



HOME ENERGY AUDIT TOOLKIT

INSTRUCTION MANUAL



DUNEDIN | kaunihera
CITY COUNCIL | a-rohe o
Ōtepoti

HOME ENERGY AUDIT TOOLKIT

Measure and improve the energy efficiency and performance of your home

Understanding how your home is performing is the first step in working out how create a warmer, drier home that's also cheaper to run. This toolkit is designed to help you identify the areas of your house that are performing well and where you can do some work. A well performing home is easy to heat, dry and energy efficient.

This toolkit can help you to:

- Keep your home warm
- Keep your home dry
- Save on hot water
- Save on appliances and lighting

The average New Zealand household spends around \$2,500 a year on energy and heating. By making some changes, you can reduce costs and may save hundreds of dollars a year.

If you have any questions or would like help using this toolkit please contact the DCC's Eco Design Advisor on 03 477 4000 or ecodesign@dcc.govt.nz

HEAT KIT CONTENTS

This kit contains the following:

- An infrared thermometer for finding hot spots or cold spots and identifying areas of poor insulation or air leaks. (worth approximately \$90)
- A thermometer/hygrometer for measuring air temperature and moisture levels in different parts of your home. (\$25)
- A stopwatch – for checking your shower flow rate. (\$19)
- A power meter for checking the energy use and the running costs of your major appliances like your fridge or freezer. (\$35)
- A moisture meter for measuring the level of moisture in firewood (\$35)
- A thermometer for measuring water temperature (\$12)

This booklet is yours to keep. In it you'll find:

- Instructions on how to use the devices above and what the measurements mean. You can also download a copy from the DCC website.
- Space to record your measurements and energy saving actions.
- A list of websites where you can find further information.

KEEPING THE HEAT IN

Heating is expensive, so save money by keeping the cold air out and the warm air in.

Start by using the thermometer/hygrometer to measure the indoor air temperature (especially in winter) and identify areas of poor insulation or where there are air leaks.

Hygrometer

Use the thermometer to measure temperatures in different rooms over the course of a day and night.



How to use the tool:

- Check the switch on the back is on “C” so the unit displays temperatures in Celsius
- Press the reset button to clear the memory from previous use.
- Allow the temperature reading to steady before writing down the reading. This could take up to 5 minutes.

Leave the unit on in different rooms of the house (bedrooms, living room) while the room is occupied. For example, in bedrooms generally you want to measure overnight, in the living room it might only be in the evenings. Before you leave the room, push the button marked “Thermo max-min.” This will record the maximum and minimum temperature. Write this down and press reset before doing measurements in another room.

What do the measurements mean?

The World Health Organization recommends minimum indoor daily temperatures of 18dgC for adults and 21dgC for households with children, elderly or people with serious health conditions. Temperatures below this increase the chance of illnesses, including respiratory problems. The temperature of the air you breath affects your health, so wrapping up might keep you warm but it doesn't help your health.

Infrared thermometer

Next, use the infrared thermometer to detect hot or cold spots on walls, ceilings, floors, fridges and window seals. This helps to identify areas of poor insulation or air leaks.



The infrared thermometer measures the surface temperature of whatever it is pointing at. Take your measurements at a time when inside temperatures are very different to outside e.g. on a cold winter evening with your house heated to comfortable temperatures.

Point the device at the surface being measured (e.g wall, ceiling) and hold down the trigger. The closer you are to the surface the more accurate it will be. If the surface is reflective it won't be as accurate.

DO NOT POINT THE LASER INTO SOMEONE'S FACE.

Children should not be allowed to use the infrared thermometer - a laser can cause permanent eye damage if pointed into eyes.

What do the measurements mean?

Ceiling

The ceiling temperature should be the same across the whole room (within a few degrees). If part of the room has a cooler ceiling temperature, it's a clue that the insulation above has been dislodged or was poorly installed. Check several areas as insulation levels may differ across the ceiling. Problem areas are often around recessed light fixtures and attic access doors. When checking the temperature around lights, make sure they are off and have been off long enough to have cooled down to avoid false readings.

Floors

If part of the room has cooler floor temperatures, it is a clue that the underfloor insulation has been dislodged or was poorly installed.

Walls

Measure the difference in surface temperature of an interior wall (both sides are in the house) compared to an exterior wall (one side is indoors, the other is outdoors) in the same room. The difference in temperature is an indication of how well the walls are insulated.

Check for air leaks around windows and doors by slowly moving the laser pointer around the seal on the edges of windows and doors. Any leaks will show up as cooler spots.

Next steps

If the checks you've done show there's room for improvement, you can take the following steps to warm up your home.

1. Upgrade/install effective insulation. Insulation will make it easier and more affordable to heat your home to a comfortable temperature. Ceiling and underfloor insulation can reduce heat loss by up to 50%. Ceilings should have two layers of insulation. If needed, wall insulation is best retrofitted during renovations.
 - a. If you have recessed lights and found cold temperatures around the fittings, it may be because you have an older style of light and insulation around it would cause a fire risk. Ideally change to an LED light fitting that can have insulation added over the top.
 - b. For more information including videos on how to check your insulation levels see genless.govt.nz/insulating-your-home.
 - c. Check to see if you're eligible for a grant that covers 90% of the cost of ceiling and underfloor insulation: tools.eeca.govt.nz/warmer-kiwi-homes-tool or call 0800 749 782.
 - d. If you can't afford the upfront cost of insulating, you may want to be part of the DCC's Warm Dunedin programme which lets you repay insulation costs with your rates. Information and criteria are on the DCC website dunedin.govt.nz/warmdunedin or call 03 477 4000.

2. Block draughts. Make sure your windows and doors fit their frames. Use draught stopping tape around windows and doors and draught excluders or door snakes along the bottom of doors. Check hinges and locks, sometimes they need to be moved or replaced to make sure the window is fitting snugly. This could save up to 20% of your heating bill.
3. Open curtains (including nets) fully during the day to take advantage of free heat from the sun. Shut curtains at dusk to retain heat. If you don't have them, consider installing lined curtains/blinds if you don't have any.
4. Fit curtains that have little or no gap at the top (or use tracks that fit directly to the wall), extend beyond the edges by approximately 20cm and reach all the way to the floor. If you have a community services card you may be eligible for assistance from a curtain bank. If you prefer blinds to curtains use well-fitted, lined roman blinds, honeycomb or cellular blinds for superior thermal performance.
5. You can make curtains by using your linen cupboard – pin a sheet to a curtain to act as a lining or use a blanket to make an extra thick curtain that you can then tuck over the curtain rail to block draughts. Get creative!
6. Ideally all windows (except the bathroom) should have a window covering).
7. Windows lose more heat than any other part of a building so also consider acrylic secondary glazing, DIY window-film kits (for timber frame windows only, from hardware stores) and even bubble wrap (dampen the glass with water then the bubble wrap will stick on the window). These can cut heat loss through windows by half and are a fraction of the cost of double glazing.

If you have questions or want more information, contact the DCC eco design advisor or visit www.genless.govt.nz.

HEATING OPTIONS

During colder months even insulated homes will likely require a heating source to reach the recommended indoor air temperature of 18°C or greater.

Funding assistance is available for heat pumps and efficient pellet or wood-burners from EECA's Warmer Kiwi Homes program. Go to tools.eeca.govt.nz/warmer-kiwi-homes-tool or ring 0800 749 782. If you don't qualify for this assistance, you may want to consider the DCC's Warm Dunedin scheme which allows homeowners to repay the cost of installing heating with rates payments. Information and criteria are on the DCC website dunedin.govt.nz/warmdunedin or call 03 477 4000.

To find the right heater for your home and to see what it will cost to run, go to genless.govt.nz/heating-your-home and read the factsheets at ecodesignadvisor.org.nz/resources.

Electric heating running costs

When choosing an electric heater, it's important to consider both the type of heater and the room you're heating. This will help you to choose the most effective heater for the room. For example, most oil column heaters heat straight up which means they're not a good choice for a room with high ceilings.

When you buy a heater, consider what it will cost to use. For example, if you're paying 25 cents per kWh of electricity, you can expect to pay the following:

| Electric heater – e.g. oil, fan, radiant | 1 hour at full power |
|------------------------------------------|----------------------|
| Heater small - 1200 W or 1.2 kW | 30 cents |
| Heater medium - 2000 W or 2 kW | 50 cents |
| Heater large - 2400 W or 2.4 kW | 60 cents |

Bedroom heating

For your bedroom it's best to have a heater with a good thermostat, ideally a timer (or a separate plug in timer) along with safety cut offs in case it gets knocked. Any heater should be placed at least 1 metre away from other objects. If you have high ceilings or large rooms, you'll want a heater that circulates air (a convection heater). If you just want a short burst of heat then it is normally best to try and just heat the people using a fan heater or a radiant heater.

Heat pumps

To work at their best, filters need to be vacuumed/washed regularly and ideally have the temperature set between 18-22dgC. Any higher and the energy use will increase significantly. The fan speed should be set to automatic.

Unflued LPG heaters

Unflued LPG heaters are not recommended due to the amount of moisture and pollutants they release. If they are used, it should always be with an open window for ventilation. Never use them in a bedroom because there's a high risk of carbon monoxide poisoning.

Wood burners

Wood burners are a great source of heat and often produce excess heat. You may want to consider having a heat transfer kit or a ceiling fan installed to try and move heat around the house.

Checking the moisture level of firewood



Use the moisture meter to check how dry your firewood is. If the wood is too damp the fire will produce less heat and more smoke.

How to use the tool:

Turn the moisture meter on. Make sure the tree symbol is showing – if not push the mode button. Take off the cap and push the prongs into the end of the wood.

What does the measurement mean?

The measurement gives the percentage of moisture in the wood. Ideally the moisture level should be below 25% and generally the drier the better. If your firewood is above this it is best to store it for a bit longer and let it dry out further. Often the most economical way to buy firewood is to purchase it in the summer and then stack it to dry, ready for use the following winter. If the wood is newly cut you may have to wait until the following winter to burn it.

KEEP YOUR HOME DRY

Removing moisture at the source and daily ventilation are key to keeping your home dry. It can be useful to understand the humidity levels your house is at now and how your actions affect them. Reducing moisture levels will reduce condensation and mould. It also makes it easier to heat your home.

Hygrometer



Use the thermometer/hygrometer to measure moisture in your home. Leave the unit on in different rooms of the house (bedrooms, living room, bathroom) for 24 hours. Once you have finished measuring a room push the button marked “Hygro max-min.” This will record the maximum and minimum humidity. Write this down and press reset before doing measurements in another room.

What do the measurements mean?

In Dunedin indoor relative humidity levels of 40 – 60% are ideal. Levels over 65% mean that mould can thrive and respiratory illnesses may be aggravated. Reducing moisture levels during will reduce condensation and mould.

What can I do to make my home dryer?

- Ventilate - try opening windows on opposite sides of the room/house to allow a breeze to blow through and watch the relative humidity drop on the hygrometer. This should be done once or twice a day for at least five minutes and up to half an hour. Check the humidity while doing this – if it’s high, you can see it drop by 10% in only a few minutes. Leaving your windows/doors open longer in winter means all the heat stored inside will be lost and your house will be hard to heat up again.
- Remove moisture at the source. Install a damp-proof membrane/ground sheet on the ground under your house. Even when the ground seems dry, up to 40L of moisture can come up from the ground each day under a 100m² house. These can be installed for free as part of the Warmer Kiwi Homes scheme. Check the website to see if you qualify energywise.govt.nz/warmer-kiwi-homes-tool. If not, you can contact an insulation installer for a quote or for guidance on installing it yourself visit www.ecodesignadvisor.org.nz.
- If you don’t have one, install and use a bathroom extractor fan and a rangehood in the kitchen. Make sure they are vented to the outside (rather than the ceiling). Ideally open your windows a little bit when using the extractor fan to improve its effectiveness.
- Avoid drying washing inside. A load of washing will release 3-5 litres of water. At least partly dry washing outside before finishing inside if needed.
- Wipe condensation off windows and dry the cloth outside. This will also let more sunshine in, helping to heat the house.

For more information visit ecodesignadvisor.org.nz/resources, www.genless.govt.nz or contact the DCC’s Eco Design Advisor on 03 477 4000.

SAVE ON HOT WATER

Hot water is about one third of a typical household's energy use. If there's a sudden increase in your electricity bill, often it's due to an issue with your hot water heating. You can make savings in two ways – make some changes so you're using less hot water and improve the performance of the cylinder.

Measuring shower flow rate



You'll need the stopwatch and a 10L bucket (the regular size of a household bucket). On the timer, press mode unlock until the display shows all zeros. Turn the shower on to full at your normal showering temperature. Use the start/stop button to time one minute while you fill the bucket.

If there is more than 9L in your bucket after one minute, the shower flow is higher than ideal. If the bucket overflows, try doing the test for 30 seconds and then double the amount of water in your bucket to calculate the shower flow.

An efficient shower should have a flow rate of 6-9 Litres per minute. Any higher than this and you're spending more on hot water than is ideal.

What do the measurements mean?

The higher the shower flow above 9L per minute, the more money and water being wasted. It is possible to have very good shower quality from with a flow rate between 6-9 L per minute.

What can I do to use hot water efficiently and save money?

Replace your shower head with one that has a more efficient flow rate of 9L a minute or less. This will cut your hot water use significantly or you can install an inexpensive shower flow restrictor. Reducing the flow rate by 1L per minute could save a household of three people around \$80 a year.

EECA has a video which demonstrates how to measure flow rate and how to install a flow restrictor or shower head <https://www.youtube.com/watch?v=AhZYXwteCx4&feature=youtu.be>.

Another way to use less hot water is to cut down on baths, limit shower time to 5 minutes and use water for washing. For more information on saving on hot water go to www.genless.govt.nz.

Measuring water temperature



Use the thermometer to test whether your hot water temperature is set correctly.

Ideally do this at the tap closest to the hot water cylinder. Run the hot tap on full until the temperature stabilises. Place the thermometer in the stream of water and record the temperature.

What does the measurement mean?

Hot water temperature at the tap should ideally be 55dgC, or within a few degrees (53 – 57dgC). Temperatures above 55dgC are unsafe as you could get burnt. If the temperature is too high you're also using more energy than needed so it is a good idea to turn the temperature down. A tap temperature less than 50dgC means the temperature inside the cylinder is too low, presenting a risk that harmful bacteria may grow.

Continuous flow gas systems deliver hot water between 38-55dgC and this is not a problem.

Improving the performance of electric hot water cylinders

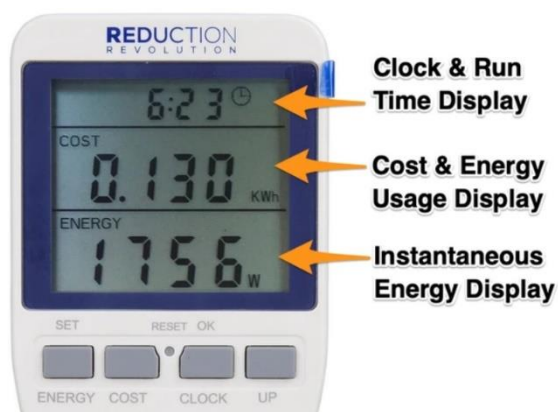
- Adjust your thermostat, wrap your hot water cylinder and hot water pipe.
- Depending on your cylinder, if the hot water tap temperature is not between 50-60dgC you may need an electrician or plumber to adjust your thermostat. It should be set to 60dgC. If you do it yourself make sure you turn off the hot water cylinder first.
- You should insulate the first 1-1.5m of hot water pipe from the cylinder by putting lagging around the pipes.
- All electric hot water systems can benefit from a cylinder wrap.

If you're away for a few days and can see your daily electricity usage online it can be interesting to look at how much power you are using when no one is home. The majority of this will be for the hot water cylinder and bigger appliances such as fridges and freezers. The electricity used while you're not at home is considered your base load. Wrapping your cylinder and pipes and turning down the temperature if needed will help to lower this.

SAVE ON APPLIANCES

Household appliances accounts for approximately a third of a typical household's energy use. The majority of this is for the appliances you run all the time such as the fridge and freezer. Start by checking how much energy your major appliances use and make sure your fridge and freezer are working efficiently.

Use the power meter to measure how much electricity various appliances are using in your home. By figuring out what the biggest energy users are, you can adjust your usage by unplugging or using the appliance less.



How to use the tool:

Always turn off the electricity at the power point when plugging and unplugging appliances into the power meter. Do not use with appliances totalling more than 2.4kW. Do not use in places where the power meter could become wet. Plug the power meter into the power point on the wall or on an extension cord and then plug the appliance into the front of the power

meter.

Before you start, find out the "unit cost" per kilowatt hour (KWh) from your electricity bill and programme it into the power meter. If you don't know the unit cost, assume it's the average unit cost of 25c/KWh.

1. Press the COST button for 2 seconds and release.
2. Press the UP button to choose your currency symbol then press OK to set.
3. Press OK to select TARIFF 1 and press UP to change the value.
4. Press SET to save and move to the next digit.
5. Repeat the process until you have entered each digit.
6. Press OK twice to exit.
7. *We recommend you enter your tariff the nearest whole cent per kWh. So, if your electricity bill says 27.678 c/kWh you should enter **00.28***

The instantaneous energy display at the bottom gives you the energy use in that instant. This can be good to see the standby usage of an appliance. By pushing the Energy button you can scroll through different readings but the most important is W.

To measure an appliance over a time period you need to switch from clock to run time display. The Run Time mode enables you to use the meter for an ongoing tally of energy use (plug it in and come back after a period of time).

1. Press the CLOCK button to switch between Clock Time (clock icon) and Run Time (no icon) in the top part of the display screen.
2. **To reset** the run time clock press SET and CLOCK at the same time.

The Run Time reading will accrue as long as the appliance is drawing more than 2W of power. There is also a day count shown in the middle section of the screen if the Run Time exceeds 24 hours.

Cost & Energy Usage Display - The middle part of the screen shows four values. Press the COST button repeatedly to scroll through them.

- \$ - Total cost since last reset.
 - **To reset** press SET and COST at the same time.
- kWh - Total energy usage since last reset.
 - **To reset** press SET and UP at the same time. Also resets kgCO₂, Max W & Min W at the same time.
- kgCO₂ - Cumulative CO₂ emissions at a pre-set value.
- TARIFF 1 & 2 - As per the 'Tariff Set-up' above.

Common Power Meter Usage Examples

1. Appliances that switch on and off all day (like refrigerators & pumps).
 - a. Plug the appliance into the power meter for at least 24 hours. Note the total kWh used and compare this to the average on your power bill (kWh/day). An appliance that uses 1kWh in 24 hours, on a 10kWh/day bill, represents about 10% of total power usage.
2. Appliances that complete a set process (like kettles, dishwashers & washing machines).
 - a. These can be reviewed over one full cycle. In this way the running cost of different settings can be checked, such as a 'hot wash' versus a 'cold wash'. Review total kWh used and total cost at the end of each test.
3. Appliances that are used for a set time period (like heaters & computers).
 - a. These can be reviewed over their typical usage time. If you normally use the TV for 4 hours in the evening, measuring it over this period will indicate its contribution to your power bill.
4. Electronics that are on all day in standby (like TVs & stereos).
 - a. Spot check how much power these items use in Watts. Anything drawing above a few watts constantly can be switched off at the wall when not needed.

Fixed wired appliances

The power meter can't be used for heat pumps, ovens and hot water cylinders as they are typically not plug-in appliances. Heat pumps and hot water cylinders are used for many hours at a time and need special attention when trying to cut electricity use and bills. Heat pumps are a very energy efficient technology for both space heating and water heating provided they are sized, installed, maintained and

used properly. Understanding the different settings and how to programme will help you to use them effectively.

Other ways to understand appliance usage

If you're having trouble with the power meter, below are three other options for understanding appliance use.

Using the appliance label and calculating

Follow the steps below:

1. Find the wattage on the appliance label. Most high-power appliances have an energy label on the back or base of the appliance.
2. Multiply wattage by hours used each day.
3. Divide the result by 1,000.
4. Multiply your answer by the number of days you're measuring (eg x 30 to calculate power cost over a month).
5. Multiply by the cost of electricity per kWh (eg x 0.25 for 25 cents/kWh).

Check online

Use the appliance energy rating label in conjunction with the Genless running cost calculator genless.govt.nz/running-costs-calculator

How can I save costs running household appliances?

- Choose energy efficient appliances. You can cut down on running costs by choosing the right size and type appliance for your needs and taking note of the stars on the energy rating labels. The model with the most stars is the most energy efficient. The Genless Rightware tool can help you compare efficiency and running costs. genless.govt.nz/rightware-for-the-home
- Turn appliances off at the wall when not in use rather than leaving them on standby. Some older appliances may have 15-20 Watts standby power, costing \$35-45 a year even when you're not using them.
- Make use of timers/thermostats. Use timers on electric heaters to pre-heat rooms outside of peak periods and thermostats to avoid overheating rooms. Use timers for towel rails that come on automatically at certain times of the day.

Fridges and freezers

- If you have one, get rid of your second fridge or freezer – they are expensive to run if you don't really need them.
- Make sure there's space between the back of the fridge/freezer and the wall (3-5cm) and both sides (2-3cm). This is important because it allows free movement of air to take away the heat given off by the outside of the fridge. Poor air circulation may double the electricity use of a fridge or freezer.

- Check that the temperature is set correctly - freezers should be between -15° and -18°C, fridge compartments should be 2°C to 4°C. You can use the thermometer/hygrometer in the kit to check the air temperature inside the fridge and freezer.
- Ensure that fridge and freezer doors are sealing properly.

Checking for air leaks and ensuring good ventilation

Put a torch into the fridge at night (with the room being dark) to see if light comes through the seals. Also look for sections that are cracked or brittle or pressed out of shape. You can also try putting a piece of paper in the seal and closing the door. If the seal is working properly, it will hold the paper firmly.

Use the infrared thermometer to check the wall temperature behind the fridge/freezer and then the wall a meter or so away from the fridge/freezer. If the wall behind the fridge is one degree or warmer than the same wall but away from the fridge/ freezer it shows that there is not enough ventilation or space behind the fridge to allow the condensers at the back to cool.

Lighting

LED lighting is one of the easiest ways of saving on your power bills.

A 14 W LED bulb puts out the same amount of light as a 100W incandescent bulb, but costs much less. Even though the LED bulb may cost more, they pay for themselves within a few months. With the longer life of the LED bulb, they save \$100-\$300 per bulb over their lifetime.

| Bulb type | Cost for 1 year, used for 5 hours a day |
|--------------------|-----------------------------------------|
| Incandescent 100 W | \$45.65 |
| LED 14 W | \$6.40 |

If you're unsure which LED bulb you should buy and it can be a good idea to take your old bulb to the shop with you so you can compare light output. LEDs also offer both warm and cool light options – generally for inside the home warm light is best.

If you have recessed downlights it is best to change the whole fitting to an LED fitting that is rated to be covered by insulation.

PRICING YOUR POWER PLAN

Being on the wrong plan or with the wrong power company can cost you a lot of money.

- Get in touch with your electricity company to see if you're on the right plan. If you've had a significant reduction or increase in electricity use lately, there may be a better plan for you.
- Check Powerswitch to see if there might be a better deal for you, this could mean significant savings in your power bill. powerswitch.org.nz
- Compare your unit cost of electricity and daily fixed charge with friends, family and neighbours or approach other power companies and ask what they can offer you.

It can be useful to record some details from your electricity bill to give you an idea of what you're currently using. You can then compare this over time. Remember the weather has a big effect on your power bill as heating can cause a large increase during colder months.

ALL DONE?

Please check you've returned the instruction cards, manual and all six tools to the kit.

If you've found any of the tools are faulty or that batteries have run out, please let a librarian know when you return the toolkit to the library.

We'd love to know what you think of the kit and whether you have any ideas for improvement. Please let the Eco Design Advisor know by emailing ecodesign@dcc.govt.nz or calling 03 477 4000.

Further advice

Homeowners, landlords and tenants in Dunedin can seek tailored advice from the DCC's Eco Design Advisor. The free service involves a consultation at people's properties, looking at each household's situation and offering a range of advice, including some no and low-cost options.

You can make an appointment at dunedin.govt.nz/eco-design-advice, by emailing ecodesign@dcc.govt.nz or calling 03 477 4000.

Online resources

- The Eco design advisor website: ecodesignadvisor.org.nz
- Assess your home using the free HomeFit Online Check: homefit.org.nz
- Visit the government's energy efficiency website genless.govt.nz