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From the Editor

About ReNew

ReNew is published by the ATA (Alternative Technology Association), a non-profit community group concerned with the promotion and use of appropriate technology. *ReNew* features solar, wind, micro-hydro and other renewable energy sources. It provides practical information for people who already use these energy sources and demonstrates real-life applications for those who would like to.

ReNew also covers sustainable transportation and housing issues, the conservation of resources, recycling and broader environmental issues. *ReNew* is available from newsagencies, by subscription and as part of ATA membership. ATA membership costs $65 per year, and offers a range of other benefits.

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Contributions are welcome, guidelines available on the web at www.ata.org.au or on request.

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Cities minus vehicles

Despite all the recent talk about emissions reduction, Australian cities are expanding and making more and more room for cars. When there is congestion in one area of the city, governments build new roads, not a train, tram or bus line. More cars equate to higher greenhouse gas emissions—unless there is a sudden and rapid uptake of electric vehicles.

Even if electric vehicles do take off (as we all hope) it still means we're stuck with traffic. At the Eco Edge conference earlier this year, former mayor of Bogota in Colombia, Enrique Peñalosa, described cars as unfriendly to people, especially children. He set about urban reform in Bogota, such as reducing car use in the city, and in the process created a more socially sustainable place to live. As a bonus, he reduced greenhouse gas emissions too.

Some cities in the world have buses galore. Take Curitiba in Brazil for example, which features in our article about sustainable car free cities. On the main routes in Curitiba, buses come every minute, similar to a subway. There are even buses that link the hospitals. Imagine that.

If governments are serious about reducing greenhouse gas emissions they need to discourage car use. This means not building new roads to combat traffic problems, but investing in public transport. Or instead of building a freeway, how about a pedestrian freeway, such as the one that spans 35 kilometres in Bogota, providing a car-free multi lane road for bikes?

Cover

Those are solar lights on the cover. The Solar Mallee Tree sculpture in the Adelaide Festival Centre Plaza is just a stone's throw from where the 3rd International Solar Cities Congress was held in February. Each 'tree' produces an average 864kWh per annum (but uses 125kWh per year), with the excess production returned to the electricity grid. A data reading of electricity to the grid is at the base of each tree.

Jacinta Cleary

Photo courtesy of the State Government of South Australia.

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Terms and Conditions

(1) The competition is open to anyone in Australia who subscribes to *ReNew* or joins the Alternative Technology Association (ATA) during the competition period, including existing subscribers and ATA members who renew their subscription/membership during the competition period.

(2) The prize is not redeemable for cash. Price includes GST.

(3) Solar Shop Australia reserves the right to change specifications without notice.

(4) Paid ATA staff, members of the ATA executive committee and members of their immediate families are ineligible to enter.

(5) The competition runs from 26 July 2007 to 5pm on 23 May 2008, and subscriptions/memberships must be paid by this time and date.

(6) The competition will be drawn at 5.30pm on 23 May 2008 at the Alternative Technology Association, level 1, 39 Little Collins St, Melbourne VIC 3000.

(7) The winner will be contacted by phone and will be notified in writing. The winner's name will be announced in ReNew issue 104, released in mid June 2008.

(8) The competition is open to individuals only. Corporate entities, collectives and organisations are ineligible.

(9) To enter, subscribe or join the ATA using the subscription form in ReNew issue 101, 102, or 103 (or a copy of it), visit our website (www.ata.org.au), or call the ATA on (03) 9639 1500 to pay by credit card.

(10) The competition is only open to Australian entries and includes delivery and installation in Sydney, Melbourne and Perth metro areas. Solar Shop Australia will pay other installer's standard install costs in other locations. This competition is not open to overseas residents.

(11) The winner must be eligible for the PV Rebate Program (ie, you have not received the rebate previously on your current property), with the rebate to be paid to Solar Shop Australia.

(12) The PV system must be installed on the winner's primary place of residence. If the winner does not own an eligible property, then they may donate the prize to the person of their choosing who has an eligible property. It cannot be installed on rental, investment or holiday properties.

(13) Prize includes16 Kaneka GEB 60 watt modules, 1x SMA Sunnyboy SB-1100, 1 x mounting frame and 1 x installation by Solar Shop Australia plus wiring and components valued at $13,955.

The *ReNew*/Solar Shop Australia subscriber competition is proudly sponsored by Solar Shop Australia, 155 Payneham Road St Peters SA 5069, ph:(08) 8362 9992, email: solar@solarshop.com.au, www.solarshop.com.au

New SA feed-in tariff

South Australia has become the first state in Australia to introduce solar feed-in tariffs. The feed-in tariff offers 44 cents (twice the retail electricity rate) for every kilowatt-hour of electricity which is fed back into the grid from solar PV systems. Greens MLC Mark Parnell's proposed amendments—to extend the rebate from five to twenty years and include organisations with annual consumption up to 160MWh—were accepted by the State Government.

The payment extension from five to twenty years is a big achievement and will hopefully encourage a higher uptake of solar PV panels in South Australia. However, it is still only a relatively modest measure, due to the fact that it is based on net metering, whereby system owners are only credited for excess electricity fed into the grid rather than the entire production of their system. As a result, the certainty required to get widespread uptake of renewables is not achieved.

The Alternative Technology Association will continue to push for progressive and ambitious feed-in tariffs around the country. For more information or to subscribe to a regular feed-in tariff newsletter, visit www.ata.org.au/feedintariffs

Solar Cities Congress

Over 800 people from 36 countries gathered in Adelaide for the 3rd International Solar Cities Congress in February. The theme of the congress was *Visionary Voices Talk Sustainable Cities,* with speakers highlighting a range of innovative solar energy projects and technologies taking place around the globe.

There was an impressive contingent of delegates from East Asia, headed by Dr Zhengrong Shi from Suntech Power, highlighting the rapid development of the solar industry and uptake of renewable technologies in China, a country where 10% of homes have solar water heaters.

While there was some excitement in the wake of South Australia's Premier Mike Rann's announcement of Australia's first feed-in tariff, international experts such as Herbert Girardet reinforced the need for much more work to be done in Australia. Mr Girardet called for the adoption of progressive and effective feed-in tariffs across the country to tap in to the solar revolution which is happening internationally, a call that was echoed by many other speakers over the weekend.

Federal Environment Minister Peter Garrett addressed the delegates to a warm reception, announcing a commitment to build a 910kW solar power station in Coober Pedy, and the congress was closed with a sobering address by Ross Garnaut on the extent of climate change, and further calls for immediate and extensive action.

Cool in a crisis!

Have you ever been happily watching a DVD with the subwoofer pumping, suddenly someone turns on the washing machine, the dishwasher, the water pump, the fridge starts, the microwave, and your son decides to practise his welding techniques in the back shed. Your remote power system is stretched to the max, but calmly the new PS1 recognises the large load, starts the generator and smoothly transfers the load to the generator, no fuss, no panic.

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Crackdown on false green

Companies that make misleading 'environmentally friendly' claims for their products could face tough fines, the Australian Competition and Consumer Commission (ACCC) has warned.

The ACCC's new guide, *Green Marketing and the Trade Practices Act* warns that the use of symbols such as forests or trees on products can be misleading and incorrect use deemed a breach of the Act. The document comes as more companies use green credentials as a marketing tool.

Areas that the ACCC will watch include false claims of being carbon neutral and stating a product is recycled when only part of it is made from recycled materials. Misuse of the word 'green' is also stated as risky or ambiguous. The document also states that when making any claim about a business or product, 'be honest and truthful.' Fines for companies are up to $1.1million.

A biofuel advance

CSIRO and Monash University have developed a chemical process that turns green waste into a stable bio-crude oil.

The process uses low value waste such as forest thinnings, crop residues, waste paper and garden waste, some of which would ordinarily end up in landfill.

The plant wastes being targeted for conversion into biofuels contain chemicals known as lignocellulose, which is seen as an important raw material for the next generation of bio-ethanol. Lignocellulose is renewable and potentially greenhouse neutral.

Higher rating appliances

Federal Environment Minister Peter Garrett says that a ten-star rating for all household appliances will be fast tracked, enabling consumers to make better decisions on the shop floor. The rating system will for the first time include all appliances, meaning that appliances such as high-power-use plasma televisions will need to have a rating sticker. The new ratings are expected to come into effect in April 2009.

Switch off on March 29

Up to 30 million people are expected to turn off lights and other appliances during Earth Hour on Saturday March 29. The event was a big success in Sydney last year with 2.2 million people reducing electricity use for an hour. This year 16 cities have joined Sydney including Melbourne, Brisbane and Adelaide, along with Christchurch, Aalborg and Tel Aviv.

Earth Hour asks residents in participating cities to turn off lights and non-electrical items at 8pm to raise awareness about carbon emissions and climate change. Sign up at the Earth Hour website: www.earthhour.org

The E-126 wind turbine.

Big wind

Still a prototype, the E-126 wind turbine by German company Enercon is record-breaking. The tower is 138 meters high and its walls are 45 centimeters thick, the diameter of the rotor is 126 meters and the blades feature an improved trailing edge that boosts production. It is rated at six megawatts, yet some say it will probably produce more than seven. Although it is quite large, the turbine is easier to install than its predecessors because each blade is made of two components that can be transported separately.

The E-126 should produce about 20,000,000 kWh per annum.

Ocean power supply

Australian ocean energy company BioPower Systems has been awarded a $5million grant under the Australian Government's Renewable Energy Development Initiative (REDI). The grant will be matched by BioPower to fund a $10.3 million, two year project involving the deployment and ocean testing of the company's proprietary wave and tidal current energy converters.

Under the REDI-funded project, the company will build and install full-scale prototypes of both its wave and tidal system engines. Each 20 metre prototype will generate enough power to supply up to 500 homes. Preferred sites are Tasmania's King Island and Flinders Island. Both islands rely on diesel powered generators (along with wind power), so the project could reduce greenhouse gas emissions. BioPower's conversion technologies are based on biomimicry, using biological species as inspiration in engineering design.

Emissions check

The Federal Government's National Greenhouse and Energy Reporting Act (NGER) will establish a national framework for Australian corporations, requiring them to report their greenhouse gas emissions, reductions, removal and offsets and energy consumption and production from 1 July 2008. The framework will apply to Australia's 700 most energy-intensive companies. Three hundred of these companies will be reporting emissions for the first time. More information is available from www.greenhouse.gov.au/reporting

EU patio heaters to go

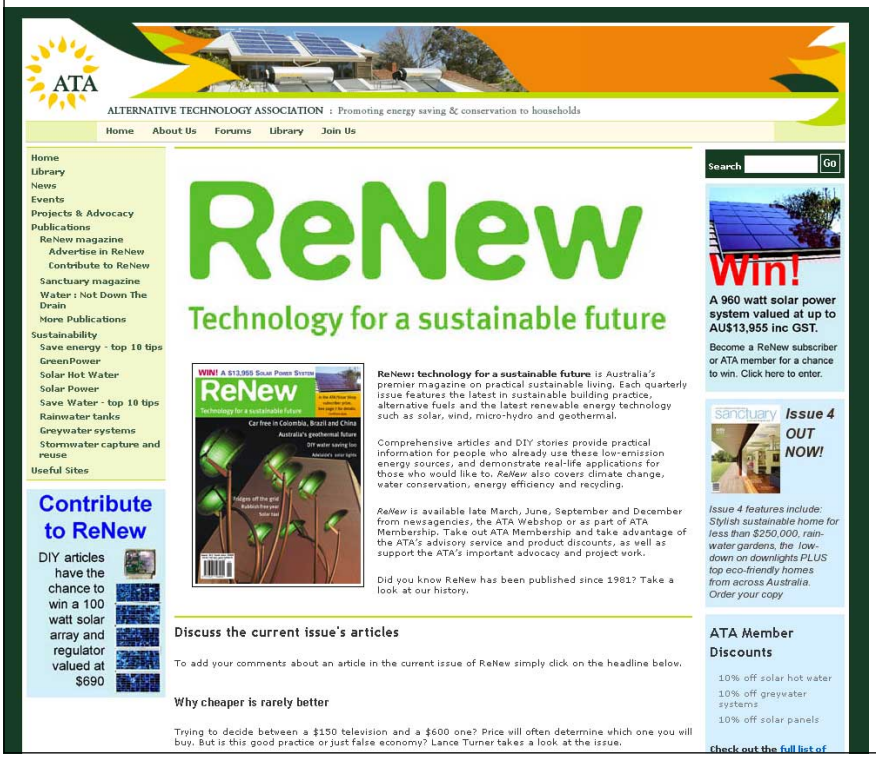
An overwhelming majority of European Union MPs voted for a ban on patio heaters, calling on the European Commission to set a timetable for the withdrawal from the market of these and other 'very energy-inefficient items of equipment.' Outdoor patio heaters have become popular in the last ten years, commonly used outdoors at cafes and pubs to warm the air.

Pig manure good

The Thai ministry has set a target of building 1540 100MW biogas plants by 2011, with many of them fuelled by solid waste and polluted water.

Thailand has around 5.8 million pigs, and one pig produces up to two kilograms of waste per day, hence the development of biogas.

Have your say!



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Go to our new website and have your say and see what other readers are talking about.

www.renew.org.au

Gel cells and cloudy days

On the far north coast of NSW we have had solid overcast weather, drizzle and rain for about three months. This may go on until winter. Having been on a remote solar system for 14 years, I have also been watching my 17 panels (Solarex and BP) degrade in high temperature performance about 2.6% per year. They now output 46A instead of 74A.

The good news is that low temperature performance is still good, and they still perform well in this crappy weather.

My old flooded cell batteries needed to be replaced and I selected Sonnenschein 600Ah gel cell Dryfit solar, to see if they offered advantages. It appears most solar stores will coerce you into buying cheaper flooded cells, because they are locked into a conservative price/longevity mindset, which assumes that maintaining flooded cells is your only pleasure in life.

In the last three months I have possibly fully charged my batteries about twice, and used the genset maybe four times. This would drive a flooded cell owner nuts. I know the electrolyte in gel cells doesn't stratify, but I have also realised that they self-equalise rapidly. More-charged cells waste energy by producing more gas.

The Sonnenschein battery handbook informs me that they are about 15% more efficient than 'flooded cells', but what is not obvious to a prospective buyer is that if you are neurotically keeping your batteries fully taper-charged and gassed every day, then you are wasting huge amounts of panel output. Batteries suck in more power when they are flatter, especially when you have old panels.

I don't advocate the flattening of any gel cell, but they can be worked lower down without needing to be fully charged every day. This means you can continually take risks with consumption, and be pleased if you only see any tapering in the last hour of charging. Undercharging conserves their electrolyte.

There is a trend in Melbourne to sell Sonnenschein 600Ah batteries cheaper than other sizes. Although the price has gone up, it is still worth a look for those who want a life and don't like the idea of filling out monthly forms for three years, to keep flooded cell warranties.

Chris Johnson-Walker
renew@nviro.org

There are certainly some advantages to sealed lead-acid batteries, both gel and AGM, including reduced maintenance and slightly higher charging efficiency, but they are less forgiving to an accidental serious overcharge, and require more accurate charging regimes, although this is pretty easy to achieve nowadays with programmable charge regulators etc.

However, my main issue with them is that, despite containing essentially the same components as a flooded cell battery, in many cases they are more than twice the price of an equivalent capacity flooded cell battery. Perhaps one of the battery manufacturers can explain why the price discrepancies are so huge?

Lance Turner

Write to us!

We welcome letters on any subject, whether it be something you have read in *ReNew*, a problem you have experienced, or a great idea you have had. Please limit letters to 350 words. Due to limited space, we can't guarantee to publish all letters received.
Send letters to: *ReNew*, Level 1, 39 Little Collins St, Melbourne VIC 3000, Australia,
email: renew@ata.org.au

Better booster control

Nick and Jo Killey have identified a logistical flaw in boosting your solar hot water with off-peak electricity (*ReNew 102*). A simple fix, but not commonly offered by installers, is to have a cut-off switch for your booster mounted inside your house where you can easily access it.

I had one installed with my heater 13 years ago, complete with a little red light that goes on whenever the booster is operating. The 'on' side of the switch has a raincloud symbol, the 'off' side a radiant sun.

In practice, we turn the booster off for most of the year—sometimes tank temperatures are so low we might shower in 100% 'hot' water, but they will inevitably rise over the day to provide enough heat to keep us happy and clean for the ensuing period.

With such a switch we can anticipate solar gains from a sunny tomorrow and not electrically heat the water overnight. Without such a switch, water temperatures are unnecessarily maintained at peak levels day and night, regardless of usage patterns.

Paul Anderson
15gething@gmail.com

Not-so-sustainable sewage systems

Gone are the days of the leaky old septic tank—nowadays most councils require rural home builders to install the latest waste water treatment system which converts greywater and blackwater to clean water. While these systems are good for the environment because they prevent the contamination of groundwater and recycle the water to gardens, some manufacturers have forgotten the energy side of the sustainability equation. Do your research before purchasing one of these systems to avoid being stuck with an energy guzzler.

The typical plant comprises two main chambers: the first enables anaerobic digestion (without air) similar to that occurring in a septic tank, and the second treats this water aerobically using air-loving microbes to produce clear water containing very little biological

contamination. This water is usually treated with chlorine before being pumped into the garden or paddock.

Most of the treatment plants on the market require power to drive an air blower for the aerobic step and a pump to discharge the treated effluent. The air blower normally runs continuously around the clock, while the pump operates only when the discharge chamber fills and is therefore intermittent.

The main consumer of power is the blower which typically uses a nominal 80 to 150 watts, depending on the make and model. This is equivalent to a large incandescent light globe running 24 hours per day so it's a big energy drain, especially if you are relying on solar for all your power. In contrast, a design which recently entered the market uses worms as well as microbes to treat sewage and this requires minimal air using only five watts of blower power.

The advertised blower power consumption stated above is bad enough because of the continuous operation of the blower, but because of the type of air blower typically used, power usage is actually far in excess of the 'nameplate' wattage. This is because the blower is generally a diaphragm pump operated by an electromagnetic device with a very poor power factor (the ratio of useful power to total power) indicating large losses as heat, inertia and friction.

In the system I installed, as verified by the blower supplier, the nominal power of the blower was 80 watts, but the effective consumption was 190 watts. If this were run continuously as recommended by the supplier, it would use 4.5kWh per day, about half the needs of many entire homes. This hidden loss results in big energy wastage—contributing to greenhouse emissions or else requiring oversized solar arrays for those independent of the grid.

Owners of such treatment plants really have little choice but to reduce the hours of operation of the blower, which is only practical where the sewage load is low, such as for weekenders. In such cases a simple timer can achieve this.

But more importantly, the issue should be addressed by treatment plant manufacturers who are often providing systems for homes independent of the grid and reliant on solar power. Either way it should be quite easy for engineers to design systems with efficient blowers and not offer energy-draining products to the market. If you are looking to install such as system, shop around and make sure you get the most efficient system you can find.

Robin Brown
rfm.brown@bigpond.com

The power factor of a device is actually not the issue here. With any reactive device, you have real power and reactive power, but the reactive power is not consumed by the load, but is in fact returned to the power source. Reactive power does contribute small resistive losses due to the higher current flows, but it is not a huge amount.

When measuring the energy consumption of a system you must use a power meter that does real-time integration to get an accurate indication, such as the Power Mate meter. Measuring the AC current with a multimeter, for instance, gives a meaningless figure as much of the current measured is reactive current and is not actually part of the energy consumed.

The issue could well be that the pumps/blowers are being used in situations that produce greater pressure differentials than they are designed for. In effect, they are excessively loaded and so draw more power than they should.

However, I have to agree that there are indeed many manufacturers overlooking vital design factors in many systems, and not just in wastewater treatment systems. It seems to be happening more and more in all manner of treatment and energy generation systems, with components being incorrectly specified simply to make the system more appealing to the customer on an initial purchase price basis.

Lance Turner

Biofuel penalties

I've recently read in the RACQ magazine *Road Ahead* that anyone caught making biofuel at home will have the equipment seized and be fined as well. To me this just shows how serious this government is about renewable fuel and encouraging people to do something about it.

Keep up the good work with your magazine.

H Widmer
Ravenshoe QLD

Electric boosting poorly designed

I agree with Nick and Jo Killey that there is a problem with electric boosting in solar hot water systems. When we built an energy efficient house about 15 years ago we had an Edwards system installed on the roof. The booster element was half way up the tank, which reduced the use of electricity.

Many people in the UK have electric water heaters with two elements, one at the bottom and one about a third the way down. The householder can choose the amount of hot water, depending on the number of people in the house.

The area we have moved to is subject to frost, so this time I have opted for an evacuated tube system to avoid the maintenance involved with indirect systems. There is no way the manufacturer will supply the tank with the booster anywhere but the bottom. I have accepted this, knowing that with only two people we shall never have the booster on anyway.

To obviate the problem, a useful addition for when there are more people would be a thermometer, the sensor of which could be buried in the insulation against the side of the tank, a quarter, third or half the way down. It could have a display on the tank or in the house—if it was showing 'cold' you would know to switch on the booster, if it was showing 'hot' you could leave

the booster off with confidence. Is this a product that the ATA could sell, as an aid to reducing energy use?

Richard Stanford
ripening@bigpond.com

There are actually quite a lot of electronic thermometers available, used for measuring the temperature both indoors and outside, so they usually have a sensor on a lead. Some of these are limited to around 50 degrees, but others, such as Jaycar Electronics item number XC0224, can measure to 150 degrees or more.

Lance Turner

Solar not wind farms

As a reader of your magazine for many years, I have found your great articles informative and enjoyable as Australia makes the inevitable move away from coal into a bright sunny solar future. But I have also been dismayed to hear again of problems with those eagle killing wind farms. Australia needs a solar future, not a wind farm one.

In 2001 the federal government set up a scheme to force electrical energy distributing companies to buy a proportion of their energy from 'renewable' sources. This scheme is known as MRET (Mandatory Renewable Energy Targets). The initial target was only about 2% but there is discussion of this being raised under the current Rudd Government to as high as 20%. The trouble is, there are some major problems with MRET.

Firstly, MRET is not a scheme for reducing greenhouse gas emissions. It does nothing to combat our ancient, dirty, coal-fired power stations or our ever increasing demand for electricity. According to the WWF, Hazelwood power station in Victoria is the most polluting of all power stations operating in the world's major industrialised countries.

We need a plan to decommission our worst coal-fired power stations and reduce our energy consumption overall. Australia exports huge quantities of natural gas (a lower greenhouse gas emitting fuel than coal) to China, while back home we sell massive amounts of cheap coal-generated electricity to multinational companies (Alcoa in Portland for example) who could be using gas instead.

Secondly, MRET allows for some suspect definitions of 'renewable' energy. 'Wood waste' sourced from logging of native forests can be burnt to produce 'renewable' electricity. Hydro schemes that flood pristine wilderness, like the Lake Pedder hydro power station or the defeated Franklin Dam project are definitely 'renewable' under the MRET guidelines.

And thirdly, MRET has no planning overview but rather is a market driven scheme whereby power companies will buy 'renewable' power from the cheapest source available. This has led to wind farm companies building their towers in beautiful coastal areas with no regard for the surrounding residents, be they people or eagles, if this is the most profitable location for these companies.

But it's not all bad.

Despite Australia being the sunniest country on the planet we have been slow to get with the solar revolution. But we are getting there now. The current federal government has announced that every Australian school will have solar panels on its roof. Large projects such as the Victoria Market solar roof (installed in 2003, it is the largest urban grid-connected solar photovoltaic installation in the southern hemisphere) are already up and running.

But the most fun can be had on your own roof. We currently have a federal rebate scheme of up to $8000 for the installation of grid-connected photovoltaic systems and a further $1200 for solar hot water conversions. It's the best deal on the planet! For around $6000 (after the rebate) you can have a 1kW grid-connected system on your own roof, massively reducing your power bills and saving the world as an added bonus. If you want to do something about global warming, do this.

So if another hydro project is planned to flood a wilderness valley in Tasmania or another wind farm proposed for our coast, I will be there protesting again, as I have before.

But you cannot believe my smile as I return home each day to watch our electricity meter spinning backwards from the solar panels on our roof. The attached photo shows our solar panels with the space left for the solar hot water system that goes in next week.

Chris Hayward
chayward@parks.vic.gov.au

From the publishers of *ReNew*

Sanctuary magazine

Issue 4 OUT NOW

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No rubbish for 365 days

Do you think you can live rubbish free for twelve months? One New Zealand couple are giving it a go this year. Matthew Luxon explains how.

I don't feel like a hippy, greenie, tree-hugger, radical or freak—nor courageous, revolutionary or determined—but these are some of the ways my wife and I are currently being described. The reason for this somewhat eclectic group of adjectives being thrust in our direction is a challenge we began on 1 February 2008. We are attempting to live for one year without creating more than one official City Council bag of landfill waste from our household. We are Waveney and Matthew and, apart from Waveney's name, we've generally held a self perception of being relatively normal really.

We live with our dog and two chickens in an inner city suburb of Christchurch, Aotearoa New Zealand, where I work 30 hours a week, and Waveney also does part-time hours. We have no kids. We have a car but ride bikes a lot. We eat meat but not every day. Within five kilometres we have a bulk foods store, butcher, baker and organic store. We have a yard large enough to garden and deal with our own organic waste.

Why a rubbish-free year?

In terms of being philosophically, theologically and practically challenged, last year was a humdinger for us. It was a year in which our eyes were prised open to the multiple issues facing humanity. The year was mostly spent in Toronto, Canada, living and working in a shelter for refugee claimants where we were finely tuned into the plight facing the more than 20 million refugees internationally. Our work within the mental health field highlighted the growing numbers of people suffering with mental disorders in the developed world, and in addition we were acutely aware of the inequalities that exist within many colonised countries in terms of their treatment of indigenous peoples. So with all of these issues thrust at us, why did rubbish become the focus of our energy in 2008?

The thought process definitely started with the big picture in mind. Like many Westerners, we lived with the guilt of being part of an ethical and ecological disaster. While we found we could make good choices when presented with simple solutions, for example, curbside recycling or giving to charities, we felt guilty anyway because we knew our lifestyles sucked a disproportional amount of resources, which screws up people lower down in the consumption food chain, and, of course, the planet. (If you're not convinced do the footprint quiz at www.earthday.net/footprint.)

Hard statistics provide little relief, instead pointing out uncomfortable trends. In New Zealand the average person makes 2.5 kilograms of solid waste a day, which is less than the average person in Australia and America, but a lot higher than some other countries. New Zealanders use over 22 million plastic bags each week and each one of these that end up in landfill is estimated to take 500 years to break down. Currently, 85% of Christchurch households recycle at the curbside each week, and 55% compost at home to some extent. Despite this, organic matter still makes up to 46% of an average rubbish bag and paper makes up 28%.

With a slowly growing awareness we pondered what to do, especially when the solution is difficult, complicated and scary.

Being 'ethical' was way too huge, and vague, for types as uninformed as ourselves, and narrowing it down to consuming ethically was still too vast: is this can of beans/pair of jeans/dog toy produced in harmony with the planet and all humankind? Who owns the parent company and do they invest in the arms trade/fell rainforests? We definitely lacked the time and resources to figure all that out. Yet, the alternative, apathy, annoyed us. In response to the stalemate we somehow came up with the Rubbish Free Year. It was smaller and finite, and gave us a simple, tangible question we could answer ourselves: will this item (packaging included) contribute to landfill?

As you can probably imagine, many of the conversations we've had recently begin with a version of 'What will you do about…?' These conversations have proved to be valuable both in providing shared brainstorming as well as an often needed dose of self-confidence when we have already thought of a solution.

When we first decided to commit to a year of living without creating any rubbish we assumed it would be tough when we started, but the two months before starting was so full of preparations that already it is obvious that living rubbish free is less work than getting ready for it. The barrier is much bigger than we imagined. Preparations have consumed time and forced creative thought as we leap (or lurch?!) from our existing system of doing things to a new way. Hopefully next year we'll be working comfortably with a new operating system.

Waveney, Matthew and their rubbish-free dog at home in Christchurch, New Zealand.

How rubbish free works

As a general guide to get through the year we are focusing on:

Reusing: Waste not, want not, which I don't think is about storing up a thousand margarine and ice-cream containers on the top shelves of the pantry; they are off the shopping list as they're not recyclable in Christchurch. Rather, it is about extending the life cycle of materials by, for example, using old carpet as weed mat or, as a friend recently did, converting an unwanted popcorn maker to a wanted coffee roaster.

Recycling: Christchurch residents have actually had the amount of plastics accepted for recycling reduced, which feels a bit like going from colour television to black and white. However, the reasoning behind this move is logical, in that the City Council was finding that it was unable to find a use for anything other than number ones and twos plastic. So any plastic with a one or two, paper, aluminum and steel cans are being sent to the curb for weekly recycling.

Re-homing: Just because it is junk for us doesn't mean that someone wouldn't want it. Currently we have some good wool carpet that would make excellent weed mat for a raised garden, and we are more than happy to send it to Australia if anyone wants to pay for the shipping. We are fortunate in that having just returned from overseas we don't have too much stuff. De-cluttering prior to travel was sobering in itself, making us wary of accumulating unnecessary items. Since settling back into Christchurch we have received a lot of re-homed goods, furnishing our home with unfashionable, but comfortable, couches, tables, bedding, crockery and cutlery.

Composting: We are fortunate to have a reasonably sized backyard which easily accommodates a substantial compost bin. And, we've found that living in an apartment is no longer an excuse, as apartment-dwelling friends of ours use a small-two bin system from which we benefit about every three months; if it didn't go to us it would go to the local community garden. We actually have two composting systems: a standard one, the output of which we use on the vegetable garden, and a long term system to which we add things which will decompose but take longer, for example, nail clippings, hair, cotton and dog poo.

Home production: My grandmother talks about bringing up her children on a farm back in the 1950s, and the only items she bought for daily living were from the grocer who came once a month. Her list had about a dozen items on it, things like flour, sugar and floor polish and everything else was produced at home, including shampoo, toothpaste and soap. We are nowhere near this level of self sufficiency (nor convinced that we want to be) however it is a concept influencing our year. Our vegetable plants are likely to tell you that we have

homicidal tendencies towards them. This simply isn't true, we're just not very good at gardening. Despite the tension between flora and ourselves we still seem to eat very well from our garden. Tomatoes, lettuce, capsicums, silver beet and cucumbers are in ample supply. Other recently acquired skills have included making muesli bars, bread and hommus.

Consuming with thought: To avoid packaging, we are not buying products that we can't deal with through the above methods. This pretty much counts out the whole dairy section of the supermarket, frozen foods, bread section, snack foods like crisps, and perhaps most distressingly for me, mussels. For items other than food, we are looking for good quality secondhand products. The current item on the hunt list is a blender; it's not as much fun as it looks making hommus with a potato masher. Finally, we are exercising our consumer power**.** During 2008 we will choose not to buy anything that has non recyclable packaging or is in itself junky, made of plastic or single use.

It is true that the challenge ignores the complexity of whether a product is ultimately a good thing for our world and also doesn't address many aspects of lifestyle (e.g. burning fossil fuels in my car as I drive to the supermarket), but it puts the power back into our hands, and we have been amazed at how often avoiding packaging and plastic products makes us buy local, fair trade and ecologically friendly alternatives. It is holistic in that it has required that we consider every consumer choice, yet it has not overwhelmed us.

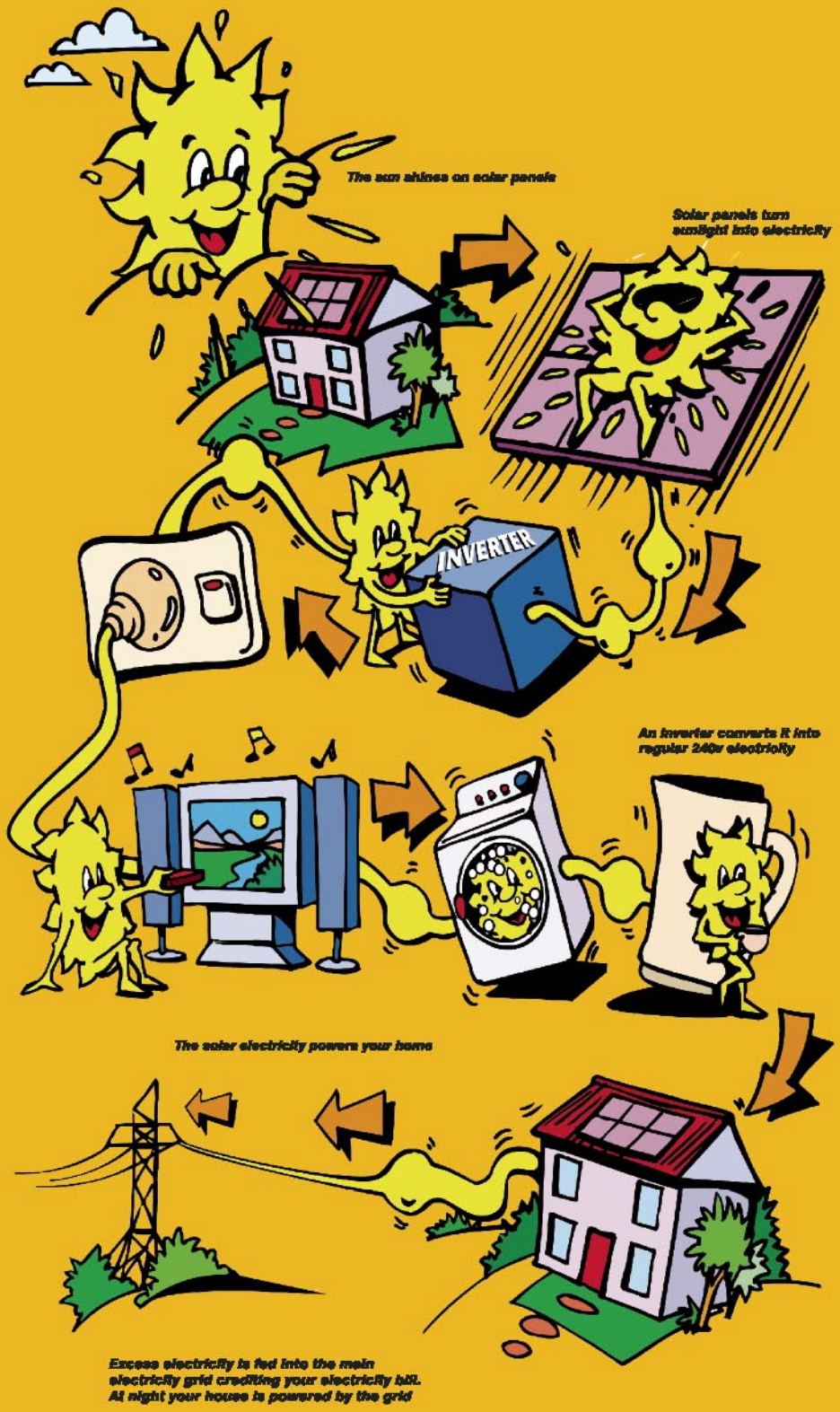
We hope that after the challenge we will be able to focus more widely, using our new-found habits as a starting point. But for now, embarking on something with a start and end date has provided us with the motivational pull we previously lacked. We are now doing things we always meant to do (like getting around to buying a battery recharger and rechargeable batteries) and we will hopefully enjoy a sense of accomplishment when the challenge ends. So far we have been really enjoying the creativity and interest the challenge has generated as well as the many conversations with a diverse range of people.

We are blogging all our relevant rubbish-free adventures and compiling a database of rubbish-free solutions and useful links on our website. Feel free to contribute your own ideas and suggestions as this will help make our year easier and make the website more comprehensive. We would also love to hear from anyone who is already doing similar things or who has decided to commit to their own rubbish-based challenge. The site is useful for rubbish-free lovers all over the world, but place-specific information concerns Aotearoa New Zealand.

No plastic with this fresh, home-grown produce.

Visit Rubbish Free Year at www.rubbishfreeyear.co.nz. *ReNew* will also keep you posted how Matthew and Waveney's Rubbish Free Year is going.

Grid Connect Solar: how it works



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Car free in Colombia

Sustainable cities have one thing in common; they don't allow cars free reign. Jacinta Cleary looks at two Latin American cities where the streets were given back to the people.

Former mayor of Bogota Enrique Peñalosa says he was nearly impeached when he ruled that cars could not park on footpaths. Peñalosa ended his three year term as mayor of the Colombian city at the end of 2000, but in a short time changed it from a city ruled by cars to one that favoured pedestrians.

A guest at the Eco Edge conference held in Melbourne earlier this year, Peñalosa talked about ways that local governments can make cities more sustainable. There are certainly many differences between Australia and a developing country such as Colombia, yet the issues to do with social sustainability are often the same.

Ciclovia in Bogota, Colombia: streets are closed to cars, prompting everyone to get on their bike.

What happened in Bogota?

Peñalosa's term as mayor followed that of Antanas Mockus, who handed over a city in relatively good fiscal shape. Mockus began an important change in Bogota's civic culture with his Cultura Ciudadana campaign, which encouraged civic behaviour and strived to create a sense of belonging for the city's inhabitants.

Yet, when Peñalosa was elected in 1998 Bogota was still a difficult place to live. Air pollution was said to be nearly as bad as Mexico City. Wealthy residents fenced off local public parks for private use, and drivers appropriated footpath space to park cars.

A study by the Japanese International Cooperation Agency in 1997 recommended a web of elevated freeways in Bogota to help ease traffic congestion, similar to an American city. Only 20 per cent of Bogota's residents owned cars, so a model based on high car ownership seemed rather strange to Peñalosa. It would only continue to alienate the large, mostly non-car-owning population who lived in the poorer shanty area south of the city.

Peñalosa abandoned the highway plans and poured the billions saved into bike routes, the world's longest 'pedestrian freeway', as well as parks, schools and libraries.

Peñalosa's urban car reform began with a ban on parking vehicles on city footpaths, freeing up more space for pedestrians. Car ownership in Colombia is typically for the upper classes, and it was assumed that parking on the footpath was acceptable. To stop illegal parking, the council built bollards, which are small concrete pillars on the footpath.

He also reduced traffic during peak hour by 40%, stipulating that all privately-owned vehicles must be off the road two days a week. This was known as the Pico y Placa system, which roughly translates to 'rush hour and licence plate'. During peak hour, licence plates ending with a given number cannot circulate on specific days of the week. Peñalosa instituted the city's first car-free day in 2000 for which he received the Stockholm Challenge Award. It was the largest and most successful event of its kind in the world. People then adopted an annual car-free day, which is on the first Thursday in February.

'It was voted through a referendum. The current mayor does not like it, but he cannot change it—unless he has another referendum,' says Peñalosa of the car-free day. 'Ninety nine per cent of people go to work as usual, the city works fine, and it's a learning experience…' Over 120 kilometres of main roads are closed on Sundays as well, allowing people to come out and ride or walk the streets. This is known as Ciclo-

via, and has been part of the city since the 1970s.

Another choice by the people of Bogota was to make the city car free during peak hour from 2015 onwards, meaning there would be no cars during rush hour from 6am to 9am and from 4.30pm to 7.30pm. This frees up more space for bicycles, pedestrians and buses. Once again it was voted for in a referendum.

Transport

You can't tell people not to use cars unless they're give another option to get around, especially in a city with no train system. Peñalosa oversaw the building or reconstruction of hundreds of kilometres of footpaths, more than 300 kilometres of bike paths, pedestrian-only streets and greenways, and more than 1200 parks. He also spearheaded the revamp of the city centre, with a new pedestrian public space.

Peñalosa launched a new bus transit system called the TransMilenio (Peñalosa jokes that the bus system should have a cool name so that people will use it.) He convinced City Council to increase the tax on petrol, which partly funds the new bus system. The Bogota buses transport 1.4 million people a day, not bad for a city of just over 7 million. Importantly, 20% of those bus users are car owners, which is significant in a developing country.

TransMilenio is a bus rapid transit network, combining modern articulated buses that operate on dedicated bus roads (busways) and smaller buses (feeders) that operate in residential areas, bringing passengers to the main grid. The system is expected to cover the entire city by 2030. The TransMilenio rapid bus service is considered efficient as there is a bus nearly every minute, and it carries commuters to numerous corners of the city.

Bogota's network of bike paths, called ciclorutas, is one of the most extensive

Photo: Luan Lenon

Brazil's model city

Envrionmental writer Bill McKibben reported that a 'municipal shepherd and his flock of 30 sheep trimmed the grass in its vast parks,' after a visit to Curitiba in Brazil. He was clearly impressed by the town's commitment to sustainable practice.

Curitiba is a provincial town and is considered one of the best examples of urban planning around the world. The city has the lowest car use in Brazil, and quite possibly the cleanest air. This is largely due to their impressive bus system.

Bogota's TransMilenio is based on the bus rapid system in Curitiba. As with Colombia, eco-consciousness and sustainable transport is not one of the first things that springs to mind when you think of Brazil. However, Curitiba has been leading the way since the 1960s, when architect Jaime Lerner (who later became mayor) led a team that suggested strict controls on urban sprawl, a reduction in city traffic and an accessible and affordable public transport system. The Curitiba Master Plan, as it came to be known, was adopted in 1968.

The bus system is used by 85% of the city's population, with different types of buses for different purposes.

Express buses are large high-capacity buses (usually bi-articulated, or split into sections) that have exclusive traffic lanes, spreading radially from the city centre in five directions. The express bus lanes each carry 20,000 passengers an hour. They are treated as an 'above-ground subway' because of their speed, capacity and frequent service.

Inter-neighborhood buses are green buses that travel outside the city centre. Some circle the city centre, while others provide important connections between neighborhoods. Direct lines, commonly called ônibus ligeirinho (quickie bus), are silver buses designed to be the quickest link between two points. They cover large distances with few stops and link with tube stations.

Feeding lines are local bus lines and 'Around Downtown' buses are small white buses designed to circle the city centre. They are used by pedestrians as a quick way to get to the other side of the area. Interhospitals are white buses that circle the town and link the main city hospitals.

In Curitiba, a bus stays in operation for an average of 3.5 years. After that they are used as mobile information points, job training centres, food markets, soup kitchens and clinics.

dedicated bike path networks of any city in the world, with a total extension of 303 kilometres. Since the construction of the ciclorutas, bicycle use in the city has increased five-fold: it is estimated that 300,000 to 400,000 bicycle trips are made every day, largely in southern, poorer areas.

These poorer shanty areas have been linked to the city by a 35 kilometre pedestrian freeway. It's wide and looks like a freeway for cars, but there's not a vehicle in sight. People can ride to town, or ride to the nearest bus station and commute the rest of the way. Some residents from the south reported that it took four hours to travel to work on the wealthier northern side of town before the bike paths and TransMilenio bus system.

Why reduce cars?

The environment has certainly gained from Bogota's car free strategies, with the TransMilenio reducing greenhouse gas emissions by 250,000 tonnes a year. It's the first bus system to be accredited under Kyoto's Clean Development Plan. Air pollution in Bogota was a concern, but not the motivation for Peñalosa's reforms. For Peñalosa, the key was creating equity for the 80% of Bogotans who don't own cars. It demonstrates that social sustainability has far-reaching effects, including a positive one on the environment.

'It shows people that they are important too' says Peñalosa of the long bike paths into the city's poorer areas. 'We built symbols of respect, equality and human dignity, not just sidewalks and bike paths. Motor vehicles on sidewalks were a symbol of inequality—people with cars taking over public space.'

Peñalosa also points to a child's fear of cars as reason to go car free. 'Say to any three year old today 'watch out, a car!' and the child will jump with fright. And with good reason as they are more than 200,000 children killed by cars all over the world each year.' He says that car-free areas allow children to roam freely without fear, and points out that poorer areas of Bogota have more children playing on the street because there are few cars there. Compare the way a child is in a car-free city such as Venice, and a traffic-clogged city such as Sydney.

Some would also say that the new social sustainability in Colombia has cut crime. Before Peñalosa was mayor, Bogota's murder rate was 87 per 100,000. Today it is still high, but closer to 24 per 100,000. The rate of kidnappings and robberies has also dropped in urban areas. While Peñalosa did not set out to directly address the crime problem, by improving the quality of life of a typical urban dweller and the way people feel about themselves, it seemed to have a secondary effect on crime.

Future cities

Peñalosa says public transport is a priority to make cities sustainable. 'We must improve public transport and we must not be afraid to restrict car use.'

He says the answer to growing traffic problems is not to build more roads. 'Is there one city in the world that has solved their traffic problems by building more roads? If we have a traffic jam (in Bogota) it means the road is right for public transport,' he laughs. His rationale is that building more roads encourages people to drive further.

Peñalosa points out that most cities were car free at the start of the nineteenth century. 'One thing that we have to have clear is, how much more space do we want to give to cars?'

In rapidly developing China, there are a few moves towards sustainable urban areas to combat the otherwise unsustainable models that spring up. A new metropolis at Dongtan near Shanghai is being promoted as an eco city because it will not produce any carbon emissions.

> ***'A city can be friendly to people or it can be friendly to cars, but it can't be both.'***
>
> **Enrique Peñalosa**

Petrol and diesel vehicles will be banned. Cars may not be necessary anyway, with the city designed so that people live near their workplace, with public transport making every area accessible.

All the energy needed for the city will be generated by Dongtan itself. Buildings will have solar panels and there will be large wind turbines outside the city area with smaller ones in housing and work areas. Biomass energy production, using waste products, will also be used. Power will be produced with organic waste such as vegetable peelings and rice husks thrown away each day during cooking.

Australia's role

So, what does sustainability in other countries have to do with Australia?

Santha Sheela Nair, in charge of rural sanitation as Secretary of the Ministry of Rural Development for the Indian Government was also a guest at the Eco Edge conference. She argues that countries such as Australia need to lead the way with sustainable best practice in urban areas, because developing countries such as India copy western countries. 'Coming from a developing country, we look to the developed world for our design models and ideas and sometimes it is frustrating that they are so out of date.'

Take the elevated road network recommended for Bogota as an example.

A cab-charge for the future

Lis Shelley received a visit from the well-travelled Solartaxi when it stopped to recharge from her grid-connected solar system.

As a 14-year-old, Hungarian born Swiss Louis Palmer dreamt of driving around the world in a car that did not destroy the earth.

Now 38, Louis brings a positive message about global warming to the people he meets on his journey around the world. His solution? A solar-powered car called the Solartaxi.

When I first read about the Solartaxi, Louis was in Turkey. As he planned to come to Australia, I invited him to charge his car from our grid-connected solar system in Lochiel, on the far south coast of NSW.

Photo: Lis Shelley

Garage of the future? The Solartaxi charges its batteries from a grid-connected solar system installed on Lis and Karl's garage.

History

No stranger to adventure, Louis rode a bicycle around Africa in 1994, flew an ultralight across the USA in 1996, broke a world record with the smallest aircraft across South America in 1998 and drove across Asia by car in 2001.

During this time he experienced first-hand the early signs of global warming—droughts, floods and hunger. He decided he could wait no longer for someone else to invent an emissions-free car.

In 2004 the Swiss teacher embarked on the project that would fulfil his childhood dream. Armed with a vision but no engineering knowledge, Louis convinced universities, apprenticeship schools, manufacturers and the Swiss traffic authorities to help him design and build the car.

In June 2006 the solar car passed registration at first inspection and was ready for some on-road tests. The next weekend Louis drove up three of the highest mountain passes in Switzerland, then invited a friend to drive with him to Spain to see how the car would perform in the summer heat. The solar trailer was added and in July 2007 Louis was ready to embark on his world tour.

So far his journey has taken him through Eastern Europe, the Middle East, India, Thailand, Indonesia and New Zealand. After crossing Australia from east to west, Louis plans to continue to East Asia and the USA before arriving home in a year's time.

Building the car

Louis first approached the owner of Swiss ZEBRA battery maker MES DEA and asked him to donate a high energy battery for the project. The factory owner agreed, on one condition—that he take two!

Servax then provided the electric motor, Rockwell Automation the steering and Alu Metzikon the aluminium for the frame. Apprentices at Schindler engineering put the frame together and boatbuilder Gerold Bucher, together with space engineer, Richard Chrenko designed the shell.

Students at the Swiss Federal Institute of Technology (ETH Zurich) completed the solar trailer under the direction of Roger Zehnder. The five metre long trailer carries 6m^2 of solar panels supplied by German company Q-Cells, currently the world's second largest manufacturer of solar cells.

Technology

The solar trailer alone provides a range of about 100 kilometres and stores energy by charging two onboard sodium/nickel chloride (NaNiCl) batteries. The advantage of a NaNiCl battery is that it is completely recyclable, is unaffected by external temperatures, can be stored indefinitely fully charged, is practically maintenance free and has a high

energy and power density. Thermal management is an issue as it runs very hot, so it comes as a sealed, insulated unit. One battery sits at the back of the solar trailer, the other behind the car's seats.

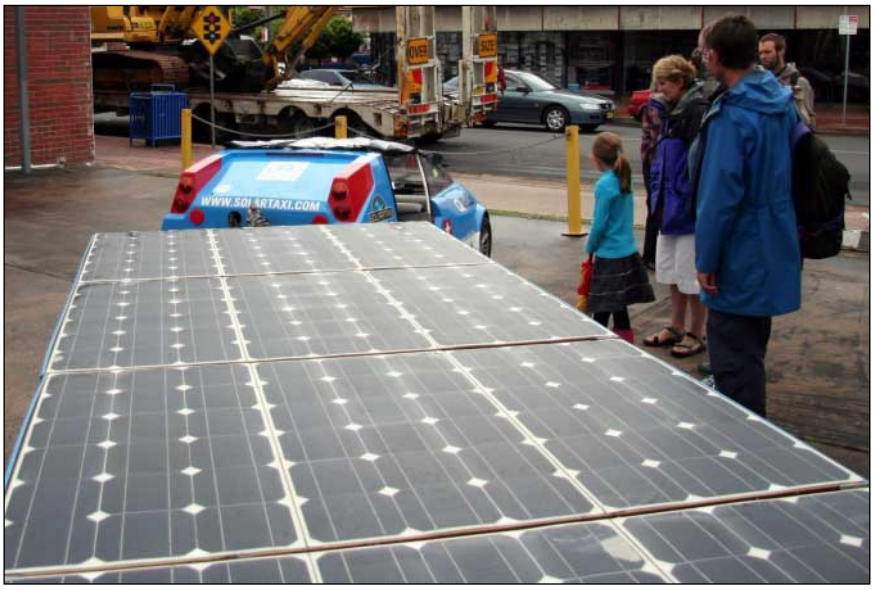
Most people would baulk at the idea of towing a five metre trailer everywhere (where would I park*that* in the city?) but fear not: the trailer can be detached so the car can run independently on its remaining battery and, most importantly, at night, when there is no sun.

The batteries can be plugged into a conventional power point, increasing the car's range to 300 to 400 kilometres a day. A quick charge takes 30 minutes and a conventional recharge six to eight hours. A similar concept is already being used by Adelaide City Council. Their 'Tindo' solar powered bus carries ZEBRA batteries and will recharge from a solar array atop the new Adelaide Central Bus station.

While on tour Louis tends to keep travel down to around 200 kilometres a day to cope with steep downhill grades, rainy weather, long distances between charging points or unpredictable road conditions. He prefers to recharge from renewable sources when available. When power has to come from the mains grid, Louis has a solution. Nine square metres of solar panels on a rooftop in Switzerland feed electricity into the grid to offset any power he uses from fossil fuel sources.

'It's like paying money into a bank account and withdrawing the money somewhere else. If we all had solar panels on our roofs, we could charge our cars anywhere and drive 300 kilometres per day without using any fossil fuels', he explained.

After 16,000 kilometres, there is barely any sign of tyre wear on the rear-drive three-wheeled car. Its light weight also means less wear on road surfaces. The car has a top speed of 90km/h but it generally travels slower on open roads than



Photos: Lis Shelley

Top: Louis Palmer meets some local wildlife at Pambula Beach. Bottom: The trailer can be detached for city or night driving.

surrounding traffic. Louis was worried that he might be abused by angry road users for causing traffic jams, but so far the reaction has been overwhelmingly positive. Driving with him from Lochiel into Merimbula one evening, we certainly turned heads and raised smiles.

Though the electric motor is noiseless (the cooling fan makes more noise) the chain drive and road noise through the vinyl doors reminded me of riding in a jeep—albeit a really low-slung, emission-free jeep!

The steering wheel slides to the left or the right and there are two sets of pedals, so the driver can pass control to the passenger without swapping seats—a handy feature for world travellers moving from left-hand to right-hand drive countries. With only two seats, it is no family sedan and there is no real luggage area, but Louis is already planning more space for Solartaxi Mark 2.

Why Solartaxi?

Louis Palmer doesn't just want to prove that the technology works; he wants to (literally) drive home the message to world leaders that the solution is here. At the Bali Climate Change Conference

last November he ferried leaders to and from their hotels. There he met the captain of the Rainbow Warrior, who offered him a lift to New Zealand. Although not on the planned tour route, it was too good an offer to refuse.

Back in Pambula Beach, it was my turn to drive. Being 1.6m tall, I found that one seat does not fit all. To reach the pedals, I had to lie almost flat on my back. I was prepared to forgive any slight discomfort however, since it is not every day that I get to sit in the same seat that has carried Minister for Environment Peter Garrett, the president of Switzerland, the mayor of New York, a prince and princess of Jordan, Nobel Peace Prize winner Dr Pachauri, the Maharanah of Udaipur and Bianca Jagger.

With 900 car workers about to lose their jobs and a car manufacturing plant to stand idle in Adelaide, perhaps a little vision from government and industry in Australia could turn Louis' dream into reality for us all. ✶

Follow the Solartaxi's progress at www.solartaxi.com.

Photo: Lis Shelley

Seven-year-old Anna wrote in the Solartaxi's guestbook: 'I think it would be really good if everyone could get around the world right now with just sunlight.'

Links: Adelaide City Council solar bus www.adelaidecitycouncil.com/tin Aptera EV, due for release in California: www.aptera.com

Energy for hundreds of years!

It has been estimated that there is enough geothermal energy in Australia to provide all of our energy needs for hundreds, if not thousands, of years. Geoff Thomas explains how it all works.

Using geothermal energy for electricity generation is not new. Italy first established a geothermal electricity plant early last century and geothermal energy is now used for electricity generation in over 20 countries. Most working plants are based on heat sources that use water reservoirs associated with volcanic regions, for instance New Zealand's well-established geothermal industry.

The use of hot fractured rocks (HFR) is a different and even simpler concept. Heat is generated by special, high-heat producing granites located three kilometres or more below the Earth's surface. The heat inside these granites is trapped by overlying rocks which act as an insulating blanket. The heat is extracted from these granites by circulating water under pressure through them in an engineered reservoir or underground heat exchanger, then back to the surface while still under pressure. The heat is then captured through a heat exchanger, with the ground water cooling as it passes through. The cooler ground water is then recirculated back below the surface to be reheated. The cycle means the water is continually under pressure so it never turns to steam and there is no loss of water from the system.

Once the heat passes through the heat exchanger, it is transferred into another closed cycle system, with an ammonia-water working fluid that has a lower boiling point. It is this liquid that is piped into the power plant to generate electricity. In the power plant, the liquid turns into vapour and is used to spin the turbines. Afterwards, the vapour is cooled back to a liquid and returned to the heat exchanger.

This 3000hp drilling rig is used to drill the deep bores for the HFR system.

HFR geothermal energy relies on existing technologies and engineering processes, for example drilling and hydraulic stimulation techniques established by the oil and gas industry. HFR power stations use technologies standard in the electricity supply industry, including within existing geothermal stations elsewhere in the world, to convert the extracted heat into electricity.

HFR geothermal energy is environmentally sound because it releases energy without:

- the production of greenhouse gases;
- nitrous oxides, sulfur dioxide or par-

ticulate matter emissions associated with the burning of fossil fuels; and

• depleting water resources—through the closed loop processes water from the underground reservoir is returned after it is used to generate electricity. The fractures in the hot rocks are naturally full of water.

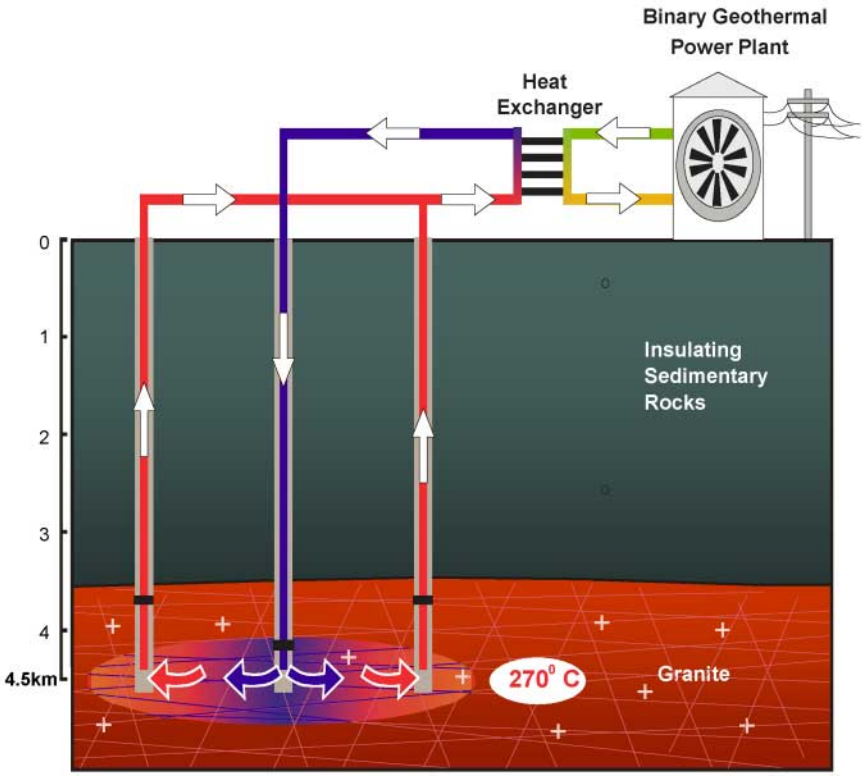
Reflecting these characteristics, HFR geothermal energy has been classified as renewable by national and international authorities.

Australia-wide HFR resources

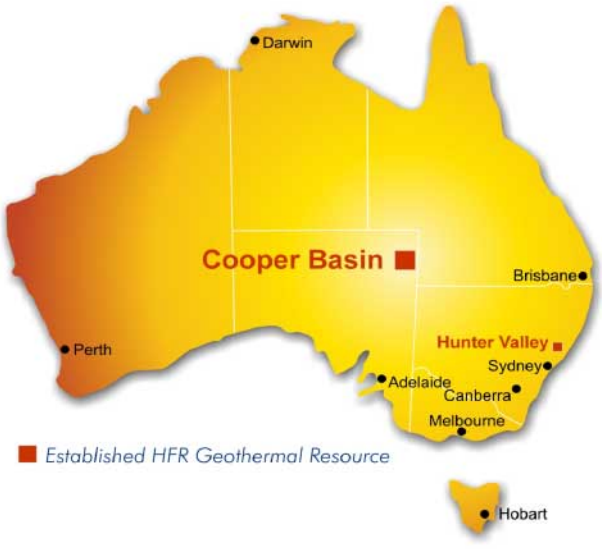
There is evidence to indicate that there is considerable potential to extract HFR geothermal energy in many other parts of Australia. Much of Australia's HFR geothermal resource exploration and development is occurring in South Australia. However, there are many places over the continent with high sub-surface temperatures trapped in deep granite.

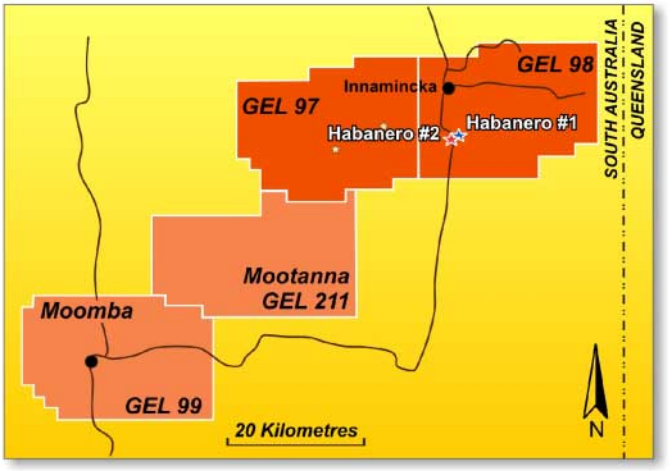
While it would require further specific exploration and analysis, the implied potential HFR energy reserves are massive. The map overleaf shows inferred temperatures at a depth of 5km.

There are now 14 companies pursuing geothermal energy in Australia, with 87 geothermal exploration licences and work commitments of over $500 million over five years. Most of the activity at present is in South Australia, where previous work by the oil and gas industry has enabled the delineation of hot rock resources. For example, Geodynamics has established that there is a



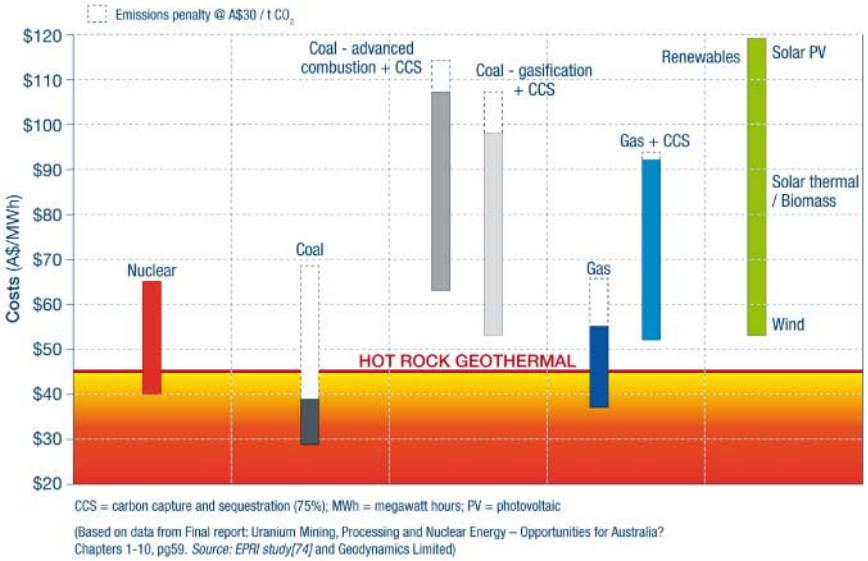
This is how a HFR generation plant works. Water is pumped into the rock, where it is heated and returns as superheated water/steam, which is used to drive a steam turbine that drives a generator. The now much cooler water is then fed back to the rock to continue the cycle.





The Cooper Basin is one of the best sites in the world for hot fractured rock (HFR) geothermal electricity generation, with the potential for thousands of megawatts of generating capacity.

large-scale HFR energy resource located below the Cooper Basin, near Innamincka on the South Australian side of the border with Queensland. They have drilled the Habanero number 1 and Habanero number 2 wells into the hot granites and identified the resource as being the hottest outside of a volcanic region yet discovered—the HFR resource has a temperature of 287°C at around five kilometres depth. What remains to be done is to demonstrate the capacity of HFR to convert a natural resource into electrical energy on a competitive and commercial basis. Once this is achieved it could put Australia into a leading position in what could become a major global industry.



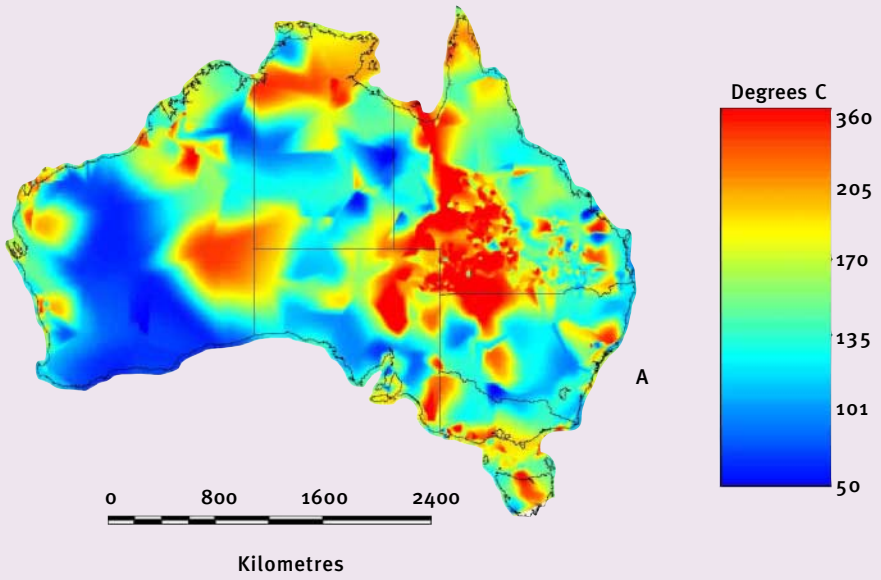
Comparative costs of the various generating technologies compared to HFR geothermal. As can be seen, the HFR system compares favourably.

Geoff Thomas originally wrote this article for the Empower Energy Fest in Cairns on the 7-7-7 Earth day, which was also attended by ATA members.

Currently Geoff is installing an 80kW grid-connected wind turbine at a school in Victoria, and has just received the go ahead for a 50kW revolutionary stand-alone system in the Northern Territory, which is expected to be the first of many. See www.iig.com.au/wind

Calculations of Australia's HFR resource

Based on temperature data from more than 3,500 boreholes (mostly oil and gas exploration wells) the Australian resource of hot dry rock has been quantified to the five kilometre level. The resulting image map of temperature at a depth of five kilometres is shown on the right.



Conservative assumptions were also made in calculating the size of the resource, in the following terms:

- the resource was defined by a minimum temperature of 225°C at a depth of 5km
- the resource was assumed to be only 1.5 km thick with temperature ranging from 225°C at the bottom to 165°C at the top (ie. average temperature 195°C)
- higher temperatures, known to exist at some locations, were ignored in the calculation
- 165°C was the assumed average temperature when the resource would be exhausted.

The resulting estimate of energy available for electricity generation was 23 million petajoules (1 petajoule = 10^{15} joules) or 7,500 years of Australian energy consumption at the current level. Over 80% of this resource is located in the Eromanga Basin, an area covering the NE corner of South Australia and the SW corner of Queensland. The distribution of the resource is given in Somerville et al (1994) [ERDC Report 243], Figure 6 and Table 1 (source http://hotrock.anu.edu.au/resource.htm).

Why cheaper is rarely better

Trying to decide between a $150 television and a $600 one? Price will often determine which one you will buy. But is this good practice or just false economy? Lance Turner takes a look at the issue.

I have to admit that from time to time I do buy items that are at the cheaper end of the market. This is usually because I don't have the spare cash for the more expensive item. Many other people do the same, as the up-front cost often seems like the main criterion to judge on. However, it makes a lot of sense to put more thought into decisions when buying any new item, and price shouldn't be the deciding factor.

So, why should I pay $299 for a DVD player when I can get one for $60? Well, the answer to that is multi-faceted, and includes reliability, performance, product longevity and environmental performance. In the majority of cases, the more expensive device has had more development work put into it, it is designed to last longer and perform better and, depending on the manufacturer, it may well have a much better environmental rating than the el-cheapo unit.

Going for cheap stuff is usually false economy. It often costs you a great deal more in the long run, produces more waste, and has a greater environmental burden than a well made but more expensive item.

So, just what should you be looking for? Firstly, you should always ask yourself do you really need it or will it just end up in a cupboard somewhere after a month or two. It can be hard to differentiate between what you need and what you want, especially with the constant advertising blitz we are all subject to. The sad fact is that the vast majority of items manufactured are made just for the sake of making them and to justify advertising departments. Most items end up in landfill after a few months or years—a terrible waste of resources.

The fan on the left was made over 40 years ago—when appliances were made to last. It is in much better condition than the fan on the right, despite being much older.

Having said that, if you really need it, then probably the most important criterion to look for is build quality. If something is a piece of junk, just picking it up and playing with it will often tell you this. Good quality items will feel like they are well made—they will often be heavier due to more solid componentry and mechanisms. This isn't always the case, but it often is.

A well-built device will nearly always last longer, not only because better quality components are more wear resistant, but also because a stronger-made device will withstand everyday knocks and bumps better than a less well made unit—many items end up in landfill simply because they have sustained physical damage.

So, when looking at appliances and devices, keep an eye out for the little things that can easily be broken, such as plastic catches and handles—in short, anything that is made of a cheap plastic when it should be metal.

Also check the warranty—something built properly should come with at least a one year warranty, preferably two or three years. A short warranty tells you the company doesn't have faith in their own products, so avoid them.

Environmental concerns

There are a number of environmental issues that should be considered. Firstly, some companies are a lot better than others at eliminating toxic materials from the products and processes than others (for a list of companies and what they are doing, see www.climatecounts.org). Apple is an example of this—they have come under fire from all quarters for the level of toxicity and lack of recyclability of their products. They have finally started to address this but are a long way behind other computer companies such as Dell and HP.

However, even companies that appear to have an environmental program can still produce products that are woefully inadequate in design. An example here is Canon. They disclose quite a bit of their environmental policy to the public, yet some of their products, such as their low-end printers, are environmental nightmares.

The S200SP printer for example, has an appalling record for reliability, with most of them ending up as junk after a year or two. The replacement print heads cost as much as the printer and they suffer from other failure modes that render the printers unrepairable. Doing an internet search on 'Canon printer fault' will yield a vast number of hits where people have asked how to fix their printers in forums. Unfortunately, these and similar printers are very popular due to their low initial cost (under $100 generally), and many purchasers never think about the long term aspects of the printer's life-cycle.

This problem is not unique to Canon. Virtually all of the low-cost bubblejet/inkjet printers suffer from the same problems, have a useful life of only a few years and are expensive to run.

The answer to this, of course, is to avoid this type of printer. Laser printers are generally better value, cost less per page to print and have a much longer service life, although they do use more energy when printing. Also, you can suffer when buying cheap units, especially colour lasers, where a change of cartridges can cost more than the printer itself.

From my experience, and from people I have talked to in the industry, the best printers environmentally are the Kyocera Ecosys range. They are designed for long lifetimes, high repairability and minimal consumables waste. They are also the cheapest laser printers to run per page. There are even new models that completely eliminate the production of ozone when operating. However, even with this range there are issues.

For instance, in the cheaper models the waste toner is stored inside the process unit, rather than in a replaceable waste toner bottle. When the process unit is full it has to be replaced, which generally costs as much as the printer. How such a design flaw crept into what is an otherwise excellent range of printers is anyone's guess.

Also try to think outside the square here. If you only ever print pages of text, by far the best printer is a good quality dot matrix impact printer. Modern units are fast—500 characters per second or more in draft mode—and will churn out a page in just a few seconds. They are dirt cheap to run, and the print heads last a very long time and are usually replaceable. The only consumable is the ink ribbon. Anyone who owned a computer early in PC history will know how reliable dot matrix printers can be. I have seen some units over 20 years old and still operating!

Rechargeable devices

Buying the cheapest when it comes to rechargeable devices is about the worst thing you can do for the environment. Cheap devices like rechargeable power tools nearly always come with low quality gearboxes, motors and NiCad (nickel cadmium) batteries. Better quality tools, such as Dewalt, will last a great deal longer through the use of better materials. They will also come with NiMH (nickel metal hydride) or lithium batteries, which are generally far less toxic and are longer lasting than NiCads, due in part to the better battery chargers that come with good quality tools.

Invisible problems—design failures

A classic example of this was a toaster I bought a few years back. It was not the cheapest by any means, and I wanted one that would last, so I bought the $40 unit (a Breville BT360) instead of the $15 one. Nine months later the toaster died. Being a tinkerer and because trying to claim warranty for a $40 device would be more hassle than it's worth, I opened it up to see what was wrong.

The design was average, to say the least, but what killed it was that some fool had specified the cheapest, nastiest, most brittle plastic available (polystyrene) for what was probably the most important component in the hold-down mechanism. This component, which was effectively the pivot/cam that controlled the toaster element switch and hold-down mechanism, had simply failed through stress—the centre had broken out of it. I managed to fix it with a new centre section with a screw for the pivot, but the unit has since failed again, this time with a less visible fault that I will have to test for.

Frankly, this sort of ridiculous materials specification makes me wonder where some engineers get their degrees. Of course, for the consumer there is no way of knowing that a device has a poorly made component, and so it simply becomes the luck of the draw, but generally, more expensive devices should last longer.

Old versus new

When you look at the electrical equipment made a few decades ago, you have to wonder why everything is so cheap and nasty these days. Sure, a lot of the old gear is clunky and heavy, but a lot of it is still running 40 years down the track! How many modern day appliances and devices will be running in 40 years?

A great example is the two fans in the photo. The fan on the left is an Elcon made back in the 60s, while the one on the right is a Chinese unit made this decade. The Elcon, after having two ca-

bles replaced due to age (rubber was the best insulator available at the time), runs like new. The Chinese fan is almost worn out, despite having seen only a fraction of the use of the Elcon.

Sure, a fan made to the Elcon's specifications will be more expensive and many people won't buy it, but in the long run it is the cheaper option of the two, both financially and environmentally. The Elcon is nearly all recyclable metals, the Chinese unit is unidentified plastic.

Electrical equipment like this is still available, but it isn't easy to find—you won't find it in your local K-Mart. You need to look around at the specialty stores, such as Tivoli Hi Fi, who sell high quality audio equipment. For some items you may have to shop overseas, but good quality items of most types can still be found if you look.

If you can't find what you are looking for new, then buy second-hand. The Elcon fan in the picture cost me around the same as the Chinese unit next to it!

Exceptions to the rule

There are occasions when a very good quality item can be bought at a bargain price. Liquidation stock, from companies that have collapsed or are phasing out a particular line, can sometimes be found at amazing prices.

Looking around online can yield some real bargains, but beware that there are many cheap Asian counterfeits out there, so do your homework and always ask questions before you buy. If a supplier won't answer questions in a legitimate manner, take your money elsewhere.

Ebay (and don't just go to the Australian site, the US site ebay.com has a much larger range) is an excellent place to find new-old-stock (NOS) items and second-hand appliances. I have found some amazing bargains there, sometimes getting new, genuine high quality items at half the recommended retail or less.

Summing up

- Don't buy on price alone.
- Play with an item before you buy it.
- Investigate a company's eco credentials if possible.
- Check the battery type in rechargeable devices.
- Make sure you get a good warranty.
- Do web searches for issues relating to the product.
- Look at suppliers and brands you wouldn't normally buy due to price—you might just get a bargain.
- Shop online, and don't be afraid to buy second-hand.
- Look for obvious failure points.

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The world's best-riding pedal machine?

Recumbent bikes and trikes are a great mode of transport, but the ride can be a bit bumpy. Julian Edgar tells us about his own design and how he overcame this problem.

It's easy to think that pedal-powered transport hasn't changed much for decades—look in any bike shop and, apart from trivial changes, bikes look much the same as they always have. But step away from the mainstream and you'll find genuinely innovative recumbent bikes and trikes. For example, Greenspeed, a Melbourne-based company, makes pedal-powered recumbent trikes that are versatile, practical and stable machines suitable for doing everything from shopping to recreational riding. After riding one I was so impressed I bought a Greenspeed GTR; my wife was so impressed that she became the Gold Coast Greenspeed dealer!

However, for the sort of riding I like doing—very hilly and bumpy roads, ridden mostly at night—production trikes like the Greenspeeds have a major deficiency: their very firm ride. Unlike a conventional bicycle, where you can stand on the pedals over the big bumps, on a recumbent trike the bumps come straight through the seat. Run high tyre pressures and ride fast down hills, and the trike can literally jump into the air over big bumps, coming down very hard. Maybe other people don't ride like I do, but after a few months of recumbent riding, I decided that suspension was a must. So I decided to build my own suspension trike.

Hundreds of hours of work and two prototypes later, the result is the Air 150.

Photos by Julian Edgar and Georgina Edgar.

Using long-travel air-bag suspension on all three wheels, the Air 150 is designed to pass over rough roads with little rider discomfort.

A new concept

The Air 150 is unlike any recumbent trike made anywhere. It uses three-wheel independent suspension with Firestone airbags providing the springing. The airbags, which use a 'rolling lip' design, are light and have a long travel. Furthermore, they can have their air pressure varied to maintain the ride height at the same level, irrespective of loads being carried.

The suspension travel (that is, the maximum vertical distance that the wheels can move) is 130mm. This large figure doesn't mean that the trike is set up to do stunt jumps; instead the long suspension travel allows about 50mm of static deflection to be used. In other words, when the rider gets on the trike and pedals off, the suspension settles about 50mm, indicative of the very soft springing. Soft springing allows the absorption of bumps, and the long travel allows big bumps to be absorbed without bottoming-out the suspension.

The very soft springing would make the machine feel sloppy and wallowy but for two other design aspects.

The first is damping. To stop the springs bouncing up and down at their natural frequency (about 2.2Hz, incidentally), dampers must be used. The rear damper is a modified steering damper from a motorcycle, its valving changed so that droop damping is much stiffer than bump damping. However, the front suspension doesn't use separate damping. Instead, the suspension

is organised so that the distance between the front tyres changes with suspension movement. This sideways movement of the tyres on the road damps the suspension.

The other design aspect that keeps the trike feeling taut and allows it to corner well is a very stiff front anti-roll bar. As its name suggests, this counters body roll. In fact, the trike rolls a maximum of about four degrees when cornered hard.

The greatest difficulty to overcome in the design of a long-travel suspension trike is to stop what is called 'bump steer'. Bump steer occurs when the wheels steer themselves during suspension movement. Bump steer makes cornering rather uncertain as the trike is responding not only to rider steering inputs but also to bumps! To prevent bump steer, the steering links and the suspension arms must be very carefully designed so that their effective lengths stay the same from full suspension droop right through to full suspension bump.

A long rear suspension arm is used so that the air spring can be placed closed to the wheel, decreasing the loads fed into the frame.

Steering

After trialling different steering systems on prototypes, I decided to use Greenspeed's 'non-crossover' steering, modified a little to suit the new application. This steering system, which uses vertical handlebars either side of the seat and a pivot point under the seat, was also chosen because it could be integrated with the proposed front suspension design.

The front suspension uses 'semi-leading' arms that diverge from the long axis of the trike by 30 degrees. As the suspension moves up and down, the camber (that's the angle the top of the wheels lean inwards or outwards) changes and the castor (the angle of the steering axis) also varies. Changing camber and castor are often regarded as big design errors in automotive circles, but this approach was taken to provide low suspension weight and better handling. For those really into suspension design theory, a high roll centre is also used. Jacking is used to offset spring compression at maximum cornering.

The rear suspension comprises a trailing arm. Both the front and rear suspension designs place the springs outboard, as close to the wheels as possible. This approach decreases the loads fed into the frame.

The front suspension uses a semi-leading arm design that is lightweight and allows for plenty of travel. The frame is constructed from chrome-moly steel tube.

Other components

The trike features a lot more than just the suspension. The frame, made primarily from 0.9mm wall thickness 4130 chrome-moly steel, was brazed together with nickel-bronze rods and an oxy-acetylene set. The welds have proved to be very strong. The seat uses a widened Greenspeed Ergo design and the 81 gears comprise off-the-shelf bicycle parts. Brakes are Magura 'Big' hydraulically activated discs and the 20 inch wheels (which need to be particularly strong to withstand sideways forces) are Greenspeed designs. Greenspeed also supplied the front steering kingpin assemblies which comprise steel shafts rotating in lubricated bronze bushes.

Night safety

A powerful lighting system comprises one 5 watt white Luxeon LED in a custom-built focussed headlight, two side-facing flashing yellow Luxeon 1 watt LEDs and two red rear-facing 1 watt LEDs. The 7.2 volt NiMH battery that

A high powered Luxeon LED lighting system is powered by an ex-Prius NiMH battery. Rear panniers are normally fitted.

powers the lights is one stick from a Toyota Prius high voltage battery pack.

Performance

So how does the trike ride? Down my test hill the bump that used to cause the non-suspended Greenspeed GTR to become airborne, crashing down after a metre or so with a gigantic thump, can now only just be felt. In fact, with a load in the panniers, you cannot even tell when the back wheel has passed over it! Data-logging of vertical accelerations felt at the seat show that on a bumpy bitumen road, the big bumps are reduced by typically 80%, and most bumps are now not perceptible. You ride along in absolute comfort, insulated from the surface over which you're riding. On really bad downhill surfaces, especially when the road is wet, the trike is incredibly sure-footed.

In terms of recumbent trikes, the machine is a very large one. It has an overall length of 205cm and a width of 94cm. The seat height is 41cm. The size of the machine was selected for a number of reasons: the wide seat is very comfortable, the wide track allows cornering stability with the high seat, and the length/width ratio allows large loads to be carried in the rear panniers without upsetting handling. The weight of the machine in base form is just over 23 kilograms.

A removable carrier is normally fitted with two Arkel RT40 panniers and an Arkel Tail-Rider carrier bag. The loads in the panniers are placed largely within the wheelbase, improving handling. As the carrier is part of the suspended mass, the greater the loads being carried, the better the ride quality. It's easily within the trike's and pannier's capabilities to go to the shops and then bring home two 10 litre containers of spring water—a 20 plus kilogram load.

But perhaps best of all, the trike is hugely exhilarating fun. Plunging downhill at night off the mountain on which I live, all light being provided by the LEDs, wind whistling through my helmet, corners racing up towards me and feeling the suspension working hard is simply fantastic. And what about the climb back up, you ask? With the range of gears and the fact that a trike cannot fall over, it's not a big problem—you just pedal fast in bottom gear and travel back up at a few kilometres an hour.

Green, mean and practical!

Julian is considering putting this trike into production. However, the estimated retail price would be around $6500 to $7000.

Pees and poos of dual flushing: a water saving solution

Do we really need three litres of water to flush away a pee? Derek Wrigley shows an easy way to use less water in the toilet.

It would seem that the credit for using water to flush and seal a toilet against foul excremental odours penetrating the house is due to Alexander Cummings, an English watchmaker who took out a patent in 1775 long before Thomas Crapper in the 19th century, who usually gets most of the credit.

The Cummings principle has served us well in conveniently disposing of our human wastes, but its consumption of super clean water is increasingly being seen as extravagant.

Until the late 20th century we accepted the two gallon flush as normal, but increasing population, drought and general environmental awareness is now causing us to question the use of an increasingly precious and expensive liquid which is far too clean and potable for the job it has to do. We have taken its availability for granted for too long and new thinking is needed.

Several biological treatment systems are now emerging which promise to revolutionise our disposal of human waste, but they will not solve the enormous problem of literally millions of existing toilets in Australia consuming unnecessarily large volumes of scarce water.

The use of greywater for cistern flushing is a rational concept but its lack of commercial availability doesn't help us in our immediate crisis. There are several other ideas being developed, but what is needed is a cheap commercial solution which can reduce the volume of clean water used in the millions of existing toilets around the country. The introduction of the 3/6 litre dual flushing system went some way to improving this problem but it still seems to use a lot of water. Using three litres of potable water to flush away a pee is still extravagant and quite unnecessary.

Also, many of our old existing cisterns are single flush and are not variable, having a single press button or lever with a linkage mechanism inside delivering around eight litres every time.

If we are to resolve this problem quickly we need a simple, cheap retrofit solution, adaptable to all cisterns. One elegant device available in hardware stores is a cylindrical weight called the 'Cistern weight' (about $10 to $15) which is easily added to most (not all) mechanisms inside the cistern.

It functions by flushing only while the button is pressed and it is claimed to save 20kL per year. Unfortunately, I have not been able to test it out.

Comparative household usage volumes for various flushing systems

Assuming two retired people at home most of the time	Single flush cistern: 8L every flush	Dual flush cistern: 3L for half flush, 6L for full flush	Variable manual flush with small pan: 0-1L for half flush, 3L for full flush.
Two full flush per day	16L	12L	0-6L
12 half flush per day	96L	36L	12L
Total toilet water usage	112L per day	48L per day	12-18L per day

A DIY solution

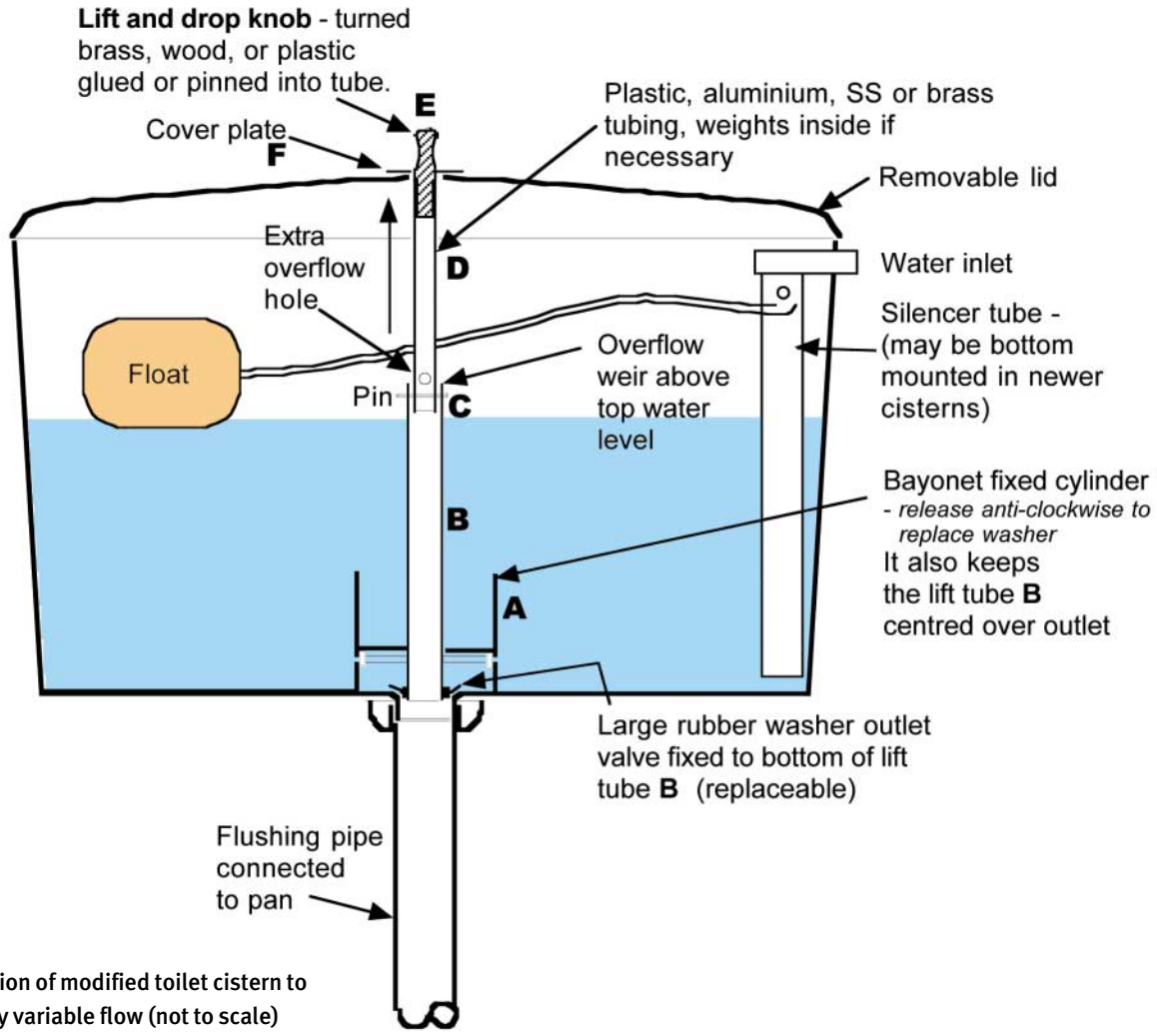
Over the last ten years I have been experimenting with ways of manually varying the water volume to suit the fact that a pee does not need as much flush as a poo. The mechanical linkages inside our two cisterns were clever but complicated (and would seem to be unnecessarily expensive to produce), so I felt that a simple lift and drop system could surely be adequate, simple and less costly to make.

I modified our two cisterns and they have worked well for the last few years. Although a pee flush *(*if actually used) could be reduced to even less than a litre, a poo flush still needed about five litres due to the pans being older, with a larger water volume.

About a year ago I needed to replace one of our toilet pans, so I chose a pan with a smaller throat or water area (actually about 30% less area), inducing a greater velocity of flow and a more thorough, economical cleansing action. This has worked extremely well with a poo flush now only needing three litres.

The table shows the significant reductions achievable, with a saving of 84% (over the original single flush cisterns) for a household of two retired people who relied on 7600 litre rainwater tanks for 52% of our consumption during the drought in 2006. This has helped us to reduce our water usage to about 62 litres per person per day.

The illustration shows how the cisterns have been modified for a variable manual flush. Please bear in mind that there are many designs of cisterns and I can only describe the ones I have (Caro-



Nominal section of modified toilet cistern to give manually variable flow (not to scale)

illustration by Derek Wrigley

ma). The drawing is necessarily simplified. Don't tackle this project unless you are a fairly confident DIY person with access to a workshop and tools.

The process

Firstly, make sure you have access to a working loo! The mains water needs to be turned off (under the cistern), the cistern emptied and the lid removed. The linkage mechanism is then dismantled, except for the vertical lift tube **B** in the centre which has the rubber outlet washer at the bottom. This is retained because it also acts as the overflow if the inlet valve ever fails. The cylinder **A** at the bottom serves to keep the tube and bottom washer central over the outlet hole and has to be removed by twisting in an anti-clockwise direction. It will be necessary to remove this whenever the bottom washer needs changing. It might be stiff, so keep trying.

The lower tube **B** is of the right height to act as the overflow weir so another tube is needed to extend it above the cistern lid with a lifting knob **E**. The upper tube **D** is smaller in diameter to allow overflow water to enter at the loose joint **C** and a piece of stiff copper wire (3mm diameter) is used to pin them together with a degree of looseness which allows the bottom valve to seat effectively (copper is malleable and won't rust).

At **E,** a turned brass knob (it just happened to be available!) was glued into the upper tube **D.** The knob should be the same diameter as the tube, which allows the cistern lid to be easily removed. Alternatively you can buy a plastic or wooden drawer knob which will, of course, need to be removable to get the lid off. The brass knob also acts as a weight which applies some extra pressure onto the bottom washer, but I have my doubts as to its necessity as I have modified another toilet with a light wooden knob which works perfectly. The weight of water above the bottom washer is really the critical factor, so remove that two litre plastic bottle of water in the cistern; its function will now be redundant.

The existing hole in the cistern lid will almost certainly not match the diameter of the upper tube (Murphy's

Law), so a circular cover plate **F** may be necessary to tidy up the hole. Your local plumbing or hardware shop may have an odd escutcheon plate used for taps or shower rose outlets. This can be glued down with a squirt of clear silicone sealer or rubber cement.

After installation

When installed the water can be turned on and the cistern filled to its previous limit (below the overflow weir). If it does overflow you will see ripples in the water reflection in the pan. If this happens bend the float arm down so that the float is submerged a little bit more (lowering the water level next time it fills).

There should never be any ripples on the water surface in the pan; if there are then you are wasting water, either by overflowing or the bottom washer is not seating effectively. Try rotating the vertical tube to reseat the washer as sometimes a bit of grit might be causing the leak. Never leave it leaking, and if you can't fix it then turn off the cock below the cistern and call a plumber. It is always much cheaper to learn how to do it yourself!

The system is very simple and should be significantly cheaper to make. Why aren't our manufacturers thinking this way and reducing their cistern costs?

Flushing is easy, with a quick action after a pee (one litre or less) and a little longer for a poo (three litres for a smaller pan). It's really quite easy to do. It saves a lot of water and has much less to go wrong. Re-washering is much simpler and it helps the environment. And the modification costs very little.

Derek Wrigley OAM is a solar architectural consultant with a passion for simple and functional design.

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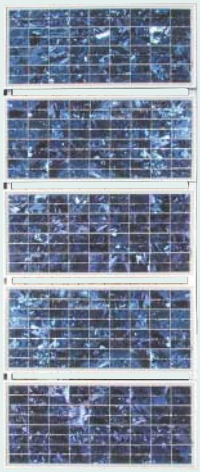

Send your ideas to: *ReNew*, Level 1, 39 Little Collins St, Melbourne VIC 3000, renew@ata.org.au. Competition closes Friday 23 May 2008.

Solar array and regulator kit kindly donated by Oatley Electronics, www.oatleyelectronics.com

Are you up to the challenge?

Cutting household emissions always starts with 'reduce': here's one resource to guide you through the process, writes Jacinta Cleary.

The serious looking man in the black T-shirt has thrown down a challenge—the R²O Challenge. In fact, Andrew (pictured), a retired school teacher from Melbourne, is far from menacing, but he knows how to set a task.

The R20 Challenge is something that Andrew devised himself. Like many people, Andrew is voluntarily finding his own way to reduce greenhouse gas emissions and getting the community around him involved too. The number of people acting beyond government policy about climate change has increased in the last few years. There are people organising long distance bike rides around the world, car rallies on alternative fuels and fund raising initiatives within their own community, all as a way to raise awareness about climate change.

Andrew's doing his part through the internet, setting up a website called Making Connections. At first it might sound like an internet dating site, but it actually contains some handy information on what Andrew has done around the home to lessen his impact on the environment. The website name also relates to his journey to a more sustainable way, and 'rediscovering past and present influences which seem to have got me to this point in my life.'

The website includes sections on solar power, rainwater collection, greywater recycling and gardening, as well as examples from friends' homes and gardens around the world. The website is also home to the R²O Challenge.

R²O Challenge

The R²O Challenge is based on three steps to reduce greenhouse gas emissions. Most will agree on the first two steps: reduce and renew. This means cutting energy use at home first, followed by investment in renewable electricity supply such as GreenPower, solar hot water or grid-connected photovoltaic systems. The third step, offset, refers to buying carbon offsets to neutralise any remaining emissions. Andrew intends that offsetting be investigated only when household emissions have been reduced as much as possible by the first two steps. Carbon offsetting is still very much unregulated in Australia, so care should be taken when purchasing carbon offsets.

Top: Andrew's grid-connected 1.67 kW solar PV system. Bottom: Andrew in his special R²O Challenge T-shirt.

Andrew's background as a teacher possibly influenced the way the challenge is set up. 'I was always making lists, my work in education had something to do with that,' he says. The R²O Challenge is very simple as it revolves around just two checksheets, available from the website.

Checksheet One is split into the three steps: **reduce**, **renew** and **offset**. Each step is categorised into areas such as car use, processed food, water and electricity, with suggested actions to tackle each area. The challenger ticks off each action as it is completed, for instance,

Recycled water use is one of the options in the R²O Challenge.

when they have installed a low-flow showerhead. Each action is categorised as either easier or harder, with the participant deciding which route they want to take.

Andrew's rationale behind splitting the Challenge into easy and hard tasks is that 'if we let people know what we think are easy things to do then they might take action.' It can be argued endlessly what is an easy task and what is a hard task, but his main concern is to get people involved.

The **renew** section includes actions such as installing a water tank (categorised as easy) or installing a water recycling system (which is in the hard column). The final offsetting section relates to car and plane travel only, as it's assumed that household emissions are largely taken care of if the renew section has been completed.

Checksheet Two is a data collection sheet, enabling participants to compare their gas, water and electricity bills, plus their petrol consumption, after spending some time on the R²O Challenge. Andrew says that Checksheet Two is intended as a way 'to know you've made a change.'

There's no start or end date to the R²O Challenge, and no one need know you're doing it. Andrew's self-published booklet, *Sustaining the Planet: actions you can take to reduce your carbon footprint*, may provide inspiration to anyone starting the R²O Challenge, or simply to those who want to reduce their household greenhouse gas emissions. It's available as a free download from the Making Connections website.

Water collection

Having lived in the same house since 1973, Andrew and wife Chris have had some time to fine tune the energy and water saving features on their property. This includes a 2200 litre rainwater tank for watering their small veggie patch and the plants in their back and front yards. Rainfall in Melbourne is still quite low, and after a couple of waterings the tank rapidly empties. Andrew and Chris therefore decided to install a water recycling system, which treats greywater from the shower, hand basin and washing machine to a high standard.

Due to space restrictions they've installed a Nubian system which uses a biological process to treat the water;

SUSTAINING THE PLANET

Join the R²O Challenge

http://www.r2ochallenge.com

What is the R²O Challenge?

First **Reduce:**

Take the plunge and choose an easy option from either lighting, car usage, processed food usage or electricity use. When this first step becomes routine, choose another easy option. After all the easy options have become routine, work on the harder options. Some reductions are harder to achieve than others, either because of expense or the need to make big changes to behaviours.

Lighting: install low energy globes (easier): leave fewer lights on (easier)

Car usage: walk more (easier); use home delivery from supermarket (easier); use public transport more (harder); cycle (harder)

Processed food consumption: grow veggies (easier); bake bread (easier); use farmers markets (harder), buy organic (harder); keep chooks (harder); buy food grown within 160 kilometres (harder)

Electricity use: turn off appliances at the power point (easier); buy 5-star appliances (harder)

Then **Renew** (ie. invest in renewables): Now that you've reduced your energy footprint have a go at investing in renewables; start with the easy options;

Watertanks (easier)

Buy GreenPower (easier)

Water recycling systems (harder)

Solar hot water (harder)

Grid-connected photovoltaic systems (harder)

And only then **Offset**

Car travel (easier)

Plane travel (easier)

other systems requiring a collection pit to be dug. They were in the fortunate position of being able to buy a more sophisticated treatment system that can treat water to a very high standard, costing around $11,000. Yet, they still only received a $500 rebate, even though it's estimated they can save around 52,000 litres of water a year.

For Andrew and Chris, investing in a water recycling treatment system is an involved and ongoing process, including:

- planning and operational permits from council
- two mandatory inspections of the system by a licensed plumber every year
- annual lab test of treated water
- annual report to local council

Treating the greywater to a high standard means that it can be used above ground to water the garden, wash the car as well as other uses. Water from the system still requires annual laboratory testing. The most recent test showed that the treated water was of a quality better than Nubian's benchmarks.

Solar energy

Last year the couple installed a grid-connected 1.67kW system (with ten 167 watt Sharp panels) connected via a Fronius inverter to a meter that registers power generated and exported to the grid and power imported from the grid.

Andrew says they should have installed the system years ago to recoup the system costs, but their main reason for installing solar power is to contribute, in a small way, to CO_2 reduction. It's estimated that the system produces approximately 5 to 7 kWh/day, depending on the season, with Origin Energy purchasing their Renewable Energy Certificates. At the moment (summer) the system provides 70% of their electricity needs.

Top: A very healthy plot of greens, thanks to a water recycling system. Right: The collection tank for the water recycling system.

Garden

The garden is thriving because it receives so much water through the water recycling and rainwater systems. There were few plants and lots of lawn when Andrew and Chris moved into the house in 1973. Now there's an abundance of Australian native plants and a small vegetable garden to supply two people with all their greens. Being a native garden it needs less water.

Andrew's neighbourhood is in the leafy green inner suburbs of Melbourne, with the suburb's median house price close to a million dollars. Andrew comments that some of his neighbours have invested in large rainwater tanks, in some cases 20,000 litre underground tanks. He says that grid-connected solar installations such as his are a rarity in the area.

The area is typical of some urban parts of Australia: big houses, maybe a couple of cars, several appliances, perhaps a heated pool and probably an air-conditioner. Some of these homes would use more electricity in a day than many lower income households would use in a week. That's why a grassroots initiative such as the R²O Challenge in the midst of these households is so important.

To do the R²O Challenge go to the Making Connections website and collect Checksheet One and Two. To let Andrew know you are joining the R²O Challenge email him via the website, although it's not necessary to make contact to do the Challenge. If participants are willing, some of their anecdotes might be shared via the Making Connections website. Web address: www.r2ochallenge.com.

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RAPS fridge buyers guide

Lance Turner examines fridges suitable for remote area power supply (RAPS) systems, what they cost and where to get them.

In the western world, refrigeration is something that we take for granted. We buy food, stick it in the big white box and eat it days, weeks or even months later. However, actually choosing your fridge in the first place is not so simple if you are concerned about energy efficiency, especially when you are also making your own electricity. Making the wrong choice of fridge type or size can be a costly experience.

This buyers guide looks at high-efficiency refrigeration alternatives available for those homes with independent power systems.

Photo: Waeco Pacific P/L

DC fridges are available in a range of sizes and types, and are usually a more efficient option for RAPS systems.

Fridge efficiency

Regardless of the fridge type, the efficiency of a fridge depends on the following:

- the efficiency of the motor that drives the pump which makes the fridge cold in the first place (this applies to compressor fridges only)
- the amount of insulation used to keep the cold in (actually, the heat out), and
- how efficiently the condenser coils disperse the heated gas and therefore reduce the work load of the pump.

Another factor is the defrosting system used. Frost-free fridges use a system of heating elements in the cabinet and doors to rapidly remove ice from inside the fridge by melting it. The compressor then has to remove all of the heat they have dumped inside the cabinet by running excessively. This may offer convenience, but is very wasteful. The efficient alternatives to look for are either push-button or cyclic defrost systems.

240 volt AC fridges

Many renewable energy installers now specify systems large enough to run a 240 volt AC fridge. This has the advantages that there is a large range of fridges to choose from in a range of finishes, and, because of the mass production of these units, they are quite cheap. However, there are some serious negative aspects of using 240 volt fridges and freezers on renewable energy systems.

The first is that, generally, AC fridges are not as efficient as equivalent-sized DC fridges. While the gap has narrowed over the last few years, it's still there. This means that you need more energy to run the AC fridge. When you generate that energy yourself it means you need a larger renewable energy system to cope with the extra load, so you need more solar panels, a larger capacity battery bank, and possibly a larger inverter.

All this extra equipment can cost more than the price difference between the AC and an equivalent DC fridge.

Also take into account the fact that most fridges have electronic controls, so the inverter must be set to keep running, even when the only load is the fridge itself, even if the fridge compressor isn't running. This means that the inverter is running 24/7, even if, for large parts of the day, there are no loads other than the fridge. This can result in considerable wasted energy, as even the best inverters will not run overly efficiently when driving small loads. This is energy that must be generated, so it increases the required size and cost of the power system even further.

The second issue that arises, and one that most people don't think of until it happens, is what if your inverter dies? While this doesn't happen often, it does happen.

Just imagine your inverter failing a week before Xmas or some other event. What happens to all that food if you can't get a backup inverter within a couple of hours? It is not unusual for a fridge/freezer to contain a couple of hundred dollars worth of edibles, so you should take this into consideration.

If you decide that you want an AC fridge for your independently powered home, then make sure you buy the most efficient unit available that meets your needs.

To help you find an energy-efficient fridge, the Commonwealth Government has devised an energy rating system for domestic appliances including fridges. An appliance is awarded between one and six stars. The more efficient it is the more stars it gets. The rating system is explained fully on the web site www.energyrating.gov.au, which includes a list of 240 volt fridges with their star ratings (so we won't be including them in this guide). Be aware that the star rating only goes to six stars, and there are some fridges that exceed this rating. When searching for an appliance, make sure you click the 'show comprehensive information' link at the top of the search results, which will show the star rating index (SRI) number, which is the equivalent stars the appliance would be awarded if the star ratings system went above six stars.

However, having looked at AC fridges, for independent power systems, a high efficiency DC fridge is often a better option.

Extra-low-voltage DC

These fridges are aimed primarily at the independent home as well as the caravan and boating markets, therefore, they are designed with high efficiency in mind.

The extra-low-voltage fridge uses the same refrigeration system as its AC counterpart. The only difference is that the motor runs directly from your 12 or 24 volt battery bank. The motor in a DC fridge is generally more efficient than one in a 240 volt AC fridge, and therefore uses less energy. There are also no inverter losses, as the energy used comes straight from the battery bank, not via the inverter. So you save another 10-15% of energy there too.

As with an AC fridge, other factors affecting efficiency include the amount of insulation, how well the condenser coils do their job, and the defrosting system used.

If you are running your home solely on 240 volts from an inverter, you will need to run a separate extra-low-voltage circuit for a DC fridge, which can add several hundred dollars to the cabling costs for the house, but that is probably far less than the extra equipment costs for running an AC fridge, as discussed earlier.

It is worth noting that if you are connected to the grid, you can still run an extra-low-voltage fridge from a regulated 12 or 24 volt power supply. Some DC fridge suppliers sell these power supplies for use with their fridges, and suitable supplies are available from electronic parts suppliers. The cost of running a DC fridge on a switchmode power supply will still be considerably less than that of the average AC fridge. However, the initial cost will be higher as DC fridges are significantly more expensive than AC equivalents.

Gas and kerosene fridges

The last option is a gas or kerosene fridge. These use the absorption method of refrigeration and are driven by the heat from a gas or kerosene burner, or electric element. The three-way fridge has both a burner and electric element(s) so you can switch between power sources. The absorption system has the advantage that there are no moving parts such as compressors and motors to wear out, but the disadvantage is that they don't work too well in high ambient temperatures.

Is it environment friendly?

Some years ago, most compressor fridges used chlorofluorocarbon (CFC) gases as a refrigerant. However, since the realisation that these gases are highly destructive to the ozone layer, and their subsequent phasing out, none of the fridges now on the market have CFC refrigerants. Compressor fridges generally use gases like R134a, which is a hydrofluorocarbon, or HFC, or others that are hydrocarbons. These gases are supposed to be far more environmentally friendly than CFCs, and while not ozone destroyers, they are still strong greenhouse gases. The refrigerant used in an absorption fridge is ammonia, which is not destructive to the ozone layer.

The insulation materials used in some fridges may contain CFCs, although this is now pretty unlikely. This is more

likely to be so if the cabinet is imported. If this concerns you, ask the supplier. If they don't know, then it might be best to go somewhere else.

If you are concerned about minimising greenhouse gas production, the DC fridge is the better option. So long as it is powered by a renewable source of energy such as solar or wind power, it is not producing any greenhouse gases while running.

Gas fridges, on the other hand, do produce greenhouse gases from their burners, mostly in the form of carbon-dioxide. A typical 220 litre gas fridge, for example, would produce around 500kg of CO_2 per year, which is about 10 tonnes over its expected 20 year life.

Increasing efficiency

There are a couple of simple guidelines that will help increase the efficiency of your fridge. The most important one is to consider the temperature outside the fridge. If possible, position your fridge away from sunlight, water heaters and ovens. Also, the back of the fridge should be well ventilated so that the condenser will cool down as quickly as possible.

Other commonsense guidelines include keeping the door closed as much as possible, avoiding putting hot food in the fridge, and defrosting regularly.

High-efficiency mains and DC powered fridges—not available in Australia!

While there is no doubt that fridge efficiency has greatly improved over the last decade or so, the extra-low-voltage DC and 240 volt AC powered fridges available in Australia still have a way to go, compared to models available overseas.

There are several very efficient DC fridges available and some that are also available in AC versions. However, like most things in life, the higher quality fridges cost a little (or sometimes a lot) more than the average AC fridge.

A great example is the Sunfrost range. These have been around for many years and have some excellent energy consumption figures. For instance, the largest model, the RF19, a 457 litre fridge/freezer, uses 744Wh a day for the 12 volt model (at 21°C ambient temperature) and 984Wh a day at 32°C. The AC version uses 770 and 1020Wh a day respectively. Figures for the smaller 287 litre RF12 (shown below) are excellent, at 288 and 468Wh a day for the DC version, and 290 and 470Wh a day for the AC version.

The Sunfrost are probably the priciest fridges we have come across, with the RF19 costing US$3100 for the DC model and US$2955 for the AC version. The RF12 costs US$2159 and US$2079 respectively.

For more information, contact Sunfrost on ph:+1 707 822 9095, fax:+1 707 822 6213, email: international@sunfrost.com, www.sunfrost.com

If you think the Sunfrost is a low energy user, have a look at the SunDanzer chest fridges and freezers!

SunDanzer make both chest fridges and freezers, in 165 and 225 litre sizes. They will run on either 12 or 24 volt DC supplies and have a low-voltage disconnect to protect the battery bank.

Other features of these units include powder-coated steel exterior cabinets, aluminium interiors for corrosion resistence and 110mm of polyurethane insulation, which is a huge level of insulation compared to most fridges.

But the best part is the energy consumption ratings. For example, the 165 litre fridge uses just 77Wh a day at 21°C ambient temperature and 168Wh at 32.2°C. The 225 litre fridge uses 90 and 198Wh a day at the same temperatures, respectively.

The freezers are equally efficient, using 272 and 441Wh for the 165 litre model, and 360 and 532Wh for the 225 litre unit. Prices range from US$1049 to US$1149.

These energy consumption figures mean that the fridges can run on one or two 75 watt solar panels—a tiny fraction of what would be needed to run a typical AC fridge.

For more information, contact SunDanzer on ph:+1 915 821 0042, fax:+1 775 201 0236, email: international@sundanzer.com, www.sundanzer.com

What's available?

This guide has been restricted to fridges suitable for domestic refrigeration. There are many other fridges on the market, including those sold as 'car fridges'. These range from cheap 'car coolers' which use Peltier devices for cooling (these are not very efficient), up to the quite advanced 'Eutectic' fridges, such as the Autofridge, which have very low power consumption requirements.

However, many people consider these too small or inconvenient for home use, so they have not been included.

About the tables

There are two tables in this guide, the first of which covers fridge-only units and combined fridge-freezers. For most people, this is all they will require, but some will need longer-term bulk storage that only a deep freeze can provide. These appear in Table 1.

The tables should give you all the information you need to make your decision, so let's examine them in more detail.

Capacity: The fridge capacity is the size of the refrigeration section of the cabinet. The same goes for the freezer capacity. Adding these two figures gives the total cabinet capacity.

Type of fuel/voltages available: Almost all of the DC fridges are available in either 12 or 24 volt versions, and some of them are dual voltage units—they have electronic controllers that allow the same fridge to be connected to either system voltage without problems. This may be useful if you are thinking about upgrading your system at a later date, but want to buy your fridge now.

All of the gas fridges use LP gas as their fuel, and should not be run from natural gas unless they are correctly set up for it. This usually requires at least a change in burner jet size.

Fuel consumption: The figures given for the DC fridges should not be taken as gospel. There are many factors that will affect fridge performance, including ambient temperature, the amount of 'turnover' of food in the fridge, and how often the kids (and adults) stand there with the door open for 10 minutes. So really, the figures are only a relative measure of efficiency, but are none-the-less useful for comparing different models.

The fuel usage figures for the gas fridges have been given in grams used per day. This allows the running time to be easily calculated from a given size of gas bottle. It should be noted here that, unlike a compressor system, the amount of fuel used does not vary with ambient temperature—the burner runs all the time with a gas fridge—though the flame size, and thus the cabinet temperature, can usually be set from the front panel.

The rest of the tables detail fridge dimensions, prices and warranties. The prices include GST.

Table 1: Deep freezers.

Make	Model	Freezer capacity (L)	Energy source/ voltages available	Refrigeration system	Fuel/energy consumption	Number of doors	Dimensions (H x W x D in mm)	Warranty	Price	Comments
Autofridge (Fisher & Paykel) Conergy Pty Ltd ph:(02) 8507 2213 fax:(02) 8507 2220 www.conergy.com.au	AF-H160S	164	12 or 24 volt DC	Cyclic defrost	820Wh/day @ 35°C	1	903 x 611 x 662	2 years	$2172.50	White, can be factory-set as refrigerator only, freezer only, or refrigerator to sub-zero
	AF-H220X	216			880Wh/day @ 35°C		903 x 746 x 662		$2486.00	
	AF-H280X	280			-		903 x 901 x 662		$2772.00	
Frostek DP Refrigeration ph:(03) 9437 0737 sales@dprefrigeration.com.au www.dprefrigeration.com.au	240	240	LP gas	Absorption	650g/day	1	990 x 1120 x 790	1 year	$3250.00	Chest type freezer
Vitrifrigo Camec Pty Ltd (03) 9799 6455 camec@camec.com.au www.camec.com.au	C55BT	56	12 or 24 volt DC	Danfoss compressor	744Wh/day	1	615 x 470 x 460	1 year	$1900.00	-
	C110BT	108			1080Wh/day		764 x 525 x 552		$2150.00	
	DW 180	144			792Wh/day	2	868 x 644 x 522.5		$2600.00	Two-drawer freezer

Table 2: Fridges and fridge-freezers.

Make/supplier	Model	Fridge capacity (L)	Freezer capacity (L)	Energy source/ voltages available	Refrigeration system	Fuel/energy consumption	Number of doors	Dimensions (H x W x D in mm)	Warranty	Price	Comments
Autofridge (Electrolux cabinet) Conergy Pty Ltd ph:(02) 8507 2213 fax:(02) 8507 2220 www.conergy.com.au	AF-ETM3600WB	277	91	12 or 24 volt DC	Frost free	1100Wh/day @ 35°C	2	1640 x 690 x 647	2 years	$3619.00	White, available in left or right hand hinging
	AF-ETM3900WB	302	91			1200Wh/day @ 35°C	2	1720 x 690 x 647		$3861.00	
	AF-ETM3900SB	302	91			1200Wh/day @ 35°C	2	1720 x 690 x 647		$4290.00	Stainless steel, available in left or right hand hinging
Autofridge (Fisher & Paykel cabinet) Conergy Pty Ltd ph:(02) 8507 2213 fax:(02) 8507 2220 www.conergy.com.au	AF-P120RW	115	6	12 or 24 volt DC	Cyclic defrost	400Wh/day @ 35°C	1	819 x 525 x 550	2 years	$1787.50	White, available in left or right hand hinging
	AF-P120RS	115	6			400Wh/day @ 35°C	1	819 x 525 x 550		$1788.50	Stainless steel, available in left or right hand hinging
	AF-E249TRW	191	57		Cyclic freezer, frost free fridge	850Wh/day @ 35°C	2	1595 x 525 x 570		$2843.50	White, available in left or right hand hinging
	AF-E249TRS	191	57			850Wh/day @ 35°C	2	1595 x 525 x 570		$3025.00	Stainless steel, available in left or right hand hinging
	AF-H160S fridge	164			Cyclic defrost	380Wh/day @ 35°C	1	903 x 611 x 662		$2172.50	White, can be factory-set as refrigerator only, freezer only, or refrigerator to sub-zero
	AF-H220X fridge	216				550Wh/day @ 35°C	1	903 x 746 x 662		$2486.00	
	AF-H280X fridge	280				700Wh/day @ 35°C	1	903 x 901 x 662		$2772.00	
Autofridge (Westinghouse cabinet) Conergy Pty Ltd ph:(02) 8507 2213 fax:(02) 8507 2220 www.conergy.com.au	AF-RA122T	120		12 or 24 volt DC	Cyclic defrost	400Wh/day @ 35°C	1	845 x 545 x 570	2 years	$1694.00	White, available in left or right hand hinging
	AF-RP241T	241				880Wh/day @ 35°C	1	1441 x 544 x 570		$2420.00	
	AF-WTB2000WA	135	65		Frost free	600Wh/day @ 35°C	2	1253 x 540 x 620		$2436.50	
	AF-WTB2300WA	165	65			700Wh/day @ 35°C	2	1389 x 540 x 620		$2618.00	
	AF-WTB2500WA	170	80			800Wh/day @ 35°C	2	1491 x 540 x 620		$2937.00	
	AF-WTB3100WA	215	95			1000Wh/day @ 35°C	2	1580 x 595 x 640		$3245.00	
Consul DP Refrigeration ph:(03) 9437 0737 sales@dprefrigeration.com.au www.dprefrigeration.com.au	QD22F	200	31	LP gas	Absorption	500g/day	2	1450x 611x 720	1 year	$1895.00	Free standing model
Engel Australia ph:1300 302 653 info@engelaustralia.com.au www.engelaustralia.com.au	SR48F	40 litres total		12, 24 volt DC or 240 volt AC	Compressor	0.5 to 2.5Ah per hour at 12 volts DC (144 to 720Wh per day)	1	531 x 423 x 510	3 years	$799.00	Built-in model
	SB47F			12 or 24 volt DC						$725.00	
	SR70F	57 litres total		12, 24 volt DC or 240 volt AC				530 x 506 x 586		$849.00	
	SR90F	80 litres total						770 x 560 x 548		$1175.00	
	ST68F	55 litres total						547 x 450 x 548		$975.00	Free standing model
	ST90F	80 litres total						780 x 520 x 548		$1249.00	
Vitrifrigo Camec Pty Ltd (03) 9799 6455 camec@camec.com.au www.camec.com.au	DP150i	118	30	12 or 24 volt DC	Danfoss compressor	720Wh/day	2	1095 x 525 x 580	1 year	$2290.00	-
	DP2600	170	60			960Wh/day		1335 x 590 x 580		$2450.00	
	BRK35	35	-			288Wh/day	1	240 x 440 x 710		$1150.00	Top loading model
	C26	26	-			192Wh/day		345 x 385 x 510		$1030.00	
	C41	41	-			288Wh/day		400 x 385 x 610		$1160.00	
	C65	65	-			336Wh/day		510 x 450 x 725		$1320.00	
	C45L	40	3.6			468Wh/day		540 x 390 x 400		$1160.00	-
	C75L	75	10.2			336Wh/day		615 x 470 x 460		$1250.00	
	C130L	133	17.1			468Wh/day		765 x 525 x 550		$1450.00	
	C60I	60	10.2			324Wh/day		615 x 470 x 460		$1190.00	
	C85I	90	12.8			360Wh/day		785 x 485 x 470		$1290.00	
	C115I	118	17.1			456Wh/day		765 x 525 x 550		$1320.00	
	usa 51	51	-			324Wh/day		523 x 380 x 520		$1190.00	
	usa 62	62	-			324Wh/day		525 x 450 x 550		$1220.00	
Waeco Pacific Pty Ltd 1 John Duncan Court Varsity Lakes QLD 4227 ph:(07) 5507 6000 www.waeco.com.au	CoolMatic CD-30	30	-	12 or 24 volt DC	Compressor	Approx 480Wh/day @ 40ºC ambient, 5ºC interior	1	440 x 250 x 730 (L1040 drawer open)	2 years on compressor, 1 year on everything else	$699.00	18kg
	CoolMatic CR-50	43	5			403Wh/day at 25°C 489Wh/day at 32°C		Flush mount 406 x 536 x 495, standard mount 384 x 536 x 447		$949.00	19kg
	CoolMatic CR-65	56.8	7.2			460Wh/day at 25°C 547Wh/day at 32°C		Flush mount 474 x 527 x 540, standard mount 452 x 527 x 492		$999.00	20kg
	CoolMatic CR-80	72.1	7.9			518Wh/day at 25°C 604Wh/day at 32°C		Flush mount 501 x 642 x 523, standard mount 479 x 642 x 475		$1149.00	23kg
	CoolMatic CR-110	97.8	10.2			636Wh/day at 25°C 720Wh/day at 32°C		Flush mount 546 x 747 x 553, standard mount 524 x 747 x 505		$1299.00	28kg
	CoolMatic RPD-190	140	45			840Wh/day @ 25°C8 864Wh/day @ 32ºC and 5ºC interior	2	590 x 1340 x 590		$2199.00	~45kg. For use on 240V use MPS50 power supply
	CoolMatic HDC-160	140	16			1008Wh/day @ 25°C 1080Wh/day @ 32ºC and 5ºC interior	1	Built in dimensions 540 x 1205 x 553		$1599.00	36kg. For use on 240V use MPS50 power supply
	CoolMatic HDC-190	140	45				2	Built in dimensions 540 x 1245 x 553		$1769.00	39kg. For use on 240V use MPS50 power supply
	CoolMatic HDC-220	168	46				2	Built in dimensions 540 x 1405 x 553		$1969.00	44kg. For use on 240V use MPS50 power supply

A RAPS system upgrade

What do you do when your independent power system is too small? Upgrade it of course! Paul Morrow explains a few features of his upgraded remote area power supply (RAPS) system.

I set up a 12 volt RAPS system two years ago thinking that I had calculated my usage needs and what I could afford. The rebate system only considered the solar panels, not the cost of batteries and inverters and certified solar installers and electrical contractors required to hook the system up.

Fortunately, the local solar installer was able to supervise my work on the extra-low voltage end so I was able to do most of the work, with him confirming that it complied with the regulations. Things such as signs and 'mechanical protection' for exposed cables are very important! My electrician also allowed me to do a lot of the basic work needed, like crawling under the house to pull cables through. These things save a fortune when tradesmen are involved.

Paul's little bush cottage is rather overwhelmed by a solar PV system, solar hot water and satellite internet. A 400 litre header tank (on the right) provides water pressure for the house.

Need more power...

After two years I decided that I needed more electricity and, in particular, I needed a fridge. Changing my system to 24 volts has made it far more efficient and allowed me to use a 24 volt fridge and to double the size of my inverter to 1300 watts. I had to run my generator to vacuum the floor (1400 watts is common for vacuum cleaners) to iron a shirt (1200 watts for an iron), and use a washing machine. The washine machine has the lowest annual consumption but still has high peaks of current usage, far too high for my 650 watt inverter. Now I can run all these plus a microwave oven and a small toaster (700 watts is the smallest I could find). I won't risk an electric jug.

I chose 12 volts originally because I could buy 12 volt lights, pumps and phone chargers made for cars and boats much cheaper than those made especially for the small renewable energy market. Now, of course, there are chargers for phones and laptops that will run on anything from 11 volts to 28 volts.

I needed a fridge that could handle the summer heat. I have been using an 80 year old kerosene fridge which was converted to LPG 30 years ago. It is not very effective when the outside temperature reaches 30°C. Insulation for fridges has moved on in the last 50 years, so I have been wasting a lot of fossil fuel.

Bushman make a small chest fridge/freezer for 4WD and caravan use that runs on 12 or 24 volts. The compressor runs on 24 volts so is ideal with my 24 volt system. I figure that when I do my next electrical upgrade I will put in a 'fridge only' upright and use the Bushman as a freezer—this only requires setting it to run at a lower temperature. The 42 litre fridge fits under a bench in my kitchen.

I had a 12 volt bilge pump which filled my water supply header tank, so to go to 24 volts I put in a second pump in series (both in the electrical and the pumping sense). I thought at first that it would be necessary to have the first pump lift the water half way to the header then have the second lift it the rest of the way. This was wrong; the pump that was running dry took all the power. I now have them close together at the level of the bottom of the rainwater tank.

Setting up renewable energy systems is not cheap and the rules for rebates are complex. I could get a RAPS system that would suit my needs for half of the

The 24 volt DC Bushman fridge lives under a bench in the kitchen.

it more suitable for charging up to about 80% then using the solar panels to finish the charging. This means starting the generator in the morning before the sun reaches my solar panels, when the batteries are at their lowest charge. Also, by running the genset while I'm having breakfast, it provides the 30 amps required to run my electric toaster while still charging the batteries. Unfortunately the charger has to be near the batteries, which are close to the house, so it is a bit noisy.

Layout diagrams of the electrical system were essential for working out where everything fitted. Keeping all cables as short as possible has increased the efficiency considerably.

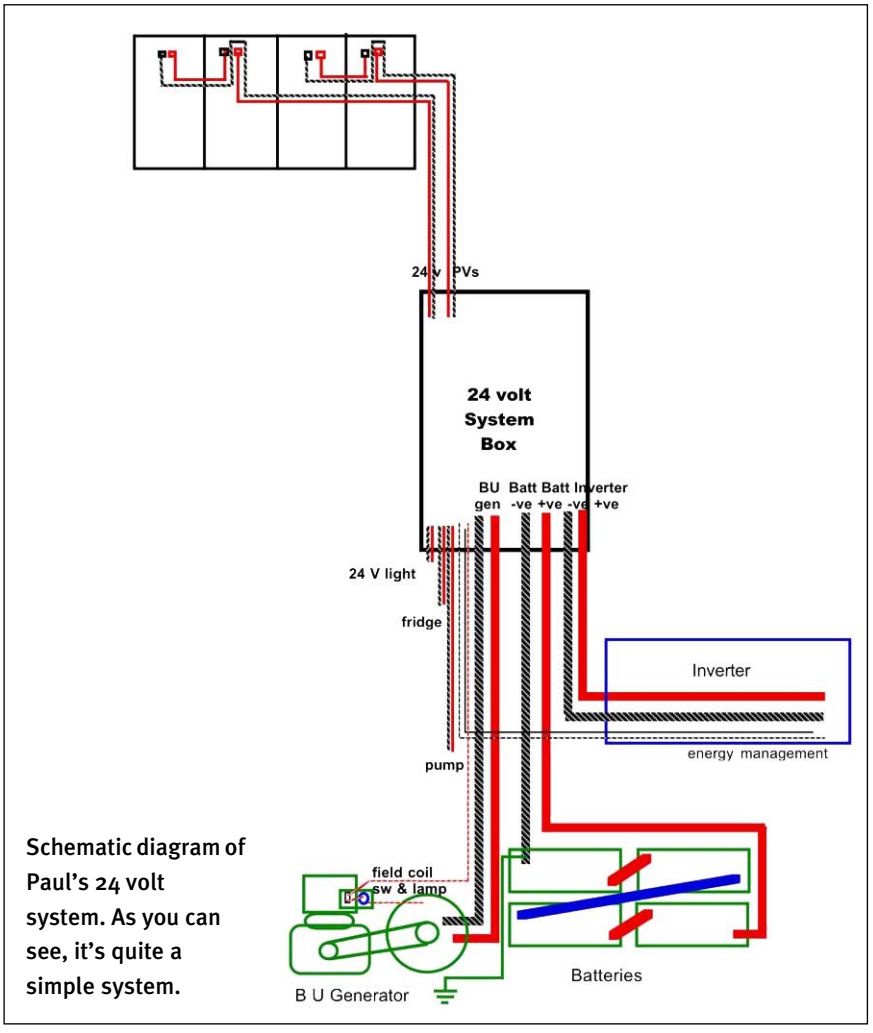
$25,000 it would cost to connect to the grid . Until I can afford that, I needed to make my present system more effective. Doubling the voltage halves the current, so the same set of batteries have half the number of amp-hours available but they work more efficiently due to the lower charge and discharge currents.

I find that my four 123 watt panels are putting out no more than their rated power in this sunny weather—the peak input today was 12.6 amps which is equivalent to 85 watts per panel, but this still keeps the batteries well charged. My little bush cottage is rather overwhelmed by my photovoltaics, satellite dishes and hot water panel.

Backup genset

I was given a three horsepower Honda 3000 rpm motor so I bought a truck alternator (24 volt 50 amp at 4000 rpm) new for $500 and direct coupled it to the motor. This is a 'direct charging plant', built according to the information in Tasman Energy's *Build Your Own Direct Charging Plant* book.

When it is overcast I am able to charge my batteries at up to 36 amps. The inbuilt regulator in the alternator makes



Schematic diagram of Paul's 24 volt system. As you can see, it's quite a simple system.

The solar experience: a survey of photovoltaic system owners

Seventy four per cent of respondents to a recent survey said they were either very or extremely satisfied with their photovoltaic solar system, writes Miguel Brandao.

The Alternative Technology Association, with support from the Australian Greenhouse Office, conducted a survey of PV system owners last year, with 1306 respondents Australia wide.

The purpose was to gain an understanding of PV system owners' experience and to find out how PV ownership had influenced and changed their lives in relation to energy use.

The survey invitations were sent by the ATA and the AGO to a sample of 4000 randomly chosen beneficiaries of the Photovoltaic Rebate Programme (PVRP) and Renewable Remote Power Generation Programme (RRPGP) rebates across Australia. The online survey (a paper version was available on request) included 52 predominately multiple choice and ranking questions.

The majority of responses came from three states: Victoria, with the highest number of contributors at 31%, followed by South Australia with 25% and NSW with 24%. Regional areas had stronger representation with 59% of respondents, as opposed to suburban and urban areas making up a total 41% of all responses.

Results and evaluation

Not surprisingly, the survey results indicated a high level of environmental practice among respondents, such as waste recycling (95%), rainwater recycling (86%) and composting (81%). A high number of respondents, 78%, reported that the main reason for acquiring a PV system was for 'good impact on the environment'.

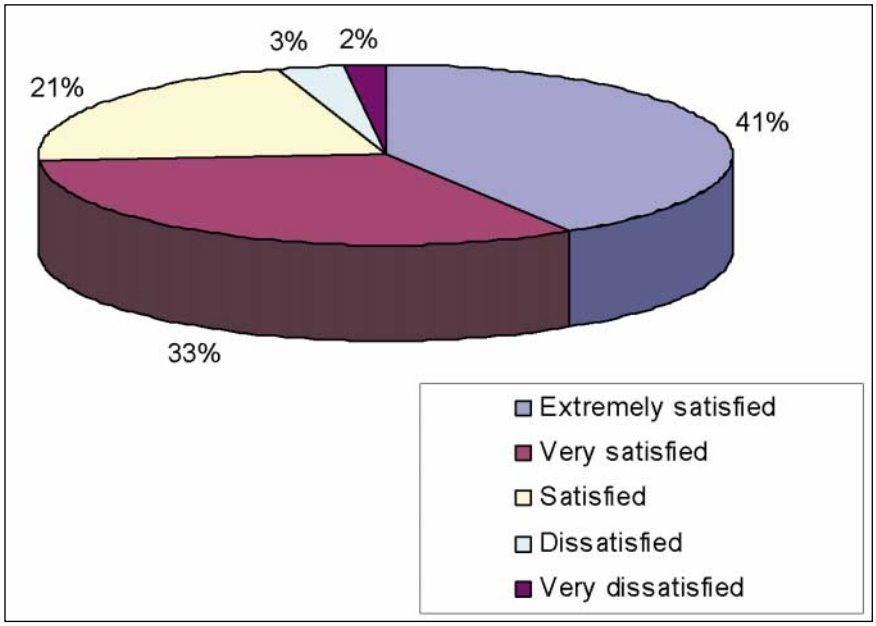
There also seemed to be a positive

correlation between owning a solar system and signing up for GreenPower. Importantly, PV ownership appears to be motivating owners into energy efficiency (46%) and energy conservation practices (50%). This is understandable for owners of remote systems who mention the need to meet demand with electricity supply. Among grid-connected users, the increase in energy conservation and energy efficiency measures is a significant environmental benefit following the purchase of a PV system.

The majority of PV system owners claimed rebates (91%) but 68% of respondents did not claim Renewable Energy Certificates (RECs). This was largely because they were unaware of their eligibility to claim RECs on their system. Respondents living in remote areas believe that alternatives to PVs may be somewhat limited and access to power is more important than the so-called payback times. Still, 57% of respondents favoured a preferred optimal PV system payback period of six to ten years.

While there were differing financial views over the acquisition of their own PV system, 76% of respondents considered higher financial incentives as essential to stimulate further uptake of PV systems. These could take the form of higher rebates and/or feed-in tariffs, with a buy-back premium rate to stimulate the Australian domestic market, similar to what has happened in Germany. Confirming the validity of this view, the increase in Federal Government PVRP rebates in 2007 led to a tripling of monthly acquisition and rebate requests!

With 95% of respondents considering their PV system to be performing to expectation and 74% of respondents being either *very* or *extremely* satisfied with their system, respondents mentioned other reasons for ownership satisfaction, including reduced environmental footprint and diminished or no power bills. They also said that solar provides an autonomous, or semi-autonomous, reliable source of electricity.



System owners' satisfaction levels with their PV systems was generally high, with only 5% of owners not being satisfied with their system. Reasons for this included a perceived or real lack of system performance, inverter or other problems, and installation issues.

Eighteen percent of the dissatisfied respondents were unhappy because of problems with installation and equipment as well as incorrect sizing of systems. Respondents felt this should be taken on board by the PV industry in order to establish user trust in the technology.

ATA recommendations

Given the respondents' attitudes to increased financial incentives, we recommend further exploring how financial aspects influence the decision to purchase a PV system. This could provide a better understanding of the incentive schemes (feed-in tariffs, higher rebates or other solutions) that would further encourage uptake as well as the type of information that needs to be conveyed to the potential market.

It is important the additional energy efficiency and conservation measures taken up by PV systems owners be accounted for in the calculations of the overall benefits of any Federal Government incentive. This may lead to different calculations for CO_2 abatement and enable the repositioning of the PV rebate. In addition, other energy conservation and efficiency measures may improve a potential owner's overall financial equation and consequently result in an increased uptake of PV systems.

It would also be valuable to explore reasons for dissatisfaction amongst PV system owners, such as the cited problems with suppliers, installers and electricity retailers. Further work on providing clear and accessible information on the current state of affairs and establishing a standard connection agreement would also be welcome.

Survey conducted by Miguel Brandao. To view the complete report of this study please go to: www.ata.org.au/wp-content/projects/ata_pv_survey_report.pdf

News from the ATA branches

Gitanjali Maksay spoke to the industrious members of the Alternative Technology Association's regional branches.

Adelaide branch

Two successful events kicked off the year. The Adelaide branch ran an information and book stand at the Uraidla Sustainability Fair and a stand at the Savings and Loans Green City Festival at Elder Park.

The Green City Festival was a free event organised by members of the ATA and ANZES as the opening event for the Third Solar Cities Congress. Held in marquees in the centre of Adelaide on a 36 degree day, the festival was developed around five theme areas: transport, food, waste, water and energy. Each of the five areas had stalls that related to one of the key themes. The ATA held a stall focusing on the key area of energy.

Festival attendees were asked to take a pledge in one (or all!) of the five key areas and commit to a lifestyle change that will have a positive impact on the environment. The stalls were there to provide practical information to support the pledges. A pledge could include a year-long commitment to shower for a maximum of three to four minutes, to fix leaky taps and toilets, to dry clothes on a clothesline or to do a home energy and water audit. The festival focused on providing practical advice, with over 24 speakers in two speaker tents.

The Adelaide branch stall at the Green Living Festival.

Melbourne

About 30 ATA members attended a site tour of Lorraine Hughes' residence in Knoxfield, Victoria. Lorraine's house has won numerous sustainability and environmental planning awards, including 2003 Best Design of Environmental and Energy Efficient Buildings by the Building Designers Association of Victoria.

Lorraine's house is passive solar in design, with a solar hot water system and a 4.5kW grid interactive PV array with a battery bank. The house collects and stores rainwater in a 27,000 litre underground rainwater tank and greywater is recycled for toilet use and to water a native and drought-tolerant garden. The house uses water and energy efficient appliances, draws no water from the mains and generates as much power as it uses.

Lorraine's hospitality extended to serving refreshments while she tirelessly answered questions about the practical implementation and design of sustainable housing. Lorraine also kindly collected donations for the ATA's East Timor Project.

Sydney West

Sydney West ATA branch held a talk 'Is making Biodiesel Sustainable?' at the Earthcare Centre at the University of Western Sydney.

Phil Dolan shared his very extensive knowledge of biodiesel and raised some interesting points, such as how manufacturing biodiesel can provide local employment. The presentation outlined how to convert vehicles to biodiesel and producing your own fuel. Phil discussed how making biodiesel can be sustainable if carefully managed. This includes making biodiesel from ethanol rather than methanol, using sodium hydroxide instead of potassium hydroxide, using waste oil not new oil, growing more productive local crops and using smaller vehicles. Phil said that biodiesel could be incorporated into public transport including buses, trains, trucks and 4WDs.

For more information about ATA branches go to www.ata.org.au.

The national picture

The Garnaut Review will be instrumental in shaping the new government's response to climate change, but which way will Garnaut go, writes *ReNew* policy columnist Alan Pears.

Well, Australia has a new Federal Government, with a strong mandate to respond to climate change. Its election policies include a comprehensive list of measures to help households, the building industry and business to improve energy efficiency, and strong support for renewable energy. The sense of urgency for strong action on climate change around the world is also building.

So there is increasing pressure to use the solutions we have now such as energy efficiency, cogeneration, renewable energy, and so on, because we can't afford to wait a decade. It's a whole new ballgame.

The Garnaut Review

The Garnaut Review will play a key role in shaping Australia's response to climate change. The new Federal Government has made it clear that it will rely on Garnaut's advice to set the 2020 emission reduction target. You can check out the background and progress at www.garnautreview.org.au.

Indications so far are mixed. On one hand, Professor Garnaut has been convinced that climate change is a very serious challenge, with potentially dire consequences for Australia and humanity. On the other hand, as an economist, he places a lot of faith in pricing carbon emissions correctly. In a lecture last November, Garnaut commented:

'If the price [of emissions] is established at the right level, there is no need for other public policy measures… But for as long as the price, now and expected in future, is insufficiently high to ensure that Australia lives within the national emissions budget, a case can be made for other measures, such as the mandatory renewable energy target, during the transition to an environmentally and economically rational emissions price.'

He also listed market failures that might require action beyond emission pricing, including research and development, infrastructure provision, lack of access to information, and adaptation to climate change. In these cases, other factors often dominate price signals, so complementary policies may be needed.

Yet, we have to convince Professor Garnaut that these market failures are real and significant, and that it is necessary to address them.

Productivity Commission lobbying

Professor Garnaut has also made it clear that he will take very seriously the 2006 UK Stern Review. So it was interesting to see the Productivity Commission, that ever-reliable dry economic lobby group funded by the Federal Government, publish a paper in January critiquing the Stern Review. In this paper, the Productivity Commission exposes its ignorance of the recent developments in climate science, by questioning the Stern Review's assessment of the seriousness of the problem.

It then identifies several key weaknesses in Stern's approach. According to the Commission's media release:

'The staff paper finds that the Stern Review made some important analytical advances. The Review sought to move beyond analysis based on the mean expected outcome to one that incorporates low probability, but potentially catastrophic, events at the tail of probability distributions. The Review also attempted a more comprehensive coverage of damage costs than most previous studies.

'The paper also finds that value judgements and ethical perspectives in key parts of the Stern Review's analysis led to estimates of future economic damages being substantially higher, and abatement costs lower, than most previous studies. The paper notes that the report could usefully have included more sensitivity analysis to highlight to decision makers the consequences of alternative assumptions or judgements.'

The Commission challenges Stern's use of very low discount rates in estimating future costs of response to and impacts of climate change. Economists routinely discount the value of future financial activity on the grounds that a dollar spent in another way today would have earned a rate of return each year up until that point. So the value of a dollar you receive in 2050 has to be compared with a dollar received today plus 42 years of financial returns. So receiving a dollar in 2050 for a person is equivalent to receiving 12 cents today if that 12 cents were invested at 5% per annum interest. Clearly, this approach has the

effect of heavily reducing the significance of the distant future for today's decision-makers.

Indeed, Stern chose low discount rates to attempt to address the issue of inter-generational equity, to consider the rights of future generations. If the long-term costs of our actions seem negligible, then it is logical to ignore them, even when they may involve the devastation of human society as we know it! But I guess that doesn't bother the Productivity Commission.

In any case, the Productivity Commission doesn't seem to have looked very closely at the economic modeling done in Australia in recent years. A study by ABARE (Australian Bureau of Agricultural and Resource Economics) released for the AP6 meeting in 2006 suggests that CO_2 prices in 2050 could approach $600/tonne under a 'deep cuts' scenario. More moderate modeling for the Business Round Table on Climate Change put the cost at close to $200/tonne in 2050 for a 60% cut scenario. If you discount the cost of $200 in 2050 back to 2010 at 5% per annum, that is equivalent to a CO_2 price today of around $25/tonne, while the ABARE price is equivalent to $75/tonne. So even if you discount the future, long-term carbon prices will still be substantial.

If we applied CO_2 prices of $25 to $75 now, we would drive a powerful change. My suggestion is that we just get on with introducing emission pricing and defer the intellectual debate until we have some real experience of how it works.

Are energy markets working?

Energy market reform has been hailed by economists and politicians as a great success. But is it? A recent report by the Australian Energy Market Commission has assessed Victorian retail energy competition, and declared it 'effective as an important step in the journey towards an integrated and competitive national energy market'. This report underpins progress towards complete deregulation of retail energy prices.

The report states: 'The objective of energy retail competition is to deliver efficient prices and services to energy customers and the opportunity for customers to exercise choice among competing retailers and their price and service offerings.' This is a very narrow objective that ignores social and environmental criteria that were core elements of the original objectives for energy market reform.

The report found some evidence of misleading and aggressive door-to-door sales techniques. It found about 60% of households and small businesses had signed energy contracts, but that it took pro-active measures by energy retailers (such as door-to-door sales, discounts and special offers) to capture new customers. It also found an increasing rate of switching between retailers.

Nowhere did the report estimate the extra cost to consumers of all this marketing activity and switching between suppliers. Yet a major contributor to the recently announced NSW household electricity price rises was consideration of costs to 'capture customers'.

Maybe the fact that retailers have to work so hard to capture and retain customers shows that competition in this form is simply not worth the effort; the report provides no evidence that energy bills are lower than they would have been under other retailing structures. It would be interesting to compare the performance of energy retailers with water retailers, who have geographical monopolies but are subject to benchmarking against other retailers. ✱

Passive seaside cooling

Michael Adams wanted his new house to be easy to run. What better way to do it than with passive heating and cooling.

Dawn and I decided that we wanted to build our own house for retirement. We had already bought a block near our existing home, on a street that terminated 300 metres from the beach in South Australia. With reserves front and rear, it really doesn't come much better.

The house had to be easy and cheap to run, and, using passive methods, be environmentally efficient without exceeding our building budget or incurring ongoing operating costs.

We decided to go the route many before us have gone, namely, do the basic design work ourselves. Then an architectural draftsperson turned our ideas into a set of drawings, from which a local builder constructed the house. When the house was finished we called it Sea Song.

The 27 degree pitched roof at Sea Song is home to a solar hot water system. Michael originally wanted a white rendered exterior to the house, but this was abandoned because the highly reactive clay soil might cause cracks on the exterior.

The design stage

We spent about a year playing around with different house layouts. Dawn's hobby is painting, so her main requirement was a large, well-lit room to be used as a studio. Her other hobby is gardening, but as it was to be a home to retire to, she did not want a large garden requiring constant work as we got older.

I was bottom of the class in gardening when I was at school and cannot tell a dandelion from a daisy, so we decided to keep the garden size to a minimum.

Our previous home had a 10 metre by 6 metre workshop, and I wanted one with the new house. This time the garage would be part of the house and also serve as storage for our two cars. One of my hobbies is aeromodelling, which is very messy, so I wanted a hobby room where I could make all the mess I like without upsetting Dawn.

Dawn also wanted raked ceilings, while I wanted a 35 degree pitched roof, this being the optimum angle for a solar hot water system in our area. I spent part of my childhood living in Malta, and as a consequence dreamed of a home with a white rendered exterior. I considered the white exterior very important in our quest to keep the house cool in summer. I also wanted double brick walls using Hebel panels or blocks. These were the factors that influenced our thinking, with some of them incorporated into the final design.

The engineer came to do the soil tests (necessary to meet council requirements) and we came across our first setback. The soil turned out to be highly reactive clay and we were advised to go to brick veneer. Due to the possibility of unseemly cracks in the future, my rendered exterior was also removed from the specification. The house would need to be surrounded by pavers or something similar at least a metre wide, to prevent moisture getting beneath the foundations when it rains—what rain! It was an added cost but, as we were not averse to pavers, so be it.

Things were taking shape. The block runs east/west, ideal for a building to make best use of the environment. Plans included having the lounge at the front on the northern side, along with the two bedrooms. The dining room and Dawn's studio would occupy the main part of the west end of the building, with floor-toceiling glass panels for maximum light.

The southern side would be occupied by the workshop/garage at the front,

the toilet/bathroom and then the kitchen, opposite the dining room. The south-west corner would be taken up by the laundry, a second toilet and an internal room accessed from the outside, which would be the garden shed, also containing the hot water service.

The two sides of the house would have a wide hallway running half the length of the house, petering out in the kitchen/dining area. It was also designed to be a breeze-way, allowing air to move around the house and thereby assisting with heating and cooling. Being over two metres wide it also functions as an art gallery for our collection of paintings.

Left: A spacious, sun-filled hallway for a dog. Right: Additional thermal mass comes via an internal brick wall.

The roof

That took care of the ground floor. My requirement for a 35 degree pitched roof resulted in a very high ridge line which exceeded the planning requirements, so the drafter reduced the angle to 27 degrees. It also meant that we would have a lot of useless roof space. However, as we live in the southern hemisphere with a Mediterranean climate of long hot summers and mild wet winters, I believe it is more important to try to keep a building cool in summer, rather than heat it up in winter. In South Australia we often suffer power outages in summer when people put their airconditioners on, rather than in winter.

With this in mind, we got around the surplus roof space by including a set of windows along the length of the house, below the ridge line. These allow light into the hall and, by installing four openable clerestory windows, we can harvest the daily sea breeze in summer. The breeze flows through the house, and in doing so keeps it cool.

At night we can leave the windows open as required, allowing rising hot air in the house to exit through the windows and extract the heat from the building. It also means we can listen to the nearby surf, which is very effective in lulling us to sleep at night. Part of the roof space over the studio and dining room was used to form a mezzanine floor which became my model room.

Thermal mass

The house is built on a concrete raft, which acts as a thermal mass, helping to keep the building temperature even, day and night. Part of the reason for having the garage as part of the building was so that the concrete garage floor was part of the thermal mass. In addition, one of the internal walls forming part of the hall beneath the ridge is constructed of brick, providing an additional thermal mass in the centre of the building. Due to its weight, the concrete foundations beneath this wall are two metres deep, adding more thermal mass.

Dawn got her raked ceiling in the studio and also in the adjacent dining room. The two bedrooms and the lounge have regular 2.7 metre high ceilings.

Instead of using normal sarking, the roof and end walls were insulated using Air Cell, backed by fibreglass batts which were also used in the ceilings. This effectively makes the house double insulated.

As I could not have my white rendering, I had to settle for a light coloured brick on the outside. This initially proved to be a problem, as local advice was that the usual light coloured bricks supplied by the industry had been shown to fret in the salty environment that our building would inhabit. We could not find a major brick company prepared to warrant their stock light-coloured brick in the salt environment, so we were up against a brick wall, so to speak!

The problem was solved when we found that a small, local brick manufacturer (Littlehampton Brick Company), only 45 minutes drive away, produced a light-coloured brick fired at a very high temperature, and were happy for its use in the salt coastal environment.

Local advice also suggested that the high southerly winds, which we experienced at times, could lift tiles from a tiled roof, so we opted for a metal one in off white Colorbond. Again, white was chosen to help keep the house cool. We did not expect the house to operate

without additional cooling and heating at times, so a reverse cycle airconditioning system was incorporated. It comprises two small indirect systems, with one in the lounge and one in the main bedroom. The kitchen/dining room/studio area is open plan, so has one larger indirect system to service the whole area. This allows us to only heat or cool the part of the house we are occupying at any given time, thereby reducing the heating and cooling costs.

The hot water system is solar boosted with two panels on the roof. There is no deep drainage system locally, so greywater is handled by a Ri Treat aerobic septic system made locally in South Australia. The output goes directly onto the garden, helping to reduce the watering demand.

The clay soil would not absorb the waste water easily, so an aerobic system was more or less mandatory. There was a line of small trees along the north boundary of the block. As there was no sign of an intruding root system when the foundation trenches were dug, these were retained to help shade the house in summer.

The house has clerestory windows, which collect cool sea breezes and release hot air in summer, as well as provide additional sunlight.

Any problems?

Having lived in Sea Song for two years now, how does it all work out? So far only three problems have come to light. The first was that the early morning sun in summer flooded into the east-facing windows of the lounge, raising the temperature of the room to unacceptable levels. It was solved by installing external safety shutters, the insulating qualities keeping the temperature below 20°C most of the time. They proved so effective that we fitted them on the three windows in the north-facing wall, closing them whenever the hot northerly winds are blowing in summer.

The second problem was caused by cold winter winds coming into the garage below the door, creating cold draughts via the internal garage/house door. This was easily solved by fitting door seals, with all external doors being done at the same time.

The third problem was associated with the large thermal mass interior wall. The wall is very effective in helping to keep the house cool during the day by absorbing the internal heat. However at the end of a very hot spell lasting several days in summer, the main bedroom, of which it forms one of the walls, becomes hot in the early hours of the morning, as the wall gives out its stored heat overnight. As the bedroom has an external set of sliding glass doors to a patio, it is a simple matter to leave them, and the bedroom door, open overnight. The rising warm air in the hall, exiting through the clerestory windows at the top, draws cool air through the bedroom. On only three occasions have we resorted to running the airconditioner overnight because it's been too hot outside.

We are very pleased with the way the house operates. The clerestory windows appear to be working very well, collecting the cool sea breeze during the day and clearing the house of unwanted heat at night. The solar hot water system provides free hot water in summer and doesn't do too badly throughout the rest of the year. The aerobic septic system performs silently without odours, watering the garden with recycled water, and the quarterly servicing reports are without problems. The house appears to run at around 20°C to 25°C during the summer and it is only after long hot spells that we need to use the airconditioners.

The north-facing roof is ideal for solar power generation, and that is under constant review. Up until now, we have not been convinced that it is cost effective. We hope the government will finally recognise the advantages in encouraging home owners to go solar and provide even more financial incentives to lead them along that path.

And the name Sea Song? It comes from the constant sound of the surf on the beach at the end of the road.

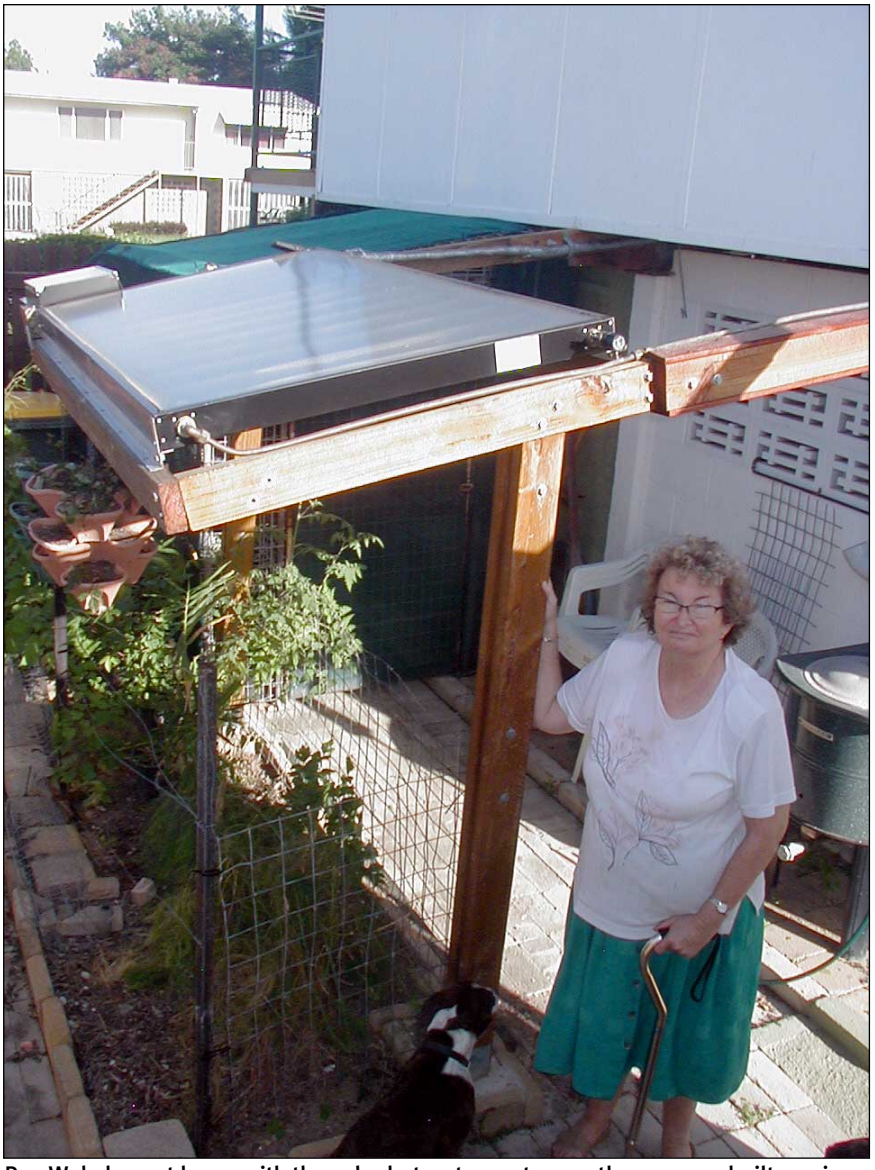
Can't afford a solar hot water system? Try a retrofit kit

Dave Wakeham investigated several solar hot water options before finding that a retrofit kit was the best solution.

I couldn't help but think there was going to be a big rise in the price of electricity, and as we are on a fixed income (both on disability pensions), I was worried that it was going to blow our budget. I was sure there was a way to beat this.

Our biggest electricity use is an electric hot water system, so I decided to start there. The cost of a close-coupled solar hot water system was about $5,500. Things are quite expensive in North Queensland but I thought this was exorbitant and beyond my means. There was additional expense because my house has an aluminum roof and needed beefing up to take the weight of a close-coupled system with a collector panel and tank. The plumber said it was not feasible to remove the large sheets of aluminum to add the timber, as it is almost impossible to put them back due to the age of the roof. He suggested that I build a lean-to off the side of the house and use the solar collector as a roof for it.

I deliberated for some time (my wife says I normally do), and when the next *ReNew* magazine arrived I was quite surprised to see there was an in-depth article about solar hot water systems. The article started me thinking that maybe I don't need a full system. I already have a perfectly good, well-insulated 125 litre electric hot water tank with a good element. A retrofit seemed to be the way to go. I read about a five-way valve, a 10 watt PV panel, 12 volt pump and a solar collector and fittings. I thought this may not be as expensive as a whole system if I could find the items locally. I investigated and found that people would rather sell me a whole system. Also, a retrofit would not be covered with a warranty and did not attract a government subsidy. Back to the drawing board.



Rae Wakeham at home with the solar hot water system on the purpose-built awning.

Buying a kit

I then read about a Solar-Mio/Metal Dynamics retrofit kit made by Albury Consolidated Industries. After a few emails to establish exactly what is in the

retrofit kit, we decided on a SM-Tops1 squat panel PV pump system with five-way fitting at a price that included freight to Townsville. We decided that one panel would be enough as we are a two-person household and only use hot water to shower each day. I was extremely happy with the price as it was less than a third of the price of a leading brand close-coupled system that sold in Townsville.

The retrofit kit arrived intact, without a scratch. It had survived the huge distance that it had to travel. Obviously the packing had been well designed as it had truck interchanges in Sydney and Brisbane. I know this as we were able to track it on the internet. I even paid for it by bank deposit through the Townsville branch of the suppliers bank. Technology is great so long as it makes things easier without costing the earth.

It was my first purchase of anything over the internet and I could not be happier with the results. The 10 watt BP solar PV panel even had a mini-maximiser to help it drive the Davies Craig 12 volt DC pump. It only took half a day and the work of a plumber to shift the old hot water system and get it all connected and running.

Above: The pump on the right of the photo is for drinking water from the poly tank. A small pump under the PV panel (not visible) is for the solar retrofit kit. Right: the purpose-built awning is ideal for plants.

Water temperature

Since it has been installed I find that I am saving 2.8kWh per day and I have only had to run the manually controlled electric booster four times in three months due to cloud cover—a digital thermometer shows when the booster is needed. I find this remarkable as it was over winter. As we live in the tropics our winters are mild, but last year we had a month of cold weather. The temperature dropped to 10 degrees for a whole week. Every electrical shop in Townsville sold out of heaters.

When first installed, the water temperature reached 55 degrees and seemed to be self-regulating at that temperture. The thermal switch controlling the pump was an open circuit below 50 degrees, and once the temperature in the storage tank exceeded 50 degrees it turned the pump on full time and the water circulated continuously. I had not yet insulated the supply pipe to the collector panel and I think the temperature losses in the line matched the temperature gain in the panel. I have since replaced the thermal switch with one that's open circuit below 70 degrees which I procured from Jaycar Electronics for less than $5. This has lifted the final temperature of the storage tank above the mandatory 60 degrees that is required for health reasons.

I also had a problem when the PV panel was shaded and the collector panel was still in full sun in late afternoon. The temperature/pressure relief valve on the collector opened and dumped a collector full of very hot water. At least I know that it works. It is preferred that the relief valve operates before the one on the storage tank as some systems dump the entire storage tank in this situation. I fixed the problem by shifting the PV panel to the lower edge of the awning, and it hasn't happened since.

The panel is situated so that it gets full sun all day in winter at an angle of 12 degrees, while one fifth of the panel should be in shade in summer to prevent overheating. The hot water tank is under the house, out of the weather.

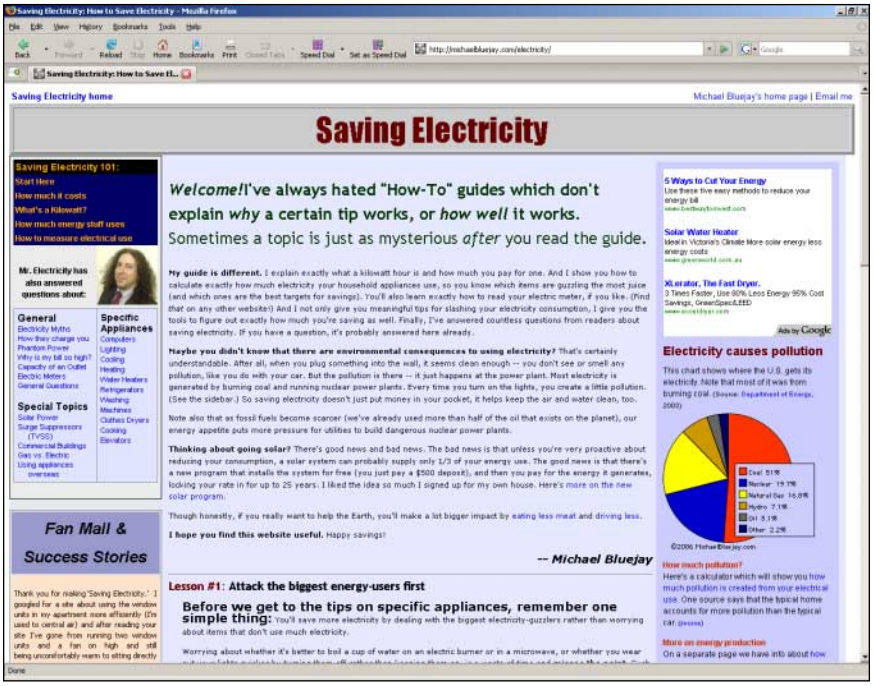
All told it has been a great learning experience. The only thing that would make it better would be a government subsidy for all solar collector panels, not just approved full systems.

www.michaelbluejay.com/electricity

To most people, electricity is one of those things that they are happy to use but don't understand anything about, or indeed, may not want to. If you want to not only understand a bit about electricity, but also learn how much appliances use, and how to make sure you use less, then this site is a great place to start.

Note that this is a US-based site, so some of the figures are a little strange as they use 120 volts over there, not 240 volts, however wattages of appliances are similar no matter what the voltage or where you are in the world.

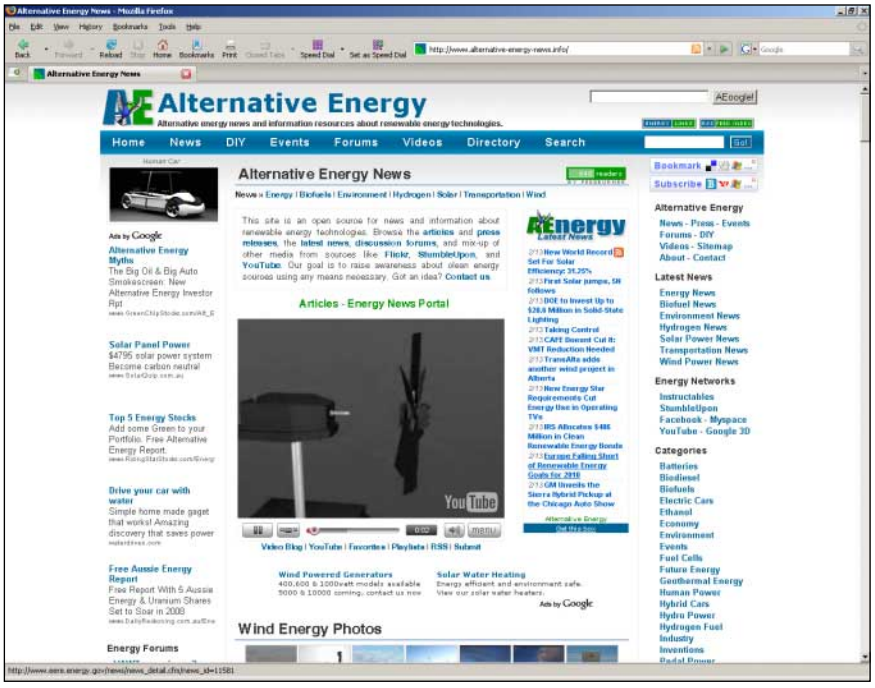
The site has a heap of useful information, from simple explanations about kilowatts and kilowatt-hours (it's so nice to find someone who understands the difference), through to electricity myths, phantom loads, and energy usage details on specific types of appliances.



There's also a page on solar electricity, though much of the information is US-centric. What this site does make you realise is that we need similar sites here in Australia!

www.alternative-energy-news.info

Websites dealing with alternative and renewable energies are springing up all over, but many are quite limited. Alternative Energy News is designed to bring together practical information from many sources (mainly other websites) and present it all in one easily accessible portal.



This site is an open source for news and information about renewable energy technologies where you can browse articles and press releases, the latest news and visit discussion forums. There are also lots of other information sources embedded in the site through widely dispersed links (click on any text that's blue!), from sites such as Flickr, StumbleUpon, and YouTube.

The owners of the site state that their goal is to raise awareness about clean energy sources using any means necessary, and we can't argue with that.

There is a great deal of interesting information, including DIY projects which are links from sites we have looked at previously in *ReNew*, such as instructibles.com.

Perhaps the best place to start on this site is the directory link. This link takes you to another site, which gives you an alphabetical list of categories to help you narrow down your searches.

Large format lithium batteries

Thinking of doing an electric vehicle conversion? If you want more range than lead-acid batteries can provide, or just want an EV that doesn't come out weighing 300kg more than the original petrol vehicle, then lithium ion batteries are the solution.

EV Power in WA has the Thundersky range of large-format lithium ion batteries, along with battery management systems to keep them in top condition (lithium batteries are not very forgiving of excessive charging and discharging).

Battery sizes range from 40 to 800 amp-hour, and they are rated for at least 1000 cycles to 80% depth-of-discharge (DOD).

EV Power can also supply smaller format lithium batteries, electric bike kits and complete battery solutions for your vehicle.

Pricing depends on purchase quantities.

Available from EV Power Australia Pty Ltd, 5690 Caves Rd, Margaret River WA 6285, ph:(08) 9757 2998, email: info@ev-power.com.au, www.ev-power.com.au

Hot day and no breeze? Make your own!

If the idea of installing air conditioning leaves you cold, then how about artificially created natural breezes? The Breeze Power fan is basically a giant fan that fits into the ceiling of your home and creates an artificial breeze through the home by drawing air in from outside and exhausting it into the roof. This has two cooling effects—the moving air cools you by evaporating moisture from your skin and it forces cooler air into the roof cavity, thus cooling it down, which ultimately leads to a cooler home.

Energy consumption of the Breeze Power is around 250 watts, which is around the same as an evaporative air conditioner (but without the huge water use), and just a fraction of what a refrigerated air conditioner would use. The fan is designed to make almost no noise, so it won't keep you awake at night, and features an automatic ceiling shutter to seal it when not in use.

RRP: POA.

The Breeze Power is available from Breeze Power Natural Cooling Pty Ltd, 41 Frederick Street, Northgate QLD 4013, ph:1800 637 175, email: info@breezepower.com.au, www.breezepower.com.au

A simple but clever idea!

There are many ways to save water, however, many of these can be expensive, and often need professional installation, so it's great to see simple inventions like the Hughie Sink.

The Hughie Sink is a simple plastic bucket that is shaped so that it fits inside most kitchen sinks. It allows you to keep the water used for many tasks, such as washing and peeling veggies and rinsing dishes.

The Hughie Sink has two strong handles to allow you to take the full sink to wherever you want to dump the water, be it on the veggie patch, pot plants or whatever. The handles also let you use it for many other tasks, including catching the 'warmup' water in the shower and laundry sink, washing the car, or as a portable sink for outdoor and camping use.

The Hughie features controlled water release, is designed to be easy to clean, and comes in several colours to match most decors. The bowl measures 330mm long x 270mm wide x 120mm deep, and the outer rim is 440mm x 380mm. The Hughie Sink is designed and manufactured in Australia.

The Hughie Sink costs $25 and is available online from the Hughie website, or from dealers in several states.

For more information, contact Hughie Products Pty Ltd, PO Box 586, Hyde Park Qld 4812, www.hughie.com.au

A big screen TV alternative?

It seems everyone wants big screen TVs, but the problem with them is that they use large amounts of energy. However, one large screen alternative is often overlooked—projectors. Not only are projectors a great alternative, but there are some low power units around that use LEDs for their light source, making them very energy efficient.

The Toshiba TDP-FF1A is one such example. These can produce an image up to 1.7 metres diagonally, feature a maximum power consumption of just 35 watts, and have a 10,000 hour lifetime rating on the 10 watt LED lamp. While you will need to watch it in a dark room to get the full effect, that's the best way to watch movies anyway!

Another useful feature of the TDP-FF1A is that it is battery powered. It usually comes with a rechargeable battery that gives up to two hours of viewing time, making it ideal as a portable presentation projector as well. Of course, it also comes with a universal mains power supply.

The TDP-FF1A may no longer be a current model projector, but we found them available at several stores as well as on Ebay, for as little as US$518 plus shipping—a lot cheaper than a big screen TV.

For more information, Google the model number, there are many reviews and references to them. To buy, look for them on www.ebay.com as they appear regularly, often as ex-demo stock at excellent prices. For more information, see www.isd.toshiba.com.au/projectors/projectors/brochures/ff1_e.pdf

Who's watching your water?

Imagine coming back home after a week away to find that a pipe has burst and your pump has happily emptied your 20,000 litre rainwater tank onto the garden, or worse, into your house. If that scenario is scary, then you should consider the Water Watchdog.

The Water Watchdog (WW) is a device that monitors the operation of your mains pressure water pump and shuts the pump down if it runs for more than a set period. By default it shuts down after 20 minutes, but the time is adjustable from one to 240 minutes, meaning the WW should suit almost any situation—even for restricting kid's shower times!

The Water Watchdog is designed for use on 240 volt systems—the WW plugs into a mains power point, and the pressure pump plugs into the Water Watchdog. Those on independent renewable energy systems who are using DC pumps would have to look for another solution.

The Water Watchdog is weatherproof, but not waterproof (submersible), and comes with a one year warranty.

RRP: $330 including GST and delivery.

The Water Watchdog is available from JETAR, 884 Chiltern-Yackandandah Rd, Indigo Valley VIC 3688, ph/fax: (02) 6026 7188, email: info@waterwatchdog.com.au, www.waterwatchdog.com.au

Electric bikes with style

Electric bikes are a great idea. They extend the distances people can travel on their bikes, and they let them tackle terrain they otherwise couldn't, such as steep hills. However, many e-bikes are a tad on the ugly side, looking like something has just been tacked on to a standard bike.

AusEBike have a range of electric bikes for both on-road and off-road use. They include bikes such as the Chopper (pictured), a classic scooter style bike, and two folding styles which are ideal for use on public transport. There are also some great off-road models, such as the quadbike, the miniquad (there's a 10km/h speed limited version), a low-speed dirt bike (ideal on the farm) and a golf trike.

For more information and your closest dealer, contact AusEBike, PO Box 6919, Wetherill Park NSW 2164, ph:(02) 9757 4075, fax:(02) 9604 3818, email: info@ausebike.com, www.ausebike.com

Solar tracker for campers

Many campers use solar panels, but those panels are often poorly utilised due to poor positioning.

Campatracka solar trackers are designed for the camping and caravanning market. The tracking controller uses LEDs as the tracking sensors. There are two models, the new V3, which can take two 60 watt panels, and the V2 which is designed for single panel use.

The trackers are designed to fold down for easy storage and transport. The V3 measures 1000mm x 300mm x 200mm when folded, and weighs around 8.5kg.

The V3 tracker is $385 plus $30 shipping inside Australia. The V2 is $330 plus $30 shipping. The tracker controller is available on its own and is priced at around $60, and will be available in kit form soon. Actuators for use on your own tracker designs are also available at $140 each.

For more information, go to www.campatracka.com or email Dave at dave@campatracka.com

Go recycled for your pet

No, we're not talking about recycled dogs here (although getting a dog from the local rescue service is infinitely better than a puppy farm one from a pet shop), but a kennel made out of 100% recycled plastic.

The Snooza kennel is available in two sizes, for small and medium sized dogs. It is designed to be easy to clean, with the floor being detachable so you can just lift the kennel and hose it all down (with rainwater, of course). The kennel has been designed with a side-mounted door and a raised floor to provide protection from draughts and the weather. It is supplied in flat pack form for easy transport.

Snooza also have other products that are more eco-friendly than the average pet shop junk, including a cat scratching post made from recycled plastic with replaceable covers. They even offer a free repair service for their pet beds so you don't have to throw them out when Fido decides they are a nice chew toy.

RRP: $198.50 for the small kennel and $268.50 for the medium size.

For more information, contact Snooza Pet Products Pty Ltd, 18 Century Drv, Braeside VIC 3195, ph:(03) 9587 3455, email: info@snooza.com.au, www.snooza.com.au

Hot water on demand

There has been a push in recent years to install hot water circulation systems so that there is no delay when turning on the hot water tap. However, most of these systems recirculate water through the hot water pipes and back to the tank either constantly, or whenever the water has cooled off to some degree. While these systems save a lot of water, they cost more in energy to run as they are constantly losing heat from the pipes, whether hot water is being used or not.

The D'MAND system from Metlund, and available here from ES, solves this problem by activating the system only when hot water is needed. The pump controller is triggered either automatically by motion sensors or door switches, or by a manual pushbutton or wireless remote control—you press the button and wait 30 seconds or so for there to be hot water ready at the tap with almost no waste.

Testing by the California Energy Commission (CEC) and the US Department of Energy (DOE) has shown the D'MAND system can save up to 20% in energy costs, and of course, it will reduce water use and wastewater treatment requirements.

For more information, contact ES, mob: 0411 051 041, email: elizabeth.tran@optusnet.com.au. Also see www.gothotwater.com.au

A greener PC

With the trend being towards planned obsolescence and lifespans of just two or three years, it's good to see one computer manufacturer making a PC to last at least five years.

Hewlett Packard's rp5700 desktop PC has been designed so that there will be no major platform changes in the next five years, so there's no need to upgrade. The PC is designed so that 95% of its components are recyclable, while the chassis can be taken apart by hand without special tools. Toxic materials have been eliminated and both the plastic casing and external cardboard packaging contain some post–consumer recycled material.

The rp5700 features an 80% efficient power supply, a low-power chipset and energy-efficient processors and BIOS settings to cut energy consumption.

Our only concern is that this unit may not be available in Australia, as while we could easily find it by searching the HP website, it doesn't appear in the online store, so we recommend you call the HP customer line and ask for it specifically. Alternatively, you could buy it from HP's USA website and have it shipped here by a freight forwarder.

For more information, contact HP on ph:1300 304 889 or go to www.hp.com.au and search on the model number.

Solar powered water purifier

Finding a clean source of water in remote areas can often be difficult, but what if you could take your purification plant with you?

The SWPU-100 water purifier consists of a 12 volt DC pump, a five micron sediment filter, carbon filter, reverse osmosis unit, a nano filter and an ultra violet lamp. All this purification means you can have clean, drinkable water from almost any contaminated water source.

The system is powered by a solar panel and incorporates a backup battery. It can produce 100 litres of clean water an hour, and typical operating time is three to four hours a day, so it can provide water for drinking and cooking for quite a few people, or all your water needs if there are only a few of you.

The unit is designed to be taken in a ute or 4WD to the water source, such as a bore, dam, creek or whatever. It is ideal for use in an emergency or in disaster relief operations. The SWPU-100 measures 1200mm x 600mm x 375 mm high.

RRP: $9000.

Manufactured by LCF & Associates Pty Ltd, 11 Adventure Pl, Caringbah NSW 2229, ph:(02) 9531 8611.

Start a social revolution!

Are you tired of being blasted by mindless advertising and TV shows every time you walk into a shopping centre? Even medical clinics have TVs running nowadays, which is the last thing you want if you are not feeling well. The solution is to turn off the TV with your own personal remote control! You will be doing your mind (and those of your fellow humans, or some of them at least) a great service, and reducing energy consumption as well.

The TV-B-Gone is a small remote control which is programmed with the on/off codes for the vast majority of TVs on the market. Just aim it at the offending TV and hit the button—the TV will be turned off. It can take up to 69 seconds to run through all the 'off' codes, but most TVs will turn off within the first few seconds. The TV-B-Gone is available in the standard model, a new SHP (super high power) model which has a range of up to 50 metres, and even in kit form.

RRP: From US$19.50 for the kit to US$39.99 for the SHP model, plus US$13.95 shipping outside the USA.

Available from Cornfield Electronics, 1800 Market St #123, San Francisco CA 94102, USA, ph:+1 866 851 5282, email: sales@cornfieldelectronics.com, www.tvbgone.com

Practical solutions for sustainable living

Support the organisation that supports ReNew.

With your support, the Alternative Technology Association (ATA) is becoming one of Australia's leading not-for-profit organisations, advocating to government and industry forums and providing practical information based on members' hands-on experience.

ATA membership also provides a range of personal benefits:

Free Advice Service
Answers to tricky questions from ATA's experienced advisors.

ATA Membership Discounts
Entitles you to discounts from ATA and the suppliers listed on the ATA website—see box at right.

Local Branch Activities
Network with like minded people in your area.

Quarterly Issues of ReNew Magazine
Packed with practical information. Sharing the experiences of ATA members

Quarterly Members' Newsletter — The Sun
Regular updates on the local, national and international projects that your membership is making possible.

Launching soon! — Interactive website
We are currently upgrading our website to include a new members-only space offering free downloads and a forum for members to share information and advice.

Without our members, none of this would be possible.

To become an ATA member or supporter go to the ATA webshop at www.ata.org.au or call (03) 9639 1500. Alternatively, fill out the order form on page 80.

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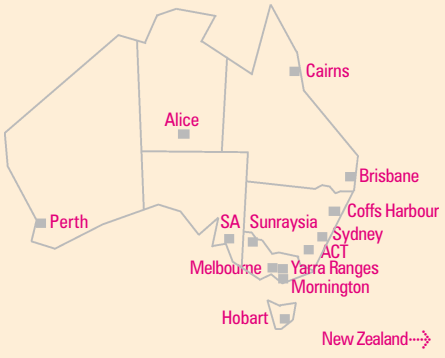
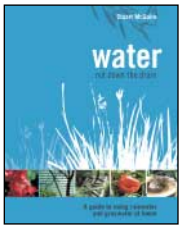
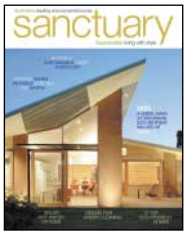
ATA branches



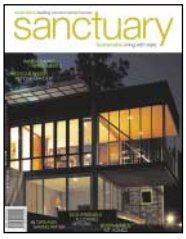
ATA shop by mail



Water Not Down the Drain: A guide to using rainwater and greywater at home
Author: Stuart McQuire
Price: $29.95 plus $8 postage
A comprehensive guide to sustainable water use around the home. Consult this book before you install rainwater tanks or a greywater system, or even if you just want to reduce your daily water use. *Item code: WNDD*

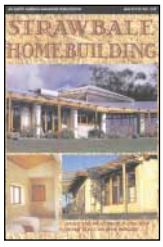


Sanctuary magazine issue 3
Price: $9.95 plus $2.50 postage
The third issue of *Sanctuary: sustainable living with style* is out now. Issue 3 features include: Buying a sustainable home checklist, design your home for green cleaning, keeping warm without costing the earth, plus 12 top eco-friendly homes from across Australia.



Sanctuary magazine issue 2
Price: $9.95 plus $2.50 postage
The second issue of *Sanctuary: sustainable living with style* is out now. More beautiful sustainable homes form across the country. Features include; water saving apartments, sustainable kit homes, eco-friendly flooring options, terraced wall garden greywater system and the latest savy, sustainable products.

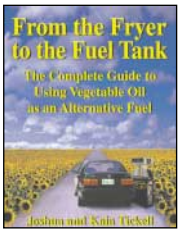
Sanctuary magazine issue 1
Price: $9.95 plus $2.50 postage
The first issue of *Sanctuary: sustainable living with style* brings together 15 of Australia's leading sustainable architects and building designers. With their cutting-edge ideas, these homes are an inspiration to anyone wanting a modern home designed for style, comfort, health and with the environment in mind.



Strawbale Homebuilding
Price: $19.95 plus $8 postage, Paperback, 156 pp
This book details practical strawbale building practices you can use to build anything from a small cabin in the bush to a mansion in the city. A great book that details many homes that have been built around Australia.
Item Code: SBH

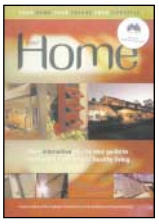
ATA Booklets series: Solar Hot Water
Price $10 each plus $2.50 postage
Solar hot water is possibly the best way to get started with renewable energy. This booklet outlines all of the different system types and which one will best suit your needs.

ATA Booklets series: Wind Power
Price $10 each plus $2.50 postage
This is our new wind power booklet. In it you will find all the information you need to get an understanding of wind power electrical and water pumping systems, how to size and install them correctly, how to look after them, safety requirements and a great deal of other information.

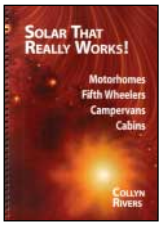


From the Fryer to the Fuel Tank
Author: Joshua Tickell
Price: $34.95 plus $8 postage
Paperback, 160pp
A great book that shows the reader how to make a clean-burning renewable fuel from waste vegetable oil. Includes detailed instructions on making and using the fuel in a standard diesel vehicle. *Item code: FFTFT*

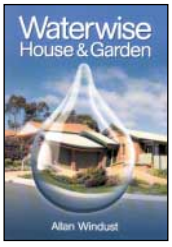
Your Home Technical Manual
Price: $49.50 (sorry, no member discount on this item) plus $8 postage
Back in stock!
Gives you the information you need to design and build a more comfortable home that is less expensive to run while being more environmentally friendly.
Contains over 60 fact sheets on sustainable solutions for designing and building your home. *Item code: YHTM*



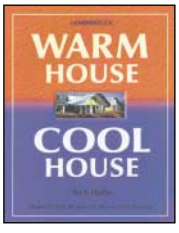
Your Home Technical Manual DVD
Price: $13.00 plus $8 postage
This DVD allows you to virtually visit some of the most beautiful, innovative and low-maintenance houses in the country. Be inspired as you take a visual tour of some of Australia's most comfortable and stylish homes, created by leading architects and designers.
Item code: YHTMDVD



Solar That Really Works!
Price: $42.50 plus $8 postage, 82pp
Whether for motor homes, fifth wheelers, caravans or cabins, solar energy is silent, clean and increasingly affordable. This book is a down-to-earth guide to getting it right the first time.
Item code: STRW



Waterwise House & Garden
Price: $29.95 plus $8 postage
This practical guide show you how to conserve water in your home and garden. The book details water saving using options including rainwater tanks, greywater recycling, and creating a water efficient garden. Included is a list of native and exotic plants that are drought tolerant. *Item code: WWHG*



Warm House, Cool House
Author: Nick Hollo
Price: $33.00 plus $8 postage, Paperback, 172pp
An easy-to-read introduction to the principles of energy-efficient housing design. Covers a broad range of topics and contains an abundance of drawings, plans and photographs. *Item code: WHCH*

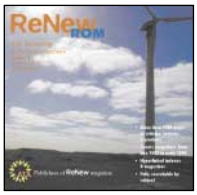
ATA Booklets series: Solar Electricity
Price $10 each plus $2.50 postage
Covers all the basics you need to know when designing a solar power system. Includes panel types, batteries, controllers, inverters and many other aspects of solar energy systems.

Renewables on CD ROM

ReNewROM

Price: $65 plus $2.50 postage

The second CD ROM of the series, covering issues 41 to 70 of *Soft Technology* and *ReNew* back issues, many of which are no longer available. This disk is fully searchable with 30 complete magazine issues in PDF format, so it can be used on PCs, Macs and Linux boxes. *Item code: RENEWROM*



ReNewROM II

Price: $65 plus $2.50 postage

The third CD ROM in the series, and covers issues 71 to 89 of *ReNew* back issues, many of which are no longer available. This disk is fully searchable with 19 complete magazine issues in PDF format, so it can be used on PCs, Macs and Linux boxes. *Item code: RENEWROM2*

ReNewROM III

Price: $45 plus $2.50 postage. The fourth CD ROM in the series, and covers issues 90 to 99 of *ReNew* back issues, many of which are no longer available. This disk is fully searchable with 10 complete magazine issues in PDF format, so it can be used on PCs, Macs and Linux boxes. *Item code: RENEWROM3*

Kits, LEDs and energy efficient devices

Professional Wind Speed/Direction Data Logger Kit

Price: $660

This wind monitoring kit provides a low cost alternative to a professional weather station.

This kit is designed to provide an affordable and easy-to-use solution for wind site evaluation and wind generator performance. The Wind Data Logger records wind speed, gust, and direction, as well as the time and date, temperature (optional), battery voltage, and other important parameters.

The logger records directly to a secure digital card to provide convenient data downloads. Includes a 1GB SD card which will store months of data at 60 second logging intervals. This means fewer trips to retrieve data from the logger. A new file is created and saved to the card for each day the logger is in use.

Then just copy the data to your computer so you use your favourite spreadsheet program to view, graph, and analyze your wind data. See the ATA's webshop at shop.ata.org.au for full details. Assembly is required. *Item code: WINDLOGGERKIT*

Low cost 3 watt MR16 LED bulb

Price $29.95

This bulb can be plugged into almost any 50mm halogen downlight socket that uses an MR16 halogen lamp. It uses three Seoul Semiconductor power LEDs (which use Cree chips) as the light source to generate over 140 lumens of white light.

The LED is driven by an inbuilt switchmode power supply, and beam angle is around 30 degrees, suitable for task lighting or highlighting.

The body is made of aluminium for good heat dissipation. Power consumption is around 3.5 watts at 12 volts.

The bulb will run from any power source of around 12 volts, either AC or DC, so can be plugged straight into many halogen sockets without changing the transformer.

Note: may not work with some electronic halogen transformers as the LED bulb is not a large enough load for the transformer to operate.

Item code: BULBMR16SPOTCW

Low-power LED halogen replacement bulb

Price: $49.95

This bulb can be plugged into almost any 50mm halogen downlight socket that uses an MR16 halogen lamp. It uses three Cree X-Lamp XR-E power LEDs (one of the most efficient power LEDs available) as the light source, and is available in neutral white light (around 5000k colour temperature) or warm white (3200k).

The LEDs are driven by an inbuilt switchmode power supply, and beam angle is around 30 degrees (with either clear or diffuse lens) or 150 degrees, depending on the model. The body is made of aluminium for good heat dissipation.

Power consumption is around 3.5 watts at 12 volts, meaning it has an overall efficiency of around 60 lumens per watt—that's better than most compact fluoro lamps!

The bulb will run from any power source of around 12 volts, either AC or DC, so can be plugged straight into many halogen sockets without changing the transformer.

Note: may not work with some electronic halogen transformers. *Item code: LEDHAL_3WMR16.* Please specify warm or cool white, and lens type.

Power-Mate energy meter

Price: 10 amp version is $295; 10 amp heavy duty version is $345 and the 15 amp version is $405

The low cost energy meter is great for general household use, but if you are looking for a more professional and robust device for energgy auditing or use on the workshop floor, then the Powermate is the meter to use!

It consists of a hand-held meter which can be connected to the appliance it is measuring via a simple piggyback plug and socket set. The meter features an LED display for easy reading and high visibility at all times.

The meter can tell you a variety of measurements including: power in watts, voltage and current, with minimum, maximum and instantaneous readings.

The meter can also tell you the cost of running the appliance, how much energy the appliance used in kilowatt-hours and how many kilograms of greenhouse gas emissions it produced, all in hourly, yearly, quarterly and accumulated figures. There are three versions available: the 10 amp, the 10 amp heavy duty, and the 15 amp unit (which has 15 amp plugs with the large earth pin). *Item code: POWERMATE-10A/10AHD/15A*

We also have a Power-Mate for hire for $30 a week inc express post to you.

ATA members now receive a flat 15% discount on ATA products, except for booklets and where noted. Ask for your discount when you order! Postage is a flat rate of $8, regardless of the number of items, or $2.50 for booklets/magazines/CD ROMs.

Wireless weather station

New lower price!

Price: $149

We now have a new wireless weather station that measures not only wind speed and direction, but indoor and outdoor temperature, humidity, barometric pressure, and even rainfall.

The data is collected by two sensor packs that are connected to a wireless transmitter. This sends the data back to the base station every minute or so, which then uses the information to give averages, accumulated totals, maximums, minimums and trends of the various data.

The transmitter requires two AA batteries while the base station is mains powered, with three AA batteries for data backup. The base station does not have the facility to connect to a PC, so you can't download data, but it does just about everything else. *Item code: WIRELESSWEATHER*

1 watt, 3 watt and 5 watt Luxeon LEDs

Each 1 watt Luxeon LED is equivalent to a dozen or more high-brightness 5mm LEDs in light output. The 3 watt LEDs are similar to the 1 watters, but draw twice the current.

With twice the current draw and twice the voltage of a 1 watt LED, each 5 watt LED is equivalent to up to 50 or more high-brightness 5mm LEDs in light output. Available in blue, green, cyan, white and warm white (**Note: the 5 watt white LED has a rated life of 1000 hours**). For more information, prices and to order, go to the ATA's webshop at shop.ata.org.au or call the ATA on (03)639 1500.

Superflux LEDs

We have both high grade Lumileds superflux LEDs, as well as the cheaper Chinese made LEDs. Superflux LEDs measure 7.6mm square, with a 5mm pin spacing. Lumileds superflux LEDs are available in red, green, cyan, blue and amber. Price: red and amber: $1 each, green, blue and cyan: $1.50 each.

Clearance! new 50% lower prices

The Chinese LEDs are available in red, amber, white, green, blue and cyan. Price: red and amber: $0.25 each, white, green, blue and cyan: $0.50 each.

Flashable, dimmable CCFL lamp

Price: $27.95

One problem with compact fluoros is that they usually can't be dimmed. These Microbrite lamps can not only be dimmed with conventional 240 volt lamp dimmers, they can also be used in situations where the lamp is turned on and off rapidly.

The 8 watt diffuse white globe comes in both warm white (2700k) and neutral white (4000k), and have light outputs equivalent to a 40 watt incandescent.

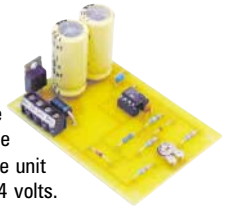
The lamps feature a cold cathode fluorescent tube rated for 25,000 hours and come with a two-year warranty! They are BC22 based, to fit the vast majority of Australian light fittings. *Item code: MICROBRITE8W_XX where XX is WW or CW.*

Dynamo multiband radio

Price: $49.95

Housed in a sturdy rubber and plastic casing, this radio is great for any outdoor activity that requires a heavy duty radio which will withstand a lot of punishment. Features include FM, MW, LW and SW bands and an alarm. It can be self-powered by dynamo operation or two AA batteries. *Item code: RADIO_DYNAMO_SW.*

Mini-maximiser kit



Price: $45

Our popular mini-maximiser kit will handle pumps up to 6 amps. The kit allows you to build the unit for use on either 12 or 24 volts.

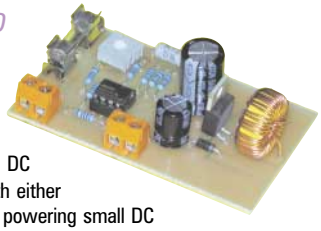
Note: not suitable for battery charging use! *Item code: MINIMAXKIT*

Simple 1 amp rectifier kit

Price $6

This very simple kit allows you to build a rectifier for use with polarised LED halogen lamps or for polarity protection of electronic equipment. Uses four Schottky diodes to reduce voltage drop and includes a 1 amp fuse. *Item code: SIMRECTKIT_1A*

Switchmode LED driver kit



Price: $30

This kit allows you to build a simple switchmode DC to DC converter with either voltage limiting (for powering small DC appliances from up to 30 volts DC) or current limiting (for driving LEDs directly from up to 30 volts DC). The voltage or current is fully adjustable, allowing the one design to be used for a huge number of appliances or LED types, including the 1 watt and 5 watt Luxeon LEDs. Efficiency is typically over 70% on most input voltages.

Kit includes circuit board, all components and instructions. No case is provided. *Item code: SWITCHMODEKIT.*

30 amp speed controller kit

Price: $49.95

This controller allows you to vary the speed of 12 or 24 volt DC motors from 0 to 100%. It is also ideal for controlling loads such as incandescent/halogen lamps and heating elements. It is ideal for use on small electric vehicle projects, such as electrically assisted bikes and go-carts.

We have tested it to over 30 amps without problems. *Item code: SPEEDCONKIT*

Constant current circuit kit

Price: $9.50

This short form kit allows you to build a simple constant current circuit for driving LEDs from almost any DC voltage. It is available in four sizes, 20mA, 50mA (for the Superflux LEDs), 300mA (for the 1 watt Luxeon LEDs) and 650mA (for the 5 watt Luxeon LEDs).

Please specify which current rating you need when ordering. *Item code: SIMCCKIT_XXX where XXX is the current rating in mA (020, 050, 300 or 650).*

Expand your *ReNew* collection

All available back issues $8 inc. postage within Australia. For a listing of what is in each issue, see the ATA's web site at www.ata.org.au. Issues available are: *Soft Technology* issues 31, 36, 37, 38, 39, 40, 41, 42, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55 and 56. *ReNew* issues 57, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 92, 97, 98, 99, 100, 101 and 102.

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103/08

Domestic wind turbines

I am interested in installing a domestic wind turbine for my private residence. Can you direct me to someone who can help me with this? I live in Mount Gambier, South Australia.

WG
Mount Gambier, SA

Installing wind generators on private homes is possible but has a few challenges.

Urban areas have a lot of buildings and trees which interfere with airflows. To get a turbulence-free stream of air you need the wind generator to be around double the height of surrounding buildings and trees.

To justify the expense of a tower that size you need a reasonably large turbine. However this can create noise that annoys the neighbours and interference to television reception.

Also, if the wind generator ever fails and loses a blade there is a danger of property damage or injury.

The other issue is that if you attach a wind generator tower to a building, this can result in vibration through the building. You would also need to take precautions against lightning strikes.

So that's the bad news. The interesting thing is that people are still starting to put wind turbines on buildings. In general, the turbines being fitted are small machines with lightweight blades that would not be much of a danger to people or property if they came loose. They also produce little vibration, noise or radio interference.

Generators such as the LVM, Rutland and Ampair units are OK for this kind of application. However, as they are extra-low-voltage units they are only suitable for battery charging and not for grid connection.

I don't know anyone in your area who could help you with this, although you could check the list of accredited installers at the BCSE website at www.bcse.org.au

The ATA is also currently doing a study on the viability of wind turbines in urban areas. More information can be found at www.ata.org.au/about/projects/domestic-wind-turbines

Mick Harris

Write to us!

We welcome questions on any subject, whether it be something you have read in *ReNew*, a problem you have experienced, or a great idea you have had. Please limit questions to 350 words.
Send letters to: *ReNew*, Level 1, 39 Little Collins St, Melbourne VIC 3000, renew@ata.org.au

Gas lighting

Can you point me to a company that manufactures ceiling-hung or wall-mounted gas lights for use inside a home, not for camping but for permanent use.

Liz Hamilton
via email

I haven't heard of any available gas lighting for inside homes. I suspect there are several reasons, the first being efficiency—gas lights produce a lot of heat and not a lot of light for the energy used. Secondly, there is the maintenance issue. Gas lights use mesh mantles to produce the light. These consist of a fireproof material impregnated with various materials including radioactive thorium, which is why the mantle glows. Mantles wear out and need replacing eventually.

However, the biggest issue would be one of safety. Apart from the fire aspect, there is the issue of ventilation. In many states, flueless gas heaters are banned as they release the CO_2 from the combustion process directly into the room, which can result in a buildup of CO_2 in a sealed room. Gas lighting would cause the same problems.

Electricity is the safest and most convenient form of energy for lighting, and even if you don't have mains power, you don't need a very big solar or wind power system to provide just lighting, so long as you use efficient lighting like good quality fluoro fittings or LEDs from the better manufacturers like Cree and Nichia.

Lance Turner

Air-conditioner sizing

Are you able to direct me towards any guidelines for sizing domestic air conditioning?

I have checked the www.energyrating.gov.au website, which gives a rule of thumb of 0.125 kW per m^2. That is helpful, but seems a bit of a broad brush (they don't ask where you live, what the house orientation or construction is, etc). I've seen the article from *ReNew issue 98*, *Pros and cons of air conditioning*. That has good background but no sizing guidelines (except to say don't overdo it).

We have three rooms we want to do: 35m^2, 15m^2, and 30m^2 (occasional use). That would need 10kW total using the 0.125kW/m^2 rule of thumb. The most commonly used rooms can be closed up (with curtains) to minimise the heat gain on hot days, and we have already shaded the windows from direct sun. Any thoughts please?

Jim Lambert
jim_moira_lambert@yahoo.com

The problem with sizing is that so many things can have a large effect on the amount of heat entering a home, that it is nearly impossible to come up with any figure that can be applied broadly. I suspect the figure from the energyrating site is the best compromise they could come up with, or it may be the figure used in the Australian Standard for air-conditioners.

The sorts of things that make a big difference include design and orientation of the house, but also things like shading from trees and blinds, window area, the colour of walls and roof, how well a building is sealed etc. So really all you can do is make an estimate as to whether your house is better or worse than average and decide on an appropriate figure from there.

Of course, air-conditioning should be the very last thing on the list, you should install insulation (both bulk fill on the ceiling and reflective under the roof tiles/sheeting), window protection (films, external blinds, shade trees etc.), draft sealing, exhausting hot air from the roof

cavity etc. before looking at air conditioning.

In general, energy efficiency measures are savings that will pay for themselves in a few months to a few years, whereas add-ons like air-conditioners not only never pay for themselves, but cost you continuously.

Lance Turner

Just the BASIX

I am interested to know your opinion about the ability of BASIX to accurately assess the environmental quality of buildings?

Although it assesses a building's heating, cooling and water running costs, it doesn't seem to take into consideration the carbon footprint or lifecycle assessment of a building. The overall impact of a building should be considered, say in terms of selected building materials and their embodied energy, environmental impact or recyclability, as well as site excavation, degradation contamination etc. I am not sure whether this basic program is adequate, and wonder whether there should be a more holistic accreditation system that buildings must perform to in regards to the overall impact.

Allison Earl
earl@terroir.com.au

None of the current government schemes operating in Australia take embodied energy and environmental impact into account for domestic construction and energy consumption. All the schemes are based, at least in part, on the CSIRO's NatHERS software (and its successor AccuRate) and associated analysis methodologies which look primarily at the energy performance of the building envelope.

BASIX goes further than other software such as First Rate by including the energy used by appliances and assessing actual energy usage and water usage versus the number of occupants.

Even though this is less than ideal it remains an important first step in taking a more holistic approach throughout the building industry. It has the advantage of significantly reducing the ongoing energy and water requirements of domestic housing at relatively low cost and ease of implementation. This, coupled with various state government intitiatives such as mandatory water tanks or solar hot water systems, will form the foundation for further improvements in the way in which the built environment is constructed.

There are a number of private building practitioners (architects, designers, builders, etc.) who claim to take a more holistic approach and perform more comprehensive life cycle analysis. It is often very difficult to account for all areas and many individuals and organisations tend to focus on a few areas such as embodied energy, minimising habitat destruction, use of recyclable materials etc.

As we gain experience and our tools become more sophisticated we will develop more holistic methods and accreditation systems to provide the environmental outcomes we desire when constructing buildings. It should be noted that this will need to be done within the wider context of the whole built environment including community and urban design, transport, work and recreation options, food supply, natural and built ecosystems, etc.

Michael O'Connell

Fridge running too much?

I think that my fridge runs a lot, which would use more electricity than it needs to. However, I haven't measured how much is a lot, and I don't have a benchmark.

It stays cold okay, I can't find any leaks of cold air around the seals, and I defrosted it recently. But it seems to me that it runs a lot through the day even when it isn't being opened.

My plan is to wait until mid-morning, when it hasn't been opened for a few hours, then write down times of when the compressor cuts in and out to get an idea of the duty cycle.

But what would be a normal duty cycle for a fridge that isn't being opened?

Graham Denney
denney@dcsi.net.au

At most, fridges should run about one third of the time, or about eight hours a day. This varies a lot according to the weather and usage but it gives you a rough idea. It could have some problems such as some of the refrigerant gas may have leaked out, or the thermostat could be faulty. Or it may just not be a very efficient fridge. Do make sure there is plenty of ventilation around the back as that might help.

There are some tips on running a fridge efficiently at www.energyrating.gov.au/rfuse.html. You will also find an energy ratings guide on this site for various appliances, including fridges. Just make sure you select the 'display comprehensive information' link when viewing the tables, as this gives you the star rating index (SRI)—the higher the SRI number, the better.

Mick Harris

Classifieds/ Suppliers Directory

When selecting an installer get 2 or 3 quotes and check accreditation/references. § = ATA Member discounter.

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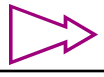

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