Future Living Skills

Topic: Energy Efficiency

Energy (power) saving in your home –why it matters and how to do it

This learning guide is designed for use by individuals and groups who seek independent information and help with taking action at home, in New Zealand. It includes suggested discussions and activities that support learning and understanding, which could be included in a two-hour class or solo session.

You may not have time to tackle all of these in one session, so read through in advance and make a selection of activities (some require printing) based on where you think the group's emphasis will be: eg towards investments that reduce carbon footprint in the longer-term, becoming warmer and drier at home and/or towards immediate saving of money on power and fuel bills.

The column on the right is for extra information. There are a lot of links to other websites if you need more detail, but don't get lost!

If self-leaning, you will find some activities can be skipped, but others are designed just for you. If you need feedback or have questions, feel free to get in touch with Sustainable Living tutors. Your council will have some contacts of trained staff members or others who have been contracted to offer courses through the council or local boards. They may even have some upcoming classes that you can attend in your area – see the council members pages on the website for those details.

This Learning Guide fits alongside topics on food, water, waste, eco-building and renovation, gardening, transport and community resilience which are also available, free to download in member council areas of New Zealand, at www.sustainableliving.org.nz.

The building topic includes information on embodied energy and passive design principles, which are not touched on here.

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Learning in a group?

If this session is early in the group's experience together, you may want to repeat **introductions?** Try using a remote control handset, passed from person to person. Everyone is quiet 'on stand by' until the remote control is passed to them – they hold it and speak their name and say something about one or two of their electric power uses at home (I'm …. And I use power for…) then pass on the remote control.

Renewable geothermal energy heats water to steam for turbines at the Wairakei power station near Taupo.

NZ has a high use of renewable energy in power generation but still uses some gas and coal.

Huntly power station (pictured below)

Take stock of earlier learning

Activity 1. Start this session by reviewing people's learning so far on 'sustainability at home' and what actions they are beginning to take on topics such as food choices, waste minimisation, gardening, etc. What have been the barriers encountered to taking action and how were they addressed – if people say they 'got stuck', can anyone else suggest a way around the block, such as local information on where to obtain something, or a technique to interest or persuade family members to support a change?

The global context for local action

The **introductory reader on Sustainable Living**, available free on our website refers to peak oil production and climate change, which are relevant global issues. Key points to note are:

- We can start by dispelling a common confusion. The ozone hole (over Antarctica and sometimes as far north as NZ), which is letting in more ultra-violet light from the sun, is not the same as global warming. This high-atmosphere ozone hole actually reduces the warming of Antarctica by letting out reflected and radiant heat, so its gradual recovery (because ozone-depleting chemical emissions are controlled under the internationally supported *Montreal Protocol*) will actually speed up warming.

- Global warming results from the increasing atmospheric levels of various 'greenhouse gases', including carbon dioxide CO_2 from burning fuel, nitrous oxide NO_2 and methane CH_4 from livestock, plus water vapour H_2O. Some of each of these is present naturally, and without them the Earth surface would be too cold to live on. However, the United Nations Intergovernmental Panel on Climate Change (IPCC) has compelling evidence, agreed by thousands of scientists, that the greenhouse effect is being enhanced or accelerated by human actions, especially **fossil carbon fuel burning** (called 'fossil' because we are rapidly burning historic carbon stores, that were accumulated by plant photosynthesis and geological processes over millions of years). The United Nations *Kyoto Protocol* set out to reduce nations' carbon emissions but many nations had either not signed up (e.g. USA, China) or effectively dropped out (e.g. New Zealand). The resulting rise in atmospheric carbon compounds had passed 400 parts per million by 2015, well beyond a proposed 'safe' level of 350 ppm.

- New Zealand carbon emissions have increased by 42% between 1990 and 2013. They have risen due to higher levels of car and truck use (transport is another Future Living Skills learning guide topic), a rising amount of power generation from burning gas, and a rise in cattle livestock numbers – each belching methane from bacteria in their gut as part of digesting grass. Many of the pine trees capturing carbon in NZ since the early 1990s are mature and being felled, leading to a drop in carbon storage, too.

- Global oil and natural gas supplies are finite and most of the easy-to extract land based reserves have been explored and are

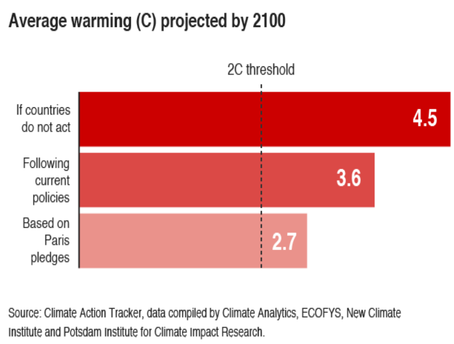
has burned non-renewable coal and gas since 1982 for up to 953 megawatts per annum of NZ electricity generation (5% of NZ carbon emissions). It has consents through to 2037. Operator Genesis is phasing out coal use as part of the NZ target of 90% renewable electricity by 2025.

Power is distributed along and between the two main islands on a 'grid' of high voltage cables. Transmission is inefficient, so not all the power that was generated at a distance reaches consumers.

New Zealand has a high carbon impact per person but a small population in world terms.

The impact of climate change on New Zealand is forecast to be warmer and wetter in the west, and warmer and dryer in the east. See the Resilience topic at our website .

You could reduce your carbon 'footprint' by everyday choices made about energy at home, school and work, on food, and how you travel. See NZ's carboNZero website for calculators .



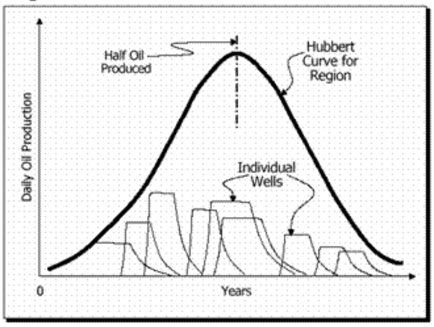
The outcome from Paris International Climate Summit of December 2015 described briefly in this BBC report.

IPCC Fifth Climate Assessment Report 2014 info link

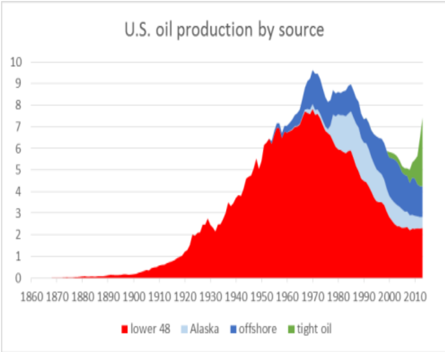
Useful animated graphics on climate change at this page (BBC).

being drawn down towards depletion, with global 'peak cheap oil' production reached. Exploration is moving to deep sea sources such as the arctic and offshore New Zealand and to hydraulic fracturing and chemical extraction (fracking) on land from rocks where oil is locked up too tightly to flow. Both of these methods have greater environmental impacts than pumping liquid oil and risk the investment of energy into extraction close to the energy value of the output, which would make them unviable. It is also very significant that if the globally-estimated oil and coal reserves were all burned, the Earth's atmosphere would be warmed by several more degrees, with catastrophic results. There is a growing need to keep the fossil fuels in the ground and use renewable alternatives, well before we 'run out'. Share prices of fossil fuel companies are falling in response – we are coming to the **end of oil.** For a humorous look at this topic, check out the End of Oil music video.

HUBBERT CURVE
Regional Vs. Individual Wells



Background info on Peak Oil here



USA oil production by source, to 2010 View original at larger size here.

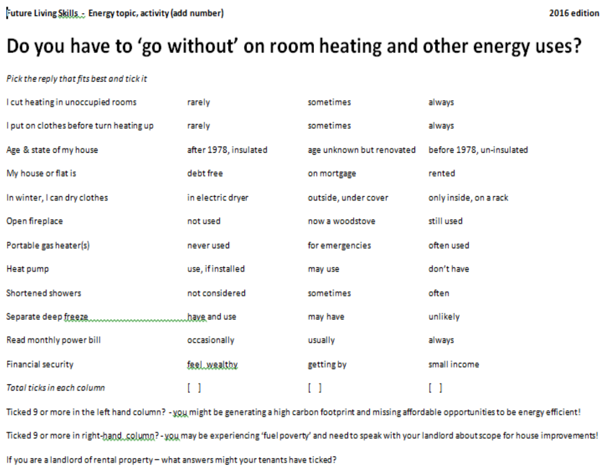
Oil production curve over time for USA shows recent impact of fracking for tight oil (the green colour layer, above red for the lower 48 states' inland oil sources which peaked in 1970, the pale blue for Alaska which peaked in 1990, and darker blue for USA offshore, not expanding.) The USA is still a huge volume importer of cheap oil from other countries, including the political hot spots of the Middle East.

The local social and economic context

Access to energy sources is not equally easy for all the population. New Zealand has many cold and damp homes with inadequate insulation, heating and ventilation, especially those built before 1977. Low incomes mean that about 20 to 25% of the population would have to spend over 10% of income on fuels and electricity in order to live in healthy homes. Sadly, many cannot do this, which is reflected in New Zealand's high childhood asthma rates, winter deaths from respiratory diseases in the elderly, and frequent colds and coughs that keep both children off school and adults off work.

In contrast, households with currently high energy use tend to be those that pay little attention to further-improving the energy efficiency of their house, own many energy-using appliances, and have little regard to energy-efficient practices. This cluster of high energy using households (around 20% of the population) is generally wealthier and thus faces fewer barriers than others to making efficiency improvements, if and when they choose to do so. This group could achieve significant, cost-efficient gains in energy conservation, once informed and motivated. They may also include landlords of the first group!

Activity 2: Identifying 'fuel poverty'.



Future Living Skills - Energy topic, activity (add number) 2016 edition

Do you have to 'go without' on room heating and other energy uses?

Pick the reply that fits best and tick it

I cut heating in unoccupied rooms	rarely	sometimes	always
I put on clothes before turn heating up	rarely	sometimes	always
Age & state of my house	after 1978, insulated	age unknown but renovated	before 1978, un-insulated
My house or flat is	debt free	on mortgage	rented
In winter, I can dry clothes	in electric dryer	outside, under cover	only inside, on a rack
Open fireplace	not used	now a woodstove	still used
Portable gas heater(s)	never used	for emergencies	often used
Heat pump	use, if installed	may use	don't have
Shortened showers	not considered	sometimes	often
Separate deep freeze	have and use	may have	unlikely
Read monthly power bill	occasionally	usually	always
Financial security	feel wealthy	getting by	small income
Total ticks in each column	[ ]	[ ]	[ ]

Ticked 9 or more in the left hand column? - you might be generating a high carbon footprint and missing affordable opportunities to be energy efficient!

Ticked 9 or more in right-hand column? - you may be experiencing 'fuel poverty' and need to speak with your landlord about scope for house improvements!

If you are a landlord of rental property – what answers might your tenants have ticked?

Download the EnergyActivity2 file and print black & white copies for all participants. (If you only have one copy available you could complete it by each putting first names or initials against the answers selected, but it will get cluttered!)

Warming you, or warming the planet?
If you used a wood burner or wood pellet fuel burner at home, instead of burning coal or gas in a central power station and transmitting electricity to heaters at your home in winter, you would save about 0.65 of a tonne of carbon emissions to the atmosphere in a year, per household.

An electric heat pump is about 3x more electricity- efficient so the carbon emission saved by burning wood at home compared to using electricity drops, to 0.22 tonnes.

Users of wet-back water heaters on woodstoves, or solar water heating, will be lower consumers of electricity than households relying on mains power for all their water heating.

Electricity use at home

Electric power is measured in watts and one thousand (or kilo) watt hours is one 'unit' on your meter. The kW indicates the energy rating or intensity (such as a jug-kettle element or an oil-filled radiator rated at 2kW or a light bulb at 60 watts) multiplied by the hours for which it is used. E.g. if a 2kW jug boils water in 2 minutes which is 1/30 of an hour, it has used 1/15 of a kWh.

Group Activity 3. The power use matching game. In preparation for this session, download the PDF file from the Energy section of our website downloads area. Print, preferably in colour, cut up and shuffle the pairs of cards used for this game. They illustrate typical household devices and their energy use. Hand the cards out at random across the group – invite participants to match up and display the pairs (3 mins). Discuss any surprises from what you see when all pairs are displayed on the floor or table top? What are the highest power users and the lowest? Which seem best value for money?

Individual Activity 3.Read the electricity meter(s) and repeat this each day for seven days at a regular evening time, such as just before heading to bed. Record – as below - how many kWh units your household activity used, and note the days on which you are aware of using extra power, such as radiators turned on, doing several batches of laundry, or running a bath with electric-heated water. Don't try to note each kitchen jug use, lights, TV, computer or everyday cooking activity, but perhaps do note if the oven is used for a long batch of baking or roasting. If you have two meters for the household, one of these will probably be a 'day time' meter and the other an 'off peak' meter (for 11pm to 7am when power is cheaper, often when electric hot water cylinders are automatically switched on). In this case note readings for both meters and add the total.

Date of reading	Meter (kWh)	Day's consumption (Day 2-Day 1 etc)	Weather? Gues
Monday	1234	Start point	Add notes for a
Tuesday	1235	1	
Wednesday	1236	1	
Thursday	1237	1	
Friday	1238	1	
Saturday	1239	1	
Sunday	1240	1	
Monday	1241	1	
	Week's total:	7	kWh

From this you can calculate what your recent weekly household power use and cost is, at this time of year. How many people is this for? Divide the averages by the number of people to get a per-person figure.

If meeting regularly as a group, you can compare your readings the next time you meet. You have all experienced similar weather in this sample week but will be from different houses and different lifestyles: so what may best explain some of the power use differences? Finally, convert the weekly household consumption into money cost, based on a charge of, say, 33c per day (=$2.31 per week) for the connection, plus cost per unit consumed of 27 cents (or the rate you pay, if different). What is the cost per person?

Hot water is often the largest power use in a household of four or more, as it has to take water temperature from around 10^{o}C in underground pipes up to a safe 60^{o}C (to kill bacteria). Note also that some additional power has been used to pump the water into your mains supply and more will be used to pump away wastewater and sewage: you pay for that in Council Rates and the supplying company's service charges.

Reading the electricity meter. The numbers displayed usually include tenths of a kWh unit, at the right. There's no requirement here for accuracy down to tenths of a unit, but be consistent if you do record figures below the decimal point, or your use calculations could be out x10.

Your calculations after 7 days:

Note weekly total for household.

Multiply by energy cost (eg27c/kWh) = $……….

Add fixed charges (eg 7x33c) +$2.31 ….…….

Number in household this week …

Weekly cost per person …………..

Note – Is this winter or summer? (Summer weekly power use can double or triple in winter, for more space and water heating, lights)

What power do different appliances use?

Energy Activity 4 – if a plug-through power meter is available for the group session (typically max load 2.5 kW), look at the power used by varied electric appliances, such as an electric jug heating water, a small oil-filled radiator, fridge, hair dryer and desk lamp.

Energy efficient appliances use much less power than their predecessors from an era of cheaper electricity, a decade or two ago. Well insulated and better controlled fridges and freezers, for example, use only half as much power, perhaps 450 kWh a year (compare older models, at perhaps 1300 kWh). If you keep the old fridge running, instead of recycling it, you use in a hot garage during summer, only half-filled (typically with beer or soft drink bottles, that could be easily dry stored until needed?) you are increasing its power demand considerably compared to one that is full and in a shaded, cool house interior. The new 'Energy Star' rated fridges and freezers save around 0.1 tonnes of carbon dioxide per year compared to older models.

Front opening freezers are less energy efficient than the top opening 'chest' type which traps in cold air; whilst front loader washing machines are more efficient than top loader, because they heat and rotate a lower weight of water. The energy efficiency rating of new appliances is indicated in showrooms by Star rating labels and the most efficient earn the special blue Energy Star label. These are available in New Zealand on: heat pumps, solar water heating, dishwashers, laundry machines, fridges and freezers, TVs, computer monitors, copiers and printers, also on lighting and most recently on windows.

The fastest growing domestic electricity demand is from consumer electronics (TVs, computers, games, mobile device chargers) while the area in which easiest running cost savings can be achieved through technology change is in lighting, where compact fluorescent lighting and now light emitting diodes (LEDS) have replaced tungsten filament lamps.

High performing LED lamps (Energy Star) consume between 5 and 13 watts to give light levels that formerly required 60 to 100 watts for a metal filament, which mostly produced heat instead of light. LEDs run cool, which is a fire safety feature when used in recessed downlights. LED bulbs are more expensive to buy than the tungsten filament type, but longer lasting, and if you only had limited total power supply – such as a house operating 'off the grid' with on-site electricity generation - you would need to use LED lighting in order to reduce power demand and thus the size and capital cost of the power generation system.

Annual power use

Through a typical year, power use changes with length of daylight hours and outside temperature. If room heating is all-electric using resistance heaters (and not a heat pump) the winter months peak may be four times as high as summer, and if wood stoves or other heating fuels are used, at least twice as high.

The example below is real data for a small 90m^2 house for two adults which in winter is part electric and part wood-stove heated,

ENERGY STAR New Zealand's Most Energy Efficient Products

Energy star rating labels.

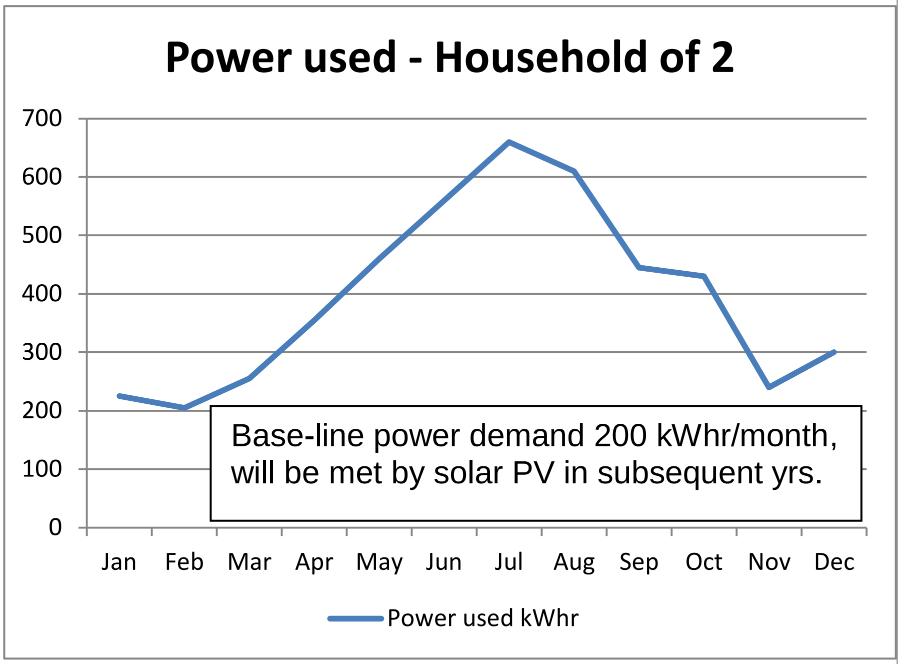
Visit the EECA website for calculator

Little changes add up! In the UK about a quarter of the nation's annual electricity consumption is for domestic appliances and lighting, with a further eighth on space heating (as the UK uses lots of gas and oil for space heating, too). Increasing the efficiency of existing lighting and appliances could save their national grid 26 terrawatt-hours (1 thousand million kilowatt hours) a year by 2030, equivalent to the output of 1500 wind turbines. Source *Global Action Plan* 2014.

For light bulb type comparisons, see this EECA web page, including a two minute video.

One criticism of compact fluorescent (CFL) bulbs has been the complexity of disposal after use: they should not go into general refuse. They contain a fluorescent powder and a very small amount of mercury, but *1000x less* than is used in a clinical thermometer, so the poisoning likelihood is tiny, and the hazard from sharp glass fragments is greater. To be prepared, read how to clean up after a CFL bulb breakage here.

is well insulated and has solar water heating, which reduces power demand for water heating top-up during the warmest two thirds of each year.



Activity 5. Look at your own power bill (if possible ask other group members to bring theirs along too) and see if it includes a graph of power use by month for the past year. Although some months may be estimated rather than actual meter readings, it will give you a sense of the summer to winter variation (driven by shorter daylight hours and colder temperatures) and also the 'base line' of power use that all your daily activity requires at any time of year – in the example above this is 200 kWh per month . Bring the bills & graphs to the next group session, to compare. Keep in mind the number of people in the house or flat.

Electricity generation by PV

Photovoltaic solar systems (PV) convert energy from sunlight into direct electricity. A device called an inverter steps up the voltage to 240V and creates alternating current to match the 50Hz mains (for which home appliances are designed), and will synchronise the connection if you are on-grid. Originally a very expensive option at $79 per watt capacity in the 1970s, and affordable only for spacecraft, silicon crystal glass-covered PV panels have become over 100 times cheaper, to compete with centrally-generated power. Cost per watt of PV capacity will probably not get much lower – indeed, rising metals prices or drop in the New Zealand dollar exchange rate could start to put it up again. Home generated power is now cheaper than grid purchased, but unless you store it, is not available 24 hours a day.

Solar PV capacity of 2.2kW (8 or 9 panels, about 1m x 1.6m in size) could provide daytime power supply for appliances in the

Installing **solar thermal water heating** to substitute for electrical heating, for a household of four, could save 0.45 tonnes of CO2 a year, compared to only using mains power. Photo below shows solar water panels (made in Christchurch), installed on a green roof in South Canterbury.

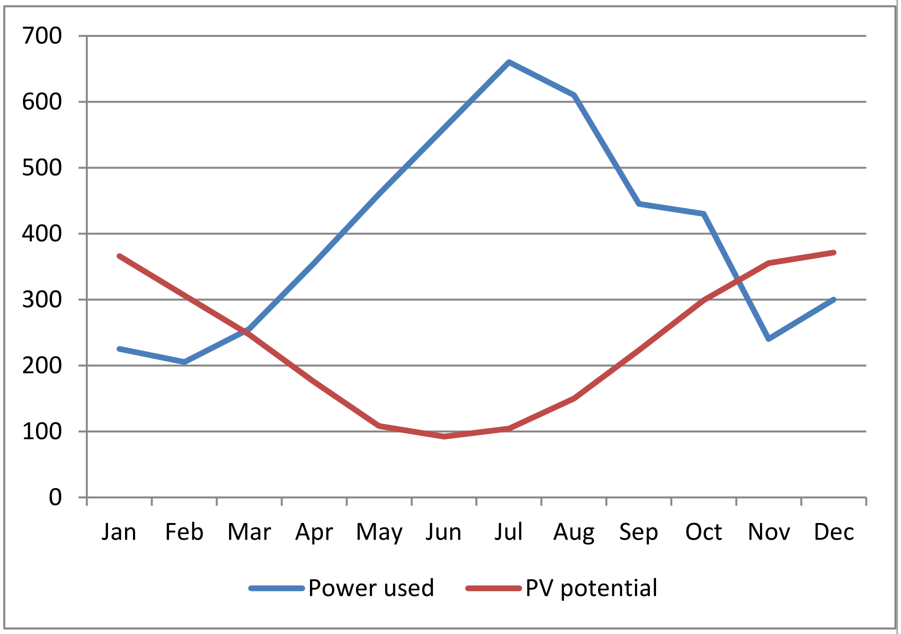
In terms of investment cost, new solar thermal water heating and heat pump water heating systems can be similar. Both require the services of plumber and electrician to install and need building consent. They are best value when designed and installed in a new build project. Compare pros and cons of various water heating options at EECA website and to find out which option has the best financial payback in your household, fill out their online calculator.

Installing about 2kW of **PV generation panels** facing north at home could save about 0.5 tonnes of CO_2 emissions annually by substituting for centrally generated and transmitted power. The warranty life of PV panels is about 10 years and working life up to 25 years, (although generating efficiency will have dropped to perhaps 80% by that age).

It provides significant lifetime carbon saving for the country by substituting for fossil fuels at power stations, but the *power saving benefit to the installer* is only for the daytime direct use or for stored power in batteries or in hot water. Any summer daytime power surplus sent back to the grid earns only 8c per kWh in 2017 with most retailers compared to grid power purchase charged at, say, 29c per kWh.

It therefore does not 'pay' to install a larger system than your expected daytime power demand, including battery charging and water heating. If you are based at home with family or working from home it makes more sense than if you are a commuter.

The advent of electric vehicles (EVs) has given homeowners the ability to store solar energy in the car battery for small household described above for most of the year), with a small surplus during summer days to export to the grid and/or store (either in batteries or in hot water) ready for use in the evening or following morning. However, they would not generate enough in winter to make a dent on power demand for electric heating of rooms and water. The amended graph below shows a manufacturer's estimate of 2.2kW capacity PV generation at that location (by month, in red) compared to recent power use in that two person household (in blue). When you most need power generation is not when PV provides it!



Electrical efficiency gains and fuel choices

Doing more with what power you can afford, whether brought from a retailer and/or generated on site, is the challenge for any household seeking to reduce their carbon footprint and save money.

Appliance updates, such as the Energy Star fridge discussed above, can make significant improvements. Where to locate a fridge or freezer is also relevant – a cooler room, away from sunlight from north or west windows is preferable, or they will have to work harder and cost you more. Avoid an un-insulated garage!

Save energy by switching from an older-type top loader washing machine to a modern front loader, then washing clothes mostly on cold cycle using liquid instead of powder detergent, and only running the machine with full loads.

Arranging outside covered space for clothes drying will also remove most of the need for an electric tumble dryer, which could save annually about 0.17 of a tonne of CO_2.

Clothes dryers are energy hungry, costing $1 in power per load. Alternatives include a covered line drying area, but in some places rain and high humidity will thwart you. Have a "winter" line

later reuse in the home.(See our **travel topic** for information about battery powered cars and bikes)

Hybrid panels that generate electricity and collect heat for water have been designed overseas but are not yet available in New Zealand: their appeal is collecting useful heat which also keeps the PV surface cooler – for panels to work at best electrical efficiency.

If your home is a long way from existing mains grid supply lines, investment in battery storage and a larger array of PV panels becomes cost-effective, as in this example photographed on a Canterbury farm: these panels are motorised to track the sun by day, increasing efficiency. Lower cost panels today make it sensible to buy a few extra but fix all at north orientation, without tracking machinery.

Optional Activity 6. Revisit the matching appliances picture pairs of activity 3, and sort into (a) ones that could be daytime solar PV powered in your present home and lifestyle and (b) ones that could not. What might your daytime power demand be? Would you have to change habits?

for use in a covered place such as a carport.

If you are buying a dryer, ensure that it is 'Energy Star' efficient and that you vent the steam from it to outside the house or flat. If you can't vent steam, consider a condensing dryer that collects water driven off the clothes, using heat pump technology.

Hot water temperature arriving at the tap should not be above 55°C to avoid scalds, but we find some home cylinder thermostats are set very high – if your water arrives too hot at the tap, set the cylinder thermostat to around 63°C.

A heat pump transfers more energy than it takes to run it, using technology similar to refrigeration, so each 1 kWh of output takes perhaps 300 watts to provide. They can be used to heat water or air. The cost of 5 to 12c per kWh for a daytime heat pump compares to 15 to 22c per kWh output for a block-storage heater or elements in a concrete-floor when 'charged' on night rate power; and to 25 to 30c for daytime heat from plug-in radiators or bar fires. Using a heat pump to cool your house is a potential energy waster – window shading and ventilation may do a better job. For heat pump advice download this PDF guide from the Eco Design Advisors.

For comparison, an enclosed wood stove costs 10 to 28c per kWh for fuel depending on stove size, wood type and how dry it is (dry wood burns hotter), but it's often harder to control output and you may overheat the room, which wastes valuable firewood unless surplus heat can be transferred within the house into cooler spaces. Target air temperatures would be 18°C in living room and 16°C in bedrooms whilst outside air might be ten degrees lower.

Open fires are nearly three times as inefficient as wood stoves, and should be avoided as they often suck more heat out of a house than they produce.

Un-flued LPG gas heaters, in metal cabinets that roll on castors, are the most expensive per kWh of heat output, at 30 to 40c per kWh. They have further disadvantages, created because they have no chimney to outside: the combustion fumes include poisonous carbon monoxide which can suffocate you – and also the water vapour produced from burning the gas accumulates at a litre an hour, making your home air damp and therefore harder to heat. Read more here on health hazards. (link to http://www.health.govt.nz/your-health/healthy-living/environmental-health/household-items-and-electronics/unflued-gas-heaters)

Quick actions that save $$s

New heating, hot water and appliance choices may have to wait for you to save-up for purchases, so what actions can you take immediately to reduce power bills and move towards a warmer, dryer, healthier home?

Activity 7. Before studying these notes further, have a quick brainstorming discussion within the group on ways to reduce expensive power waste by being more efficient. Focus on behaviours as well as gadgets or appliance purchases. Write these down on a larger sheet of paper (at least A3 which is two

Line drying the laundry. Although free summer sun UV light bleaches colours if the line is un-shaded, it does help to kill house mites and freshens. Consider erecting a line in a sheltered spot – as long as it catches a breeze, it will dry just as fast and you won't have to worry about rushing out if it rains. Tumble dryers wear out fabrics faster than line drying, but are better than the worst choice, which is drying clothes on a rack inside – one of the main causes of damp and unhealthy homes.

Setting a timer on an oil-filled radiator. This one has an adjustable thermostat and option of two levels of heat input.

Electric room heaters with thermostats give you 1kWh of heat, or 100%, for each kWh you put in. That makes them inefficient compared with the 300-400% efficiency of a heat pump. Adding a timer before the plug (or using a radiator with timer built in) makes for best efficiency, as you decide when heat starts and stops. Some panel heaters have a sensor for darkness which will drop thermostat temperature by 2° when the room light is turned off, and back up when the light is on; plus a motion sensor

A4 sheets side by side) so that all can see it. After the discussion, ask if anyone is ready to try out an action that is new to them and write their name against the idea: you could re-visit this sheet at the end of the series?

Ten top healthy, power-saving ideas

1. Use curtains on your windows, preferably lined and with pelmets at the top and fabric reaching the floor. If you can't afford to buy curtains new, check if there is a curtain bank nearby, for free or cheap recycled curtains.

2. Take fewer baths: have shared baths, or shower instead, especially if the shower is 'low flow'(see notes at right).

3. Open windows and close the bathroom door after your shower or bath, or better still install a bathroom wall fan, connected to the light switch and with a run-on timer to ensure it runs for 8-10 minutes after you leave the bathroom. Steam disperses outside and the house stays dry (damp air takes more energy/cost to heat). The same advice applies to clothes racks if used indoors.

4. If you rinse dishes before loading a dishwasher, run the cold tap instead of hot. And if you notice that a hot tap drips, get that tap fixed to save up to $35 a month. Read more on drip fixes.

5. Add an insulating jacket around the hot water tank, especially if it is older than 15 years and has no 'grade A' label displayed. For any cylinder with exposed hot pipes, it costs only $5 to buy insulating foam rubber tubes to clip onto them - an easy DIY install.

6. In the kitchen, keep lids on pans when boiling and turn the temperature down. Use an extract fan or range-hood to shift cooking steam outside. 7. Plan ahead by defrosting frozen foods overnight in the fridge, instead of power-defrosting in a microwave. It helps to keep the fridge cool, which saves on fridge running costs instead of costing you money for microwave power! There is also evidence that microwaves could be harmful for the food and your health, so use with discretion.

8. Add a timer to a heated bathroom towel rail, which can be installed via behind the wall switch, or as a smart wall switch (by an electrician).

9. Store firewood dry, protected from the weather as it will burn hotter, so you will need less top-up electric heating. Consider installing heat transfer flexible ducts with quiet fans from the ceiling in the woodstove-heated room to cooler areas. Turn fan off overnight.

10. If you use a clothes tumble-dryer, clean the lint filter after each use to aid air circulation efficiency and speed up drying (the lint is fibres worn off your laundry – it's also a fire risk)

Are you **choosing the right heater** for an insulated room and want to avoid over-heating? The EECA website may help. www.energywise.govt.nz/your-home/heating-and-cooling/types-of-heater

A bath uses three times as much heated water as a shower, but there are still right times for a long soak (maybe with Mr Ducky!)

Low flow shower heads or flow restricting inserts deliver about 7 to 9 litres per minute. See this EECA video ($5^1/_2$ minutes) for how to measure and then reduce the flow. Even a reduction of one litre per minute could save your household about $80 per year on water heating.

Refer to **our water topic** for more on this.

For information on house insulation and 'Warm Up NZ', see the companion Future Living Skills learning guide on eco building and renovation

For more in depth advice, including free visits in participating council areas, contact the nearest Eco Design Advisor.

To arrange a home energy efficiency assessment (or telephone advice) if provided in yourdistrict or city , contact the Community Energy Network.