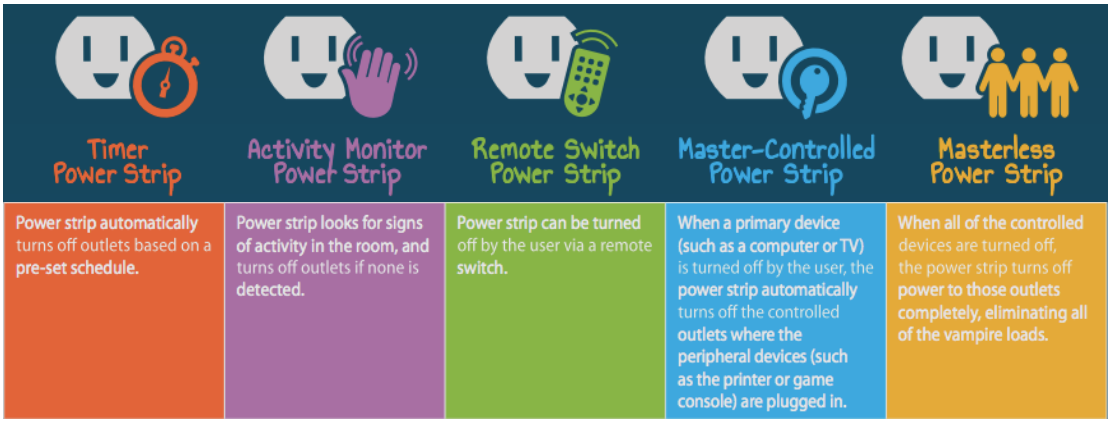
Programmable Thermostats

These cost between $100-$250 and are sold at any local appliance store (like The Home Depot). They help you save energy and money by scheduling times to turn on or off your heating/cooling

system in order to maintain the temperature you desire without running the system when it is not needed. In this way, your heating/cooling system does not run as much when you are asleep or away from home. It is a very effective way to save money and energy. In fact, you can save up to 10% a year on electricity by turning the thermostat down 7°-10°F for 8 hours a day[i].

Advanced Power Strips (APS)

Today most people have many electronics concentrated in one or two areas of their homes, like home offices or entertainment centers. Advanced power strips are different from conventional power strips because they have built-in features designed to prevent electronics from drawing power when they are off or not in use. An advanced power strip is good to have in your home to reduce wasted electricity. Advanced power strips are especially effective for people who might leave electronics on; for example, someone who tends to leave the TV on all night should invest in an activity monitor power strip that turns off when no activity is detected for a certain amount of time. A timer power strip turns everything off with a timer, remote switch power strip can be turned off remotely[xiii], and more are shown in the figure below. Depending on the size, they can cost anywhere between $20-$60, and can be found at any electronics store.



Source: nrel.gov[16]

What is an Energy Audit and how can it be helpful?

An Energy Audit is an assessment of a home/building's energy use and efficiency. They are done to help people save money by identifying areas where there is room to improve efficiency. For example, most people do not know if there are air leaks in the corners of their homes. A home energy assessment will detect where energy is being wasted.

How do I get an Energy Audit?

In order to get an energy assessment done to your home, it is recommended you speak with a consultant, since there are many different types of assessments available, a consultant will help you figure out what is best for your home. A good place to start is would be to look online at BayREN[8], which is an organization based in the bay area that implements effective energy saving programs on a regional level[xii]. BayREN collaborates with another organization called Energy Upgrade California to provide you with assistance finding a consultant/contractor for any energy upgrades you are interested in[15].

- The City of Menlo Park offers a $300 rebate for energy audits. You can find the form[6] on the City of Menlo Park website[7] for energy upgrades.

Where can I get consultation?

- BayREN[8] is a Bay Area organization that implements effective energy saving programs, including consultations.
- RC Mechanical[9] is an accredited company, based in Redwood City, which specializes in whole house performance.
- ecoProach[5] in Sunnyvale does energy home remediation using a green approach.

Why transition from natural gas to electric?

The goal that has been set for the city of Menlo Park is to reach carbon neutrality by 2025, this means all carbon emissions are counted and carefully monitored. To reach the goal, it is important to reduce carbon emissions as much as possible, starting in areas where it is easiest to reduce or even remove. If all household appliances were to be electric, eliminating the burning of fossil fuels, it would greatly reduce carbon emissions into our air. It is very much advised to remove gas appliances where they are not needed.

Renovations Guide

What is the best technology on the market?

Cooling

Air-Source Heat Pump

Heat pumps can dramatically reduce power use and work well in the mild climate of Menlo Park. This technology[2] works the same way as central AC: it pumps air throughout the home via ductwork. One of the biggest advantages of heat pumps is that they can both heat and cool using the same system, but reversed.

Air-source heat pumps *move* heat rather than *converting* it from a fuel. They consist of a compressor and two coils made of copper tubing (one indoors and one outside), which allows for efficient heat transfer. An air-source heat pump can deliver one-and-a-half to three times more heat energy to a home than the electrical energy it consumes. They also have a long life expectancy (25 years) with little maintenance. Consider using a heat pump savings calculator[10] online if you have been looking at heat pumps on the market and want to get a better idea of what the savings might look like.

By switching to an electric heat pump for cooling purposes, you could prevent **2.5 tons of CO_2** (on average) from entering the atmosphere in a lifetime. Using a heat pump could save you around **$500 /year** on energy costs, so payback time is usually between 2-10 years. *(Source: coolcalifornia.org / energy.gov)*

[2] Note that here we are referring to air-source heat pums, which are most common and recommended for this area. Geothermal ground-source heat pumps are not included here because they are more expensive and better suited to very cold or very hot climates..

Ductless Mini-Splits

This is a type of heat pump. This system is good for homes that do not rely heavily on air conditioners during the year, but perhaps a few weeks of the year. Ductless mini-split air conditioners are single room cooling (and heating) systems that do not require ductwork. Because of this, energy losses associated with ductwork are avoided, making these systems more efficient compared to traditional cooling systems that required ductwork throughout the house. However, initial costs are usually higher compared to other options.

Central Air Conditioning

Central air conditioners can work well in areas that experience high humidity. There are two types, split systems or packaged units. In a split system an outdoor metal container contains the condenser and compressor, and an indoor container holds the evaporator. A split-system is recommended for homes that already have a furnace but no air conditioner (cheapest option). A packaged system has the evaporator, condenser, and compressor all located in one container, which is usually placed on a roof or on a concrete slab next to the home's foundation. Packaged systems also include electric heating coils or natural gas furnace, therefore eliminating the need for a separate heating system.

They are rated according to season energy efficiency ratio (SEER) (cooling output divided by power input). The higher the SEER rating, the more efficient the system (recommended number is 14.5). Central AC requires ductwork throughout the home, which is also used for forced-air heating. It is very popular because of the comfort level achieved.

Switching to an Energy Star certified AC system, you could save about **$20 /year** to operate. Central air conditioning systems may cost $500 more initially, but during its lifetime use will pay itself back (about 15 years). The switch would prevent **3,302 pounds of CO_2** from entering the atmosphere each year.

(Source: aceee.org)

Ceiling Fans

In Menlo Park's mild climate, ceiling fans can make a huge difference. They use less electricity than air conditioners, they provide ventilation, and create a low-level "wind-chill" effect without actually creating colder air. The Energy Star website provides a helpful list of the "2015 Most Efficient Ceiling Fans over 52 Inches" which includes sizing, energy use, operation cost, efficiency, and more helpful information.[11] Savings depend on how much the home relies on air conditioning. Some homes, especially in more shaded areas, may be able to use ceiling fans instead of air conditioning. A ceiling fan uses less energy to operate compared to an air conditioning unit; therefore, less time with the air conditioning on and more time using a ceiling fan will save money.

Shades

Shades are the simplest and least expensive way to save energy on heating and cooling. In the summer, shades should be lowered where sunlight enters; in the winter, shades on south-facing

windows should be raised during the day to allow sunlight to enter, and then lowered at night to keep heat inside. For even greater efficiency, use dual shades—highly reflective (white) on one side and heat absorbing (dark) on the other side—that can be reversed with the seasons (the reflective surface should always face the warmest side; outwards in the summer and inwards in the winter). Dual solar shades can be found locally at a shade store called Stoneside[17] in Palo Alto. Other options for shading include exterior roller blinds and overhangs.

Canopy

The addition of trees and vines into your home can have many benefits for both heating and cooling. Trees and vines provide shade and create a microclimate. Leaves on trees provide shade in the summer, cooling the space below it. In the winter instead, the leaves fall and sunlight is able to provide warmth to the home. When done correctly, trees and vines are a quick, effective, sustainable, and beautiful way to provide shading and cooling to your home. Not only is energy saved but carbon is sequestered and restored into the earth; more trees is always a good idea.

Planting 1 tree is equivalent to saving **$10** on your energy bill (taken away from AC use) due to the shade it provides. 5 trees would prevent **.09 tons of CO_2** from entering the atmosphere each year. *(Source: coolcalifornia.org)*

Heating

Forced Air Heating (Heat Pump)

This is an air-source heat pump; therefore it is electric and does not require fuel to operate. It is highly recommended for the Menlo Park area with its mild climate. It works by a simple electric heating element that warms the air, which is then pushed throughout the ductwork of the home with a fan. If you already heat with electricity you will find that switching to a heat pump can save you between 30-40% on your energy bill.[i] Heat pumps use a lot less electricity to operate. However, if you use a gas furnace and switch to a heat pump, the cost on gas will be eliminated, but the extra cost of electricity will be added. Initial cost may be high (around $3K), but there are government incentives (listed at the end of this guide) to help with initial costs, and utility bill savings will be greater than the initial investment over the life of the heat pump.

By switching to an electric heat pump for heating purposes, you could prevent **4 tons of CO_2** (on average) from entering the atmosphere in a lifetime. However, if it costs about $1.10 per hour to operate, and heating is on for about 1500 hours a year, you would be spending $1,650 per year on electricity. Compare that to the price of running your gas furnace (which is??).
(Source: coolcalifornia.org)

Furnaces / Boilers

If a furnace or boiler is not very efficient or nearing the end of its useful lifetime, consider switching to an electric heat pump described able. If a heat pump is not an option, make sure to select a furnace with the highest efficiency rating.

The efficiency of new furnaces and boilers are rated using the annual fuel utilization efficiency (AFUE) rating to measure overall performance. Boilers manufactured since 1992 must have an AFUE of at least 80%. The best furnaces and boilers today reach 98% efficiency. Whether talking about oil or gas boilers, it is important to keep in mind that maximum efficiency can significantly reduce carbon emissions and save a lot of energy and money. If the boiler/furnace is brand new, making sure that ductwork is sealed and secure to avoid the energy losses of leaks commonly found in ductwork.

Annual Estimated Savings for Every $100 of Fuel Costs by Increasing Your Heating Equipment Efficiency*

Existing System AFUE	New/Upgraded System AFUE								
	55%	60%	65%	70%	75%	80%	85%	90%	95%
50%	$9.09	$16.76	$23.07	$28.57	$33.33	$37.50	$41.24	$44.24	$47.36
55%	----	$8.33	$15.38	$21.42	$26.66	$31.20	$35.29	$38.88	$42.10
60%	----	----	$7.69	$14.28	$20.00	$25.00	$29.41	$33.33	$37.80
65%	----	----	----	$7.14	$13.33	$18.75	$23.52	$27.77	$31.57
70%	----	----	----	----	$6.66	$12.50	$17.64	$22.22	$26.32
75%	----	----	----	----	----	$6.50	$11.76	$16.66	$21.10
80%	----	----	----	----	----	----	$5.88	$11.11	$15.80
85%	----	----	----	----	----	----	----	$5.55	$10.50
90%	----	----	----	----	----	----	----	----	$5.30

*Assuming the same heat output

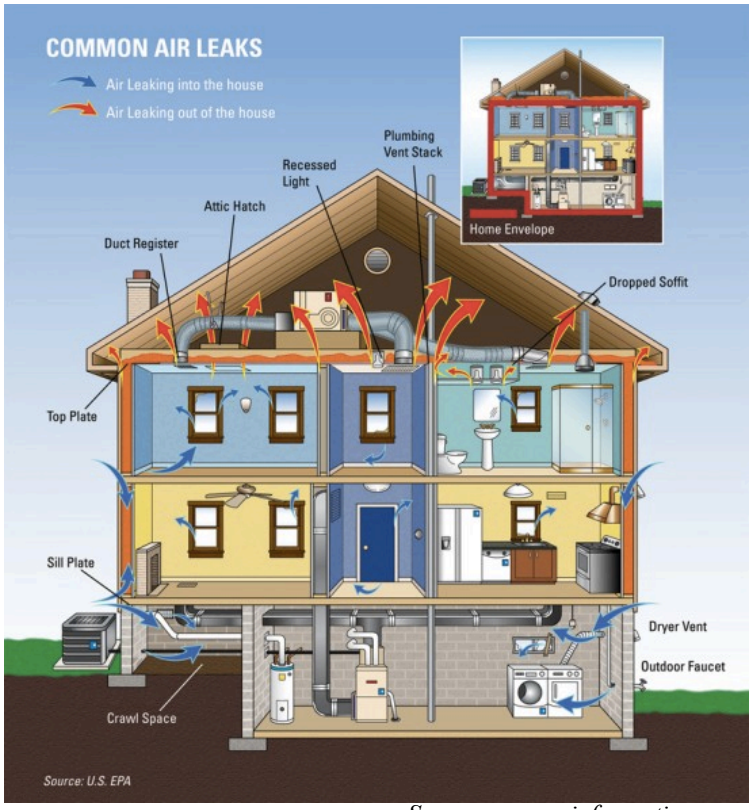
Source: Energy.gov

Weatherization

Insulation / Building Envelope

Heat loss is not only a waste of energy but also money. It is common for people to be unaware of the heat loss in their homes. Insulation is very important for your home; this means windows, doors, and building envelope. The quickest and cheapest thing to start off with is to seal all window edges and cracks with rope caulk[13]. Since it is so difficult to understand how efficiently insulated your home is, the best thing to do is to get an energy audit done on your home; A specialist will evaluate the home and consult with the owners on what changes need to be made

in order to ensure maximum efficiency (look at *Energy Audits* section on the second page of this guide). There are also ways of detecting air leaks on your own; many websites provide step-by-step instructions on how to do so[14]. The image below shows where the most common air leaks are located in a home.



Source: energyinformative.org

Applying weather-strip to windows and doors, which is a special lining inserted between window frames around the parameter of doors, to ensure a tight seal. Installing door sweeps on the bottom of doors is also highly suggested. Storm windows are also effective, cheap, and comfortable because they can come in a removable form. The temporary, plastic kits are less expensive than glass, costing around $5-$10[vii].

To know whether or not you need weatherization services, ask the following questions, and if the answer is yes, talk to a specialist:

- Do you feel cold drafts in the winter coming from windows/doors when they are open *or* closed?
- Do you need to run the heater all day in the winter to stay at a comfortable temperature?
- Do you need to run the air conditioner all day in the summer to stay at a comfortable temperature?
- Is your heating and cooling bill very expensive?

Windows

Window treatments can make a huge difference to the heating/cooling and insulation capabilities of your home. Changing older windows with more modern, efficient ones can reduce your electrical consumption by an astonishing amount. If your home receives a substantial amount of sunlight, there are a few options that can greatly reduce the use of heating/cooling systems.

Window frames are also important to keep in mind. Aluminum and other metals last long but do not insulate well. Wood frames need regular maintenance since wood responds to weather conditions, but it insulates relatively well. The overall best options are fiberglass frames and vinyl frames; they are made of plastic, which makes them stable, and can be filled with insulation for better thermal performance[i].

Low-e (low-emissivity)

This is an incredibly thin, practically invisible, metal or metallic oxide layer placed onto the surface of the glass window. In other words, it is an insulated glazing material that helps control heat transfer through the glass. Windows manufactured with low-e coatings typically cost about 10% to 15% more then regular windows, but can reduce energy loss by as much as 30% to 50%[i].

By switching all of your windows to *double-pane solar control low-e* you could prevent **2.2 tons of CO_2** (average) from entering the atmosphere in a lifetime. *(Source: coolcalifornia.org)*

Reflective Window Coatings

Used to reflect heat from your home, they are plastic sheets treated with dyes or thin layers of metal. Depending on the type of film used, they can also substantially cut glare and reduce the amount of sunlight that enters the home. There are a range of intensities of films, the best ones are able to reflect as much as 80% of the incoming sunlight; these are best for homes that experience higher temperatures. (Example brands: Suncontrol, SolarGuard).

By switching all of your windows to *single-pane tinted* you could prevent **2 tons of CO_2** (average) from entering the atmosphere in a lifetime, and *double-pane tinted* windows you could save **2.3 tons of CO_2**. *(Source: coolcalifornia.org)*

Gas Fills

Windows with tinted glazing do not usually have thermal insulation, so some manufacturers fill the space between two glass sheets with inert gas (typically argon and krypton), which has higher resistance to heat flow[i].

Water Heating

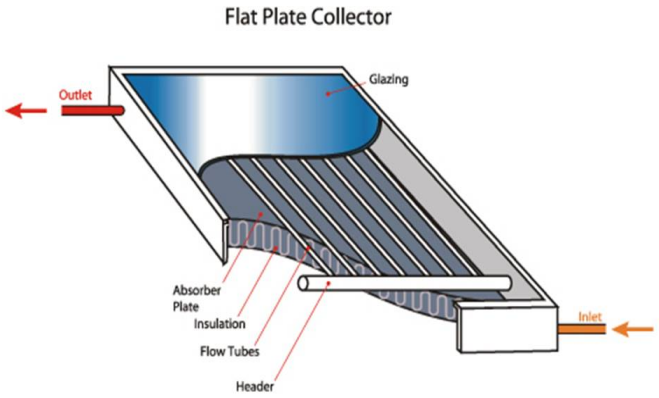
Solar Water Heater

The best-suited options for Menlo Park climate include the passive system known as "batch" system, and the open-loop active system known as "flat plate."

By switching to an electric water heater you could prevent **2 tons of CO_2** from entering the atmosphere in a lifetime.

(Source: coolcalifornia.org)

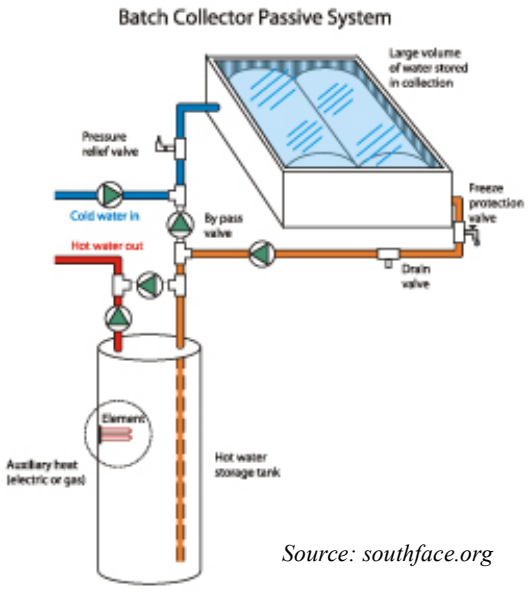
Flat Plate Collector (Active)



Source: newmexicosolarandwind.com

- Household water is stored in a series of metal tubes enclosed in glass tubes. The sun shines on the tubes and warms the water inside. The system connects to already existing water heaters so that the solar heated water can be drawn into the electric water heater when it is being used. The passive system is the most cost efficient water heater. It does not need electricity to operate, so it's easy to install, operate and maintain. There is a very short return on investment, and since it doesn't use any electricity there are zero operational costs.

Batch (Passive)



Source: southface.org

- This is an insulated, weatherproofed box that contains a dark absorber plate under one or more glass/plastic covers. It is simple to add capacity to the system if demand changes. The system integrates easily with existing systems. Flat plate collectors employ the green house effect; the glass permits sunlight to enter and heats up the water, since the wavelength of the light changes the heat stays trapped under the glass.

Substituting 25% of your hot water needs using a solar water heater could save you around **$35 /year** and **0.27 tons of CO_2 /year** (average) from entering the atmosphere.

50% saves **$69 /year** & **0.58 tons of CO_2 /year**
75% saves **$104 /year** & **0.9 tons CO_2 /year**
100% saves **$140 /year** & **1.2 tons CO_2 /year**

(Source: coolcalifornia.org)

Hybrid Electric Water Heater

These are electric storage heaters combined with a heat pump (see above for description of a heat pump). It is recommended for those who want to eliminate gas water heaters.
They use about 60% less energy than standard electric heaters[vii]. They cost between $1K-$2K, but since the savings are so large the payback period is relatively short (typically less than a decade).

With a standard electric water heater, you might be spending around $50 per month, or 450 kWh[viii]. If you switched to a hybrid electric heater that cut the use of electricity by 55%, it save you **$360 /year**, and prevent **1.8 tons of CO_2** from entering the atmosphere.

Negative aspects about these systems are:

1) They need as much as 7 feet clearance from floor to ceiling.
2) Up to 1000 cubic feet of uncooled space is needed for the heat pump to capture heat from the air.
3) These systems are usually noisier than conventional storage-tank heaters.

Kitchen Appliances

Refrigerator

Refrigerators can be real energy hogs. Efficiency can be much greater in new models (standards were updated in 2014) and especially for Energy Star certified refrigerators, which are roughly10 times more efficient than other models meeting new federal requirements. Depending on how old the current refrigerator in your home is determines the amount of potential savings. Switching to a more efficient refrigerator can save anywhere between $35-$300 from your utility bill.[vi] The most efficient refrigerator listed on the Energy Star website is a Fisher & Paykel (RB36S) which uses only 150 kWh/year, and costs $1,700. When buying a new refrigerator is it especially important to know how much energy it uses, since refrigerators are one of the top energy consumers out of all household appliances. Also keep in mind that an older refrigerator can generate a lot of access heat, which could lead to more air-conditioning.

Helpful **Tips** and **Reminders**:

- Refrigerator/freezers that are placed side by side are typically the *least* efficient set-up. **Top door freezers** usually have the best in efficiency ratings[vii].
- Larger refrigerator means greater energy consumption. The most energy efficient models are typically **16-20 cubic feet**.
- If there are two refrigerators/freezers in one household, energy costs can be cut by a lot if one of the two appliances is removed. Think about how to rearrange stored food and what foods are better stored in pantries to **save space**.

(Source: consumerreports.org)

Eliminating 1 refrigerator from your home would save you at least **$150 /year** on your energy bill, preventing **0.75 tons of CO_2** from entering the atmosphere.

If your current refrigerator uses 250 Kwh/year to operate and you switched to one that only uses 170 kWh/year, that would save you **$12 /year** and prevent **120 pounds of CO_2** from entering the atmosphere each year.

(Source: coolcalifornia.org)

Dishwasher

First question to ask is: was your dishwasher built before 1994? If so, it probably wastes more than 10 gallons of water per cycle compared to a newer dishwasher. As we all know, saving water also saves money. Things to keep in mind when buying a dishwasher are:

- Sizing
- Wash cycle options
- Electrical consumption
- Water consumption

Standard-capacity (bigger size) models hold more than eight place settings, while compact-capacity models hold up to that amount. However, running a compact-model more frequently may cost more energy over time. Having a dishwasher with several wash cycle options can use light or energy-saving cycles, which use less water and energy by running a shorter wash cycle. It is important to compare the electrical consumption and gallons of water used per cycle when buying a new dishwasher.

Energy Saving **Tips** and **Reminders**:

- **Scrap** don't rinse
- **Load up** the dishwasher before running it (dishes will not be cleaner if there are less dishes)
- Select the **no heat** drying option. Dishes may not be as dry but a whole lot of energy is saved.
- The most amount of energy is used to heat the water. Less water per cycle means less electricity. The average dishwasher uses about 206 kWh/year. *(epa.gov)*

Conventional dishwasher:	343 kWh/year	1,352 gallons of water/year	$67.68/year
Energy Star dishwasher:	283 kWh/year	884 gallons of water/year	$52.68/year
Savings:	**59 kWh/year**	**468 gallons of water/year**	**$13 /year**

Equivalent to saving **89 pounds of CO_2 /year**

(energystar.gov)

Ovens

Selecting the right kind of oven really depends on the cooking practices. People who use ovens frequently should be interested in high efficient models, but should also know what the best practices are in order to stay efficient. For example, people who peak in the oven while it's on should get an oven with a door window and a light in order to limit the amount of times one opens the oven door. With either gas or electric ovens, self-cleaning models are usually more efficient because they have more insulation. However, if the self-cleaning feature is used more than once a month than more energy will be used than saved.

All types of ovens that are recognized and certified by Energy Star are on average **20% more efficient** than standard oven models.

(Source: energystar.org)

Convection

Convection ovens use roughly **20% less energy** than conventional ovens[iii]. Convention ovens continuously circulate heated air around the food being cooked; therefore, the oven can be set at lower temperatures but still cook in the same amount of time or less. This can account for large energy savings in the kitchen.

The average energy use of an efficient, half-size, Energy Star certified convection oven uses around 3,140 kWh of electricity per year, compared to a less efficient model that uses around 3,638 kWh per year. That 500 kWh difference is equivalent to preventing **760 pounds of CO_2** from entering the atmosphere, and saves **$76 per year** from your utility bill.

(Source: energy.gov)

Microwave

Microwave ovens work by creating very high-frequency radio waves, heating the water inside the food, which will dramatically reducing cooking time along with energy consumption. It is much more efficient to use a microwave oven for cooking instead of a large convection oven because microwave ovens are much smaller. The most energy efficient microwave ovens have automatic temperature control, variable power settings, and sensory cooking that will turn off the microwave when the cook is cooked. Some affordable energy efficient microwave ovens on the

market include: Bosch HMB 8050 ($700), Sharp R-930CS ($500), Dacor DCM24 ($730), Wolf MWC24 ($730)[ix], etc. There are many, many more available, so it would be best to talk to a sales person for other brands and price ranges.

A standard microwave oven uses 0.36 kWh/15 minutes to operate[x]. A slightly more efficient model would use around 0.225 kWh/15 minutes. Let's estimate that a microwave is used for about 15 minutes each week. A standard model would be using 307.8 kWh /year and the other 182.25 kWh /year. That saves you **$19 per year** on electricity, and prevents **191 pounds of CO_2** from entering the atmosphere each year.

Cooktop

Radiant elements and halogen elements are very efficient compared to standard resistance coils (the most common type of electric stovetop). Solid disk elements are the *least efficient* because they heat up more slowly and use a higher wattage[iii].

Induction elements are the newest and *most efficient* type of electric stovetop on the market. It works by transferring electromagnetic energy directly to the pan/pot. This method uses less than half the energy used by a standard electric coil, which as a result introduces less heat into the kitchen. The downside is that this technology is very new, so it is fairly expensive.

The two most important things to know about stovetops:

1) The money spent on operating them is only about 5% (if not less) of a home's totally utility bill, which is very small.
2) Newer style induction cooktops are highly efficient and are able to transfer close to 100% of the energy created onto the pan/pot for cooking, while gas cooktops are only about 55% efficient[iv].

Helpful **Tips** and **Reminders**:

- Match the pan size to the element size. For example, a 6" pan on an 8" burner will waste over 40% of the heat produced by the burner. *(smarterhouse.org)*

Let's say your gas burner is on for an average of 1 hour a day. The amount of natural gas burned in 1 year (using a 25,000 BTU max capacity burner) would be like using 2728 kWh of electricity, which is equivalent to **2.1 tons of CO_2**. An electric stove of the same capacity would only use 2674 kWh of electricity to run the same amount, which saves **82.1 pounds of CO_2** from entering the atmosphere per year, and **$8.20** from your wallet per year. However, you would not see those $8 taken off of your electrical bill, but expenses on natural gas would be eliminated completely.

(Sources: rural-energy.net, epa.gov)

Laundry

Cloths Dryer

Cloths dryers consume a lot of energy, on average about 769 kWh/year. Most homes have a cloths dryer, so there is a lot of opportunity to save energy if everyone made some changes to household habits. Buying a new dryer has its energy saving benefits: sensory drying uses senor drying and not timed drying cycles. Another good practice is to use longer drying cycles on a low heat setting because it uses less energy than a high heat cycle.

Cloths dryers are rated by the Combined Energy Factor (CEF) which is calculated as the clothes dryer test load weight in pounds divided by the sum of "active mode" per-cycle energy use and "inactive mode" per-cycle energy use in kWh[v].

Helpful **Tips** and **Reminders**:

- Clothing damage can be seen in the amount of lint in your dryer.
- Consider air-drying! Cloths last longer when they are air-dried.

(Source: energystar.org)

Cloths dryers that are recognized and certified by Energy Star are on average **20% more efficient** than standard models. The average cloths dryer uses about 547.6 kWh /year (3-4 loads a week). The most efficient Energy Star certified cloths dryer only uses around 311 kWh /year. The 236 kWh difference prevents **359 pounds of CO_2** from entering the atmosphere, and saves **$36 /year**. *(Source: energystar.org)*

Washing Machine

Washers built before 2003 are significantly less efficient than newer models. Just like with dishwashers, thinking about the size of the appliance is important because a large washer uses more electricity but a smaller washer might be used more often, depending on the demand.

Energy Star provides a rating system for cloths washers and dryers: Integrated Modified Energy Factor (IMEF) and Integrated Water Factor (IWF). IMEF measures the energy consumed by the washer during the cycle and while on standby, the energy used to heat the water, and the energy used to run the dryer. A high IMEF means the washer is energy efficient. IWF measures water efficiency in gallons of water consumed per cubic foot of capacity. A low IWF means it's more efficient. Energy Star certified washers use 280 kWh of electricity, and 13 gallons of water per load instead of 23 gallons used by a standard machine[vi].

Helpful **Tips** and **Reminders**:

- Washers *without* a central agitator are more efficient.
- Efficient motors spin cloths fast enough during the cycle to extract more water, which means less energy used by the dryer.

The standard cloths washer uses about 590 kWh /year. Energy Star certified washing machines use around 300 kWh less which is equivalent to preventing **456 pounds of CO_2** from entering the atmosphere, and saves **$45 /year**. *(Source: epa.gov / energystar.org)*

Lighting

Why LEDs?

The very first measure to take when making energy saving renovations, whether the goal is to save money or not, LEDs shouldn't be a question. They use less electricity, saving at least 75% of electricity compared to incandescent bulbs. They also last 3-25 times longer, are very durable, mercury-free, and release 70-90% less heat waste than incandescent bulbs, which makes them much safer (energystar.gov). There are many different types of LED bulb depending on what kind of light is needed[12] (dimmable, certain type of color, etc).

In comparison to incandescent bulbs and CFLs, LEDs are more efficient because they release very little energy as heat. Incandescent bulbs release 90% of their energy as heat and CFLs release about 80% of their energy as heat[i]. Switching from inefficient bulbs to LED lighting has the greatest potential impact on energy savings due to how accessible they are. LED technology is advancing and prices are dropping; now there are available bulbs to replace 40, 60, and 75-watt incandescent bulbs.

Best practices for lighting would be to install sensor or timed lighting. This feature will put a timer or sensor on the lights so that if they are left on for too long they turn off automatically if no movement is detected. Despite the initial investment, it can save people a large chunk of money especially for those who have a habit of leaving the lights on.

Source: brewer-garrett.com

Payback period is typically less than a year. LEDs use up to **90% less electricity** and have a much longer life span. For a typical household, switching to LED bulbs could around **$170 /year**. *(Source: energystar.org)*

Links:
[1] http://www.pge.com/en/myhome/saveenergymoney/usage/index.page
[2] http://coolcalifornia.org/calculator
[3] http://www.mydomino.com/
[4] http://www.sunwork.org/
[5] http://www.ecoproach.com/
[6] http://www.menlopark.org/DocumentCenter/View/1481
[7] http://www.menlopark.org/363/Energy-Upgrade-California
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[9] http://rcmechanicalinc.com/
[10] http://energy.gov/eere/femp/energy-cost-calculator-commercial-heat-pumps-54-20-tons#output
[11] https://www.energystar.gov/index.cfm?c=most_efficient.me_ceiling_fans_over_52_inches
[12] http://eartheasy.com/live_energyeff_lighting.htm#led)
[13] http://www.acehardware.com/product/index.jsp?productId=1386305
[14] http://energyinformative.org/how-to-detect-and-seal-air-leaks-at-home/
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[16] http://www.nrel.gov/docs/fy14osti/60461.pdf
[17] http://www.stoneside.com/location/California/Palo-Alto/Solar-Shades

Sources:
[i] energy.gov
[ii] coolcalifornia.org
[iii] smarthouse.org
[iv] consumerenergycenter.org
[v] efficiency.lbl.gov
[vi] EnergyStar.gov
[vii] consumerreports.org
[viii] siliconvalleyreports.com
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[x] consumerenergycenter.org
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[xii] bayren.org
[xiii] nrel.gov
http://www.clearpath.org/en/youmatter/save-on-power-bills.html
https://www.meterhero.com
https://www.ohmconnect.com