ReNew

Technology for a sustainable future

Tips to keep warm this winter

Sustainable wood heating

Green community buildings

Microhydro for a small community

DIY solar hot water

Tasmanian passive solar home

Issue 92 July-Sept 2005
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Have your wood fire and sustainable lifestyle too! Page 61

Visit a retreat designed around a huge wood-fired boiler, which provides the house with heating and hot water needs. Page 57.

regulars

These reusable bags are available in a huge range of sizes and styles. See Products, page 81.

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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Next advertising booking deadlines: Booking 4 July, copy due 15 July 2005.

Next editorial copy deadline: 29 July 2005.

Well some things have changed

As the ATA (and *ReNew*) celebrates its 25th birthday it's an opportunity to reflect on how much the world around us has changed. When the ATA was established in 1980, the founders were motivated by their concerns about the 'oil crisis', the pollution of the planet and the proliferation of nuclear weapons—remember those 'solar not nuclear' bumper stickers!

It was during the eighties that climate change started to be discussed, with well respected scientists such as James Hanson from the NASA Goddard Institute for Space Studies, warning politicians of the impact of global warming.

Nowadays, most governments understand the threat of climate change and the need to change our current energy policies. Unfortunately the ugly spectre of nuclear power is back on the agenda with most state governments currently contemplating the extension or establishment of coal power stations.

Doers, not just talkers!

ReNew has always been a forum for doers, not talkers. Through sharing the experiences of backyard inventors who have built their own solar hot water system, made a small wind turbine from a washing machine, or installed simple measures around the home to save energy, *ReNew* has contributed to the research and development of many sustainable technologies and practices we now take for granted.

The DIY spirit and innovation is still at the core of *ReNew*. Every issue we receive great articles from readers who have spent a lot of time and effort researching, experimenting and building their projects. This makes it hard for the editorial team to decide who to give the DIY prize to! We couldn't decide on the winner from *ReNew 91,* so have given a prize each to Dave Keenan for his natural swimming pool and Rod Dilkes for his electric Suzuki Mighty Boy conversion.

So if you have a story that you would like to share with ReNew readers, give us a buzz. The next issue will be a 'food' special, something close to the heart of the *ReNew* team.

Donna Luckman

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(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, and to *ATA Supporters*.

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

(3) Sunplus CPC Solar reserve the right to change specifications without notice.

(4) Product must be installed by a licensed plumber and must comply with the relevant standards.

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

(6) The competition runs from 20 May to 18 November 2005. Subscriptions/memberships must be paid by 5pm on Friday 18 November 2005 to be eligible.

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

(8) To subscribe or join the ATA, use the subscription form in this issue (or a copy of it), visit our webshop, or call the ATA on (03) 9419 2440 to pay by credit card.

(9) The competition is only open to Australian entries and includes delivery to the nearest GPO. This competition is not open to New Zealand or other overseas residents.

The *ReNew*/Sunplus CPC Solar subscriber competition is proudly sponsored by Sunplus CPC Solar, Factory 24/7 Dunstans Crt, Reservoir VIC 3083, ph:(03) 9462 1427, email: info@sunpluscpc.com.au, www.sunpluscpc.com.au

Solar lawnmowing

Regarding the battery-powered solar charged lawnmower in *ReNew 91*, Bruce has gone to an extreme amount of work—wow, such an effort! Modifying the motor, redesigning the solenoid, machining parts. I can see this being days of time, and a lot of money for anyone without free access to a lathe. He paid $10 at a wreckers for an unsuitable contactor, when $40 at an automotive electrical wholesaler would have secured a new suitable (continuous-duty) one.

Bruce must have a good workshop and had plenty of time and not much money available.

I bought a tip shop Black and Decker Stealth mower (no electric conversion needed) without its charger, for eight dollars. I also bought a new 40Ah battery, a 10 watt solar panel and a cheap solar panel regulator. This total of about $200 and around four hours to install the parts has given me nearly four years of solar mowing.

The panel is a little small, as during spring growth the battery hardly gets back to full charge before it is used again. Our standard suburban block with a typical lawn stays mown, although we have to charge between mowing the front and back lawns when the grass is growing fast in spring. I would think my 'conversion' to be more appropriate for the average person than Bruce's.

I added amp and volt meters to the panel wiring so we can see when charging is done (volts go up and amps go down).

James Massey,
jcmassey@netspace.net.au

James, we described a similar conversion of a Stealth mower way back in Soft Technology 53. The Stealth was still available new at that time, it is a pity that Black and Decker didn't promote it better, it was the best mower I have ever used, by a long shot!

Lance Turner

Farming and water use

I am writing regarding the letter from Barrie Ridgeway, and Lance Turner's response in *ReNew 91*. I am a hydrogeologist and have worked in groundwater, salinity and catchment management for nearly 20 years, most of it based in the irrigation regions and northern catchments of Victoria.

Lance comments on Barrie's letter that 'if commercial users of water were forced into making their systems more efficient' and 'it is amazing that many farmers still use open channel irrigation to water their crops.' Unfortunately, as with most issues facing humanity and the planet today, there is a lot more to it. I also appreciate that your reply was brief and could not really explore the issue.

Let's start at the overall, philosophical level. One has to ask the question, why do we need to save water? It is a very renewable resource and is abundant from a survival point of view. The main cause of our 'problem' is that there are too many people wanting a share of it. Our increasing affluence is also a big driver of increasing water use. The crux of the issue is one of equity, between communities, individuals and now the environment. Change has been going on for a while now to address this equity issue. For example, it was recognised that excessive diversion of water was occurring in the Murray Darling Basin in the 1980s. In response, a cap was put on diversions such that new diversion is not allowed. Water trade was also introduced in the 1990s. These Council of Australian Governments (COAG) water reforms have enabled changes that have started the ball rolling. The Victorian Government's recent white paper *Securing our Water Future Together* will enable further change to occur.

We cannot escape our history either. A vital factor in our country's development was the building of dams and use of that water for irrigation. With water, sun and soil, much food is grown. Primary production based on irrigation has not only underpinned the development of regional economies, is also provides the bulk of the food (and fibre) for our massively urbanised population. Value adding to this production generates much wealth for our state economy. However, past irrigation development relied on the technology of the day—ie channel and flood irrigation—but has been evolving since.

When I started work in this region, water was paid for under a 'water right' system, where farmers paid a set amount each year and often used their right, whether it was needed or not. This sloppy practice helped lead to salinity problems and waterlogging of land. Wet climatic conditions also played a large part. However, in the past 15 years, massive change has occurred. Salinity management has necessitated a huge change in attitudes and practice. Water is now a tradeable commodity, where its use is now moving to highest value. It is no longer used indiscriminately. The impacts of drought are also forcing major improvement in efficiency.

However, flood irrigation should not be derided, as it is a legitimate and efficient form of irrigation under the right

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.
Send letters to: ReNew, PO Box 2919 Fitzroy VIC 3065,
email: renew@ata.org.au

A simple expanded scale meter

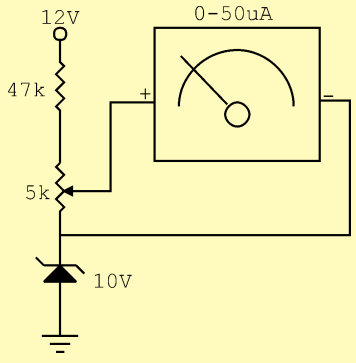
I'd never thought of how to make an expanded scale voltage meter until I saw the article in *ReNew 91*. That way is good if you have an existing 15 volt meter you want to use, but there is a simpler way using a 50 microamp ammeter. My circuit can be seen in the diagram.

Apart from the meter, only three low-cost components are required. The meter reads from 10 to 15 volts. Every 10 microamp division on the meter corresponds to 1 volt, which makes it easy to read without the need for making up a new scale for the meter, unless you really want to of course. Current consumption is a mere 60 microamps, which is so tiny the meter can be left on continuously. Just one thing to watch is that if the meter reads 10 volts, it could be 10 volts or anything less, as the meter can't be driven backwards by this circuit. But if your 12 volt battery is down to 10 volts it's got problems anyway.

Note that the 5k trimpot should be a multiturn type to make for ease of setting. Also, 10 volt zeners aren't all 10 volt zeners due to variation during manufacture. I had to buy two to get one that was close enough to 10 volts, but at 40 cents each you might as well buy a few. This is the most crucial component. With the circuit assembled, measure the voltage across the zener. I settled with 9.92 volts which is very close to 10, which defines the start point for the scale. Then, with a 12 volt battery connected, adjust the multiturn pot until the indicated voltage on the panel meter matches the battery voltage. That's it, all done.

This circuit is easily modified for different voltages and ranges.

For a scale of 20 to 30 volts, as for a 24 volt battery bank, use a 20 volt zener instead of a 10 volt and use a 100k resistor instead of the 47k. The zener always defines the start voltage of the meter. Depending on your application, values for the resistor and trimpot may have to be juggled so as to not run out of adjustment on the trimpot.



The meter I used was purchased from Jaycar Electronics and has a 3000 ohm impedance. Meters from other sources may have different impedances and the values for the resistor and trimpot may have to be changed. With the Jaycar meter my adjustment was almost right in the middle of the trimpot's range, so I'd expect my circuit would be able to cope with different 50 microamp meters.

Jon Flach,
jon_flach@yahoo.com.au

conditions. Experiments and measurements of the range of irrigation methods by my colleagues have shown that clay-dominated soils properly managed under flood irrigation use no more water than more modern systems of application. Another key factor that is often overlooked is that water savings usually translate into higher energy costs. The beauty of the channel and flood irrigation system is that it is entirely gravity driven. Compare that to sprinkler irrigation and piped supplies, where very large inputs of energy are needed to push the water up hill. Water doesn't need to be 'saved' at any cost. Trading off higher energy cost to save water is a massive constraint. (It should also be noted that the open channel system in the Shepparton irrigation region has unaccounted-for water losses very similar to Melbourne's piped water system, around 10%).

It is also too easy to blame the farmers for not changing and say they need to be forced to change. They are very definitely being forced to change. Six years of below average rainfall and runoff, the emerging water market, price increases, incentives and pressure from government to change have already seen doubling and tripling of water efficiency (in terms of output per water volume). However, farmers are at the bottom of the economic food chain and are price takers, not price setters. They can only change if they are financially viable, and so with commodities and food price governed by markets and middle men, the rate of change will be what it is. In my opinion, the rate of change is actually very good, given the circumstances.

If people were forced to implement much more energy efficient options, how quickly would that change take place and how politically acceptable would it be for the government of the day to force more rapid change than the public can bear? Hang on, that's where we're at now, isn't it? Remarkable changes in water use efficiency and consideration for the environment have and are continuing to take place. One can argue whether the rate of change is rapid enough, but a few wet years would take the spotlight off the need to save water. If only excess energy use could be solved so easily.

Bruce Gill,
Bruce.Gill@dpi.vic.gov.au

Savonius rotor experiences

Regarding Alan Marshall's comments in *ReNew 91* regarding Savonius rotor wind turbines, I have built a number of Savonius's and one was in use for over a year but with little result except to prove that it could handle high winds and storms without falling apart.

It was connected to a generator but geared badly so was not particularly useful. Another was connected to a pump and worked well but the pump had priming troubles so when there was wind the pump was usually not primed so pumped nothing. I didn't really put enough time into the project.

However, what did eventuate was a design for a Savonius which is cheap and easy to build and can be shipped in component form very easily. It consists of a three-stage rotor, each stage being 1200mm in diameter and 800mm high.

On the issue of starting torque, I did speak with someone a few years ago who was involved in building some quite large turbines for commercial water pumping and they employed a centrifugal speed cut-in mechanism, and from this I developed the idea of a one-lug dog clutch.

The idea is that the rotor is connected to the load via two plates, with only one lug on each to engage drive. This allows the rotor to turn almost 360 degrees before the lugs meet and drive is made. A light concentric spring returns the rotor back to the non-driving end of its rotation just before it stops turning.

When there is a wind the rotor turns almost 360 degrees before connecting to the load. By this time the rotor has substantial inertia and can overcome the 'stiction' or initial starting torque requirements of the load. Sure it makes a thump when it connects, but that is what is needed, some instantaneous stored energy to get things going.

I have two units as described on hand and would be interested in them again being used.

Phil Dorman,
watin@bigpond.com

Engines and ethanol

On looking through *ReNew 90*, I noticed Nathan Keiler's letter about running an engine on ethanol.

Ethanol (alcohol) has been used as a fuel for engines for many years. I have catalogues of 1920s engines which could be ordered to run on petrol, kerosene, naphtha, alcohol and several other liquid fuels. Alcohol alone or blended with other fuels was commonly used in motor racing for many years. But there is a problem in using alcohol as a fuel. An engine uses about twice as much alcohol as it would if running on petrol. This means that everything in the fuel supply—pipes, connections, filters, carburettors, carburettor jets and so on—have to be big enough to handle this increased flow.

We see evidence of this increased usage rate in E10, the petrol/alcohol blend with 10% alcohol. A car uses more E10 than it does straight petrol.

All this probably means that Nathan will have to find a suitable carburettor if he wants to run an engine on alcohol. This may be quite a problem. It will also be necessary to ensure that all other components are large enough to handle the increased fuel flow. Alcohol causes corrosion of diecast metals, such as are commonly used in fuel pumps, fuel filters, carburettors and so on. With these problems solved, any engine will run satisfactorily on alcohol.

Your statement that an engine runs hotter on alcohol is incorrect. If the air/alcohol mixture is correct, the engine will run cooler. But if the fuel flow is restricted so that the engine runs on a lean mixture, it may well run hotter. This, in turn, may cause serious problems.

Bob Jeffery,
Bribie Island QLD

Solar access

A new problem relating to the domestic use of solar energy needs some work by legislators and the legal profession. I refer to our rights to solar access. In a neighbouring council area in Adelaide, one home-owner who had installed PV panels now faces approval of a building next door which will shade his panels in winter. Likewise, we have failed in our request to have an Aleppo pine removed from a reserve on our north side, which now means we have had to abandon plans to install our own solar panels.

There are in fact no legal rights to solar access and no defence if councils approve any structure which reduces your access.

In the light of a rapid uptake of alternative energy sources, I would suggest some urgent discussion with state and federal politicians will be essential before too many people are confronted with the sort of issues I have raised here.

Bryan Milligan,
Beaumont SA

Notes and errata: ReNew 91

In the Products listing for the electric hub motors from Brett White on page 77, we stated the controller was a two-speed unit. It is in fact fully variable speed.

The architect of Greg and Sally's house featured in the article 'Gone troppo in Humpty Doo', *ReNew 90*, is Steven Ehrlich from MKEA Architects P/L and is not associated with Troppo Architects. If you would like to know more about tropical environmental sustainable design contact Steve on ph:(08) 8981 3308 or email: s.ehrlich@mkea.com.au

PV rebate gets budget reprieve

The federal government has committed to extending the Photovoltaic Rebate Program (PVRP) for a further two years at $5.7 million per annum.

The extension, announced as part of the May 2005 federal budget, will ensure a smoother integration for the solar industry with the government's long-term Solar Cities program, said Senator Ian Campbell, Minister for Environment and Heritage.

The extension has been welcomed by industry and consumer groups.

'The extension of the PVRP will make it easier and cheaper for homeowners who want to produce their own clean energy and help reduce greenhouse gas emissions,' said ATA (Alternative Technology Association, publishers of *ReNew)* Energy Policy Manager, Kane Thornton.

'In the past, homeowners have been able to reduce the initial cost of their solar photovoltaic system—costing an average of around $20,000—by up to $8000. A lot of people would not have made the investment in PV without the rebate,' said Mr Thornton.

The rebate goes someway toward compensating PV system owners for the many benefits achieved by this clean and distributed form of energy.

'The electricity market currently fails to recognise these benefits and ignores the economic and environmental value they provide,' said Mr Thornton.

The extension of the rebate is also helping to support the development of the solar industry in Australia, according to Mr Ric Brazzale, Executive Director, Australian Business Council for Sustainable Energy.

'Australia has the makings of a world class PV industry, and short term support through programs such as the PVRP are vital as the government and industry work together to address the longer-term energy needs of Australia,' said Mr Brazzale.

However, the federal government has been criticised for not committing more resources to help curb Australia's greenhouse emissions.

'Climate change is the biggest threat to the planet's and Australia's environment and economic future, yet Mr Costello has squeezed funding which should be going to tackle the trillion dollar future threat of global warming,' said Greens Senator Bob Brown.

Productivity Commission report flawed

The federal government needs to deliver on its promise to examine the full range of options to improve energy efficiency, or risk huge increases in greenhouse pollution from the energy sector, according to environment and industry groups.

In a submission to the Productivity Commission on its draft report into energy efficiency, a coalition of groups have criticised the narrow scope of the Commission's report. The commission's report recommended against mandatory energy efficiency for both new buildings and appliances that would help keep

continued on page 12.

Solar Ark: world's largest solar-power generating structure

The Solar Ark, located near the Sanyo plant in the Gifu prefecture in Japan, is a huge metal lattice structure covered in photovoltaic panels. According to Sanyo, who created the Ark, it is the world's largest solar-power generating structure. Opened in April 2002, the Ark combines a photovoltaic power generation system with a state-of-the-art science centre. This includes the Solar Lab inside the structure itself, which contains a library, solar garden, various displays, as well as the control deck for the Ark itself. Why would the Ark need a control deck you ask? Besides controlling the energy from the solar panels as it is fed into the mains grid, the deck also controls the more than 77,000 LEDs used to light the Ark at night.

There is also the Field Lab, with numerous interactive displays dotted around outside the Ark, as well as two large water features that not only provide reserve water for the fire fighting system, but also direct light into rest rooms built underneath them through 'Solights' built into the bottom of the pools.

Also on the grounds is the Solar Ark Cafe, which has seven 'Eco Interactive Tables', one for each day of the week, that you can sit at and learn interesting facts from while eating.

The Ark measures 317 metres long by 37 metres high by 14 metres thick and weighs around 3000 tonnes. It is covered by 5046 photovoltaic panels, rated at 125 watts each, for a total peak output of 630kW. Annual energy generation is estimated to be around 530 megawatt-hours.

www.solar-ark.com

Hybrid car of the future

Students at the University of Queensland have developed a car that uses 83% less fuel and emits 87% less greenhouse gas than a Holden Commodore. Called the UltraCommuter, the car is driven by two electric motors, one in each rear wheel, which are powered by a lithium ion battery pack.

The UltraCommuter has a driving range of 500 kilometres with the addition of a fuel tank and a top speed of 150 kilometres an hour. Filling the car with fuel would be as easy as parking in the sun to recharge the battery pack using the 2.5 square metres of transparent solar cells on the bonnet and back windscreen. A summer day would 'top-up' the battery pack by about 50 kilometres.

According to UltraCommuter coordinator Dr Geoff Walker the use of good aerodynamics and lightweight materials has reduced its energy needs and improved its range and performance. 'It's not too radical. It's still a two-seater car that people can sit in and commute in and get quite dramatic improvements in economy.'

'We're aiming for under two litres per 100 kilometres which is about a five or six-fold reduction on your average car, said Dr Walker.

Hybrid watchdog

Meanwhile, concerns by scientists that many new cars are being marketed as environmentally-friendly hybrids has led to the development of the first independent website on hybrid cars.

The HybridCenter site has been developed by the Union of Concerned Scientists (UCS) to assist potential buyers to find a hybrid car that suits their lifestyle and budget. In the watchdog section, UCS analysts will monitor the hybrid market and expose models that don't deliver on the promise of hybrid technology.

You can visit the site at www.Hybridcenter.org

Photo: Chris Stacey, The University of Queensland.

A working model of the UltraCommuter, which researchers at the University of Queensland hope to have on the road within a year.

continued from page 11.

household energy bills down and reduce greenhouse gas pollution.

'This report is fundamentally flawed,' said Australian Conservation Foundation Executive Director, Don Henry.

'The government white paper says that energy efficiency is expected to deliver 40% of Australia's greenhouse pollution reduction from the energy sector, and yet the government failed to provide Terms of Reference to allow the Productivity Commission to examine the greenhouse benefits of energy efficiency,' Mr Henry said.

'The commission's recommendations fly in the face of overwhelming evidence that saving energy will reduce energy bills as well as benefit the environment,' said Kane Thornton, ATA Energy Policy Manager.

The coalition of groups are calling on the federal government to reject the recommendations of the Productivity Commission and to establish an inquiry that genuinely examines the potential economic and environmental benefits from improving energy efficiency as promised in the Energy White Paper.

Climate change will cause more famine and disease

Climate change threatens to increase crop losses and the number of people facing famine, as well as intensifing some diseases, according to a report by the United Nations Food and Agriculture Organisation (FAO).

While northern industrialised nations may increase their crop production, for 40 poor, developing countries (with a combined population of two billion), the outlook could be devastating. Production losses due to climate change may drastically increase the number of undernourished people and severely hinder progress in combating poverty and food insecurity.

The increase in international trade and travel will also highten the risk of new pests and diseases caused by changing ecological conditions resulting from climate change. 'Avian flu is the most recent example,' states the report.

Humans live beyond needs

Approximately 60% of the ecosystems that support life on earth—such as wetlands, oceans and mangroves—are being degraded or used unsustainably, according to the *Millennium Ecosystem Assessment Report*, a study conducted by 1300 experts from 95 countries.

Scientists warn that the harmful consequences of this degradation could grow significantly worse in the next 50 years.

'Any progress achieved in addressing the goals of poverty and hunger eradication, improved health, and environmental protection is unlikely to be sustained if most of the ecosystem services on which humanity relies continue to be degraded,' the study states.

The ongoing degradation will seriously affect human well-being, including the emergence of new diseases, sudden changes in water quality, creation of 'dead zones' along the coasts, the collapse of fisheries, and shifts in regional climates.

The report also states that humans have changed ecosystems more rapidly and extensively in the last 50 years than in any other period.

www.millenniumassessment.org

Antarctic Peninsula glaciers shrinking

The first comprehensive study of glaciers around the coast of the Antarctic Peninsula reveals the real impact of recent climate change. Research by the British Antarctic Survey (BAS) shows that over the last 50 years, 87% of the 244 glaciers studied have retreated, and that average retreat rates have accelerated.

More than 2000 aerial photographs dating from 1940, and over 100 satellite images from the 1960s onwards, were studied to understand how much ice has melted—which is critical for predicting future sea-level changes.

'Fifty years ago, most of the glaciers we looked at were slowly growing in length but since then this pattern has reversed. In the last five years the majority were actually shrinking rapidly,' said researcher Alison Cook.

The temperature in the Antarctic Peninsula has risen dramatically by 2°C in the last 50 years.

'These glacier retreat patterns, combined with dramatic ice shelf breakups, leave us in no doubt that the

Antarctic Peninsula ice sheet is extremely sensitive to recent warming. What we still need to determine is whether or not the warming in this area has its roots in human-influenced global warming,' said BAS Glaciologist, Dr David Vaughan.

A nation of wasters

Australians waste some $10.5 billion in products and services they buy each year according to a report by The Australia Institute. On average, each Australian household wasted $1226 on items purchased but unused in 2004.

Based on a survey of 1644 Australians by Roy Morgan Research, the biggest waste was in unused food, with Australians throwing away $5.3 billion in food last year, which represents more than 13 times the amount donated by Australian households to overseas aid agencies in 2003.

Other items accounting for huge levels of waste included clothes, books, CDs, unused gym memberships, unused rooms in increasingly large Australian family homes and unused motor vehicles in two- and three-car garages.

According to the report, the richer we become the more we spend on goods and services that we do not use. As we become wealthier over the next decades, we can expect a more than proportionate increase in wasteful consumption.

www.tai.org.au

Wind power potential in NZ

Wind energy could supply around 35% of New Zealand's future peak power demand according to a study commissioned by the New Zealand Ministry of Economic Development. Rapid advances in technology makes wind power an important part of New Zealand's future energy supplies.

Currently wind power accounts for only 2.5% of New Zealand's electricity, however the report notes that as the country has a long coastline, with predominant westerly winds and sea breezes, it has great potential for expansion.

'With the advent of new tools such as forecasting software, a more diverse distribution of wind farms around the country and turbine technology, the future is looking very positive for wind power,' said New Zealand Energy Minister Trevor Mallard.

'We are not expecting the potential to be realised overnight, but wind generation could play a significant part in meeting on-going growth in electricity demand.'

World's first wave farm in Portugal

The world's first commercial wave power farm will be built in the Atlantic, five kilometres off the coast of northern Portugal. Ocean Power Delivery, based in Scotland, has signed a contract with a Portuguese consortium to install three Pelamis machines. The 120-metre long, 750-tonne machines face the waves and the power is generated by the articulated body driving hydraulic rams, which push fluid through the motor. The electricity is fed down a cable to the seabed and back to shore.

The wave farm will supply 2.5 megawatts of electricity, enough to power 1500 homes. As Portugal has to import most of its energy there is potential for an expansion of wave energy along its coastline.

www.oceanpd.com

President Bush visits biodiesel plant

United States President, George Bush heralded the benefits of biodiesel when he visited a plant near Richmond,

Virigina in May.

'Biodiesel is one of our nation's most promising alternative fuel sources, and by developing biodiesel you're making this country less dependent on foreign oil,' said Mr Bush.

Speaking at the Virginia Biodiesel Refinery, a biodiesel plant that started operations in March 2004, Mr Bush said high petroleum prices highlight how consumers and lawmakers need to look towards domestic energy sources, and he pressed Congress to pass a comprehensive Energy Bill.

It is the first time any US president had visited a biodiesel plant.

Bear break-in for biodiesel

A US man received a surprise visit when a bear broke into his car to get at the tasty-smelling biodiesel fuel.

Connecticut electrician Larry Joy said he came home to find the window of his Volkswagen Rabbit shattered and paw prints surrounding a pool of cooking oil on the ground from where the bear had gnawed through fuel hoses.

Larry was philosophical about the incident; 'I think it's cool that bears do whatever they want,' he said.

www.environmentalmanagementnews.net

ReNew Prize winners

Congratulations to Paul Van Verumingen of Como, New South Wales, the winner of the *ReNew 90–91* subscriber prize—a fully optioned Selectronic SA32 sinewave inverter valued at $4642.

Paul is going through the research process to build his own passive solar home with solar power so the inverter will be very useful.

'It is extremely pleasing and satisfying, unbelievable, as we will be needing one'.

'I'm stoked', said Mr Van Verumingen.

Australian biodiesel map

Want to fill up your car with biodiesel but don't know where you can purchase it? A new website has been established dedicated to listing the locations of bowsers and bulk biodiesel sellers in Australia.

If you know of a location, add it to the map at www.grownfuel.com

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*Roof mounting kit extra.

Testimonial *'After buying a SolarVenti 14 for our 60m² summer cottage, we have got a nice supplement to the heating of the house, especially in spring and autumn. It's also great in winter partly heating the house, while circulating fresh natural air. ...It is an ingenious product which absolutely fulfils what it promises, and we highly recommend it.' Best regards, Kurt & Lone Rise*

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Keeping warm in the cooler months

You don't have to freeze during winter to be environmentally friendly. Here are a few tips to staying warm while keeping your energy use low

Most people's energy bills go up in winter due to heating and hot water requirements, but you needn't pay so much each year. By making a few changes to your home, and maybe one or two to your habits, you can reduce your heating bills considerably and stay comfortable in the process.

Warmer clothing

Obviously, if you feel cold and you are sitting around your home in a t-shirt and shorts, then you are not dressing for the season! Simply wearing warm clothes might eliminate the need to use heating at all.

Wise heating choices

Electricity is not the best way to heat a home. While it is true that most electric heaters turn all of the energy they consume into heat, the overall fuel cycle in Australia is around 30% efficient—in other words, 70% of the energy contained in the coal or whatever used to create the electricity never makes it to your home.

If you have limited options, reverse cycle air-conditioners can make better use of the energy consumed, as they generally have a coefficient of performance (COP) of two to three. This means that for every unit of electrical energy consumed, they move two to three units of heat from outside to inside the home.

If you must have electric heating, why not take the plunge and sign up for green power? By buying clean electricity from your retailer you are supporting the development of renewable energy in Australia.

There are many other heating options, including solar hydronic with gas boosting, gas only, heat pump hydronic, solid fuels like wood, and even alcohol burning heaters that use methylated spirits (see Products in *ReNew* 89).

Get the warmth of an open fire without the mess—this heater runs on methylated spirits!

Personal heaters

If your home is only moderately cold, and you will be in one place for most of the day, such as when working from home or just watching TV, maybe you should consider using a personal heater instead of a space heater. Personal heaters are low-wattage electric heaters that radiate heat directly into objects placed close by. If that object is you, then you get warm.

We have used these in the ATA office in past years to great effect. They are available in various forms, including under-desk flat panels, portable flat panels and foot warmers which you rest your feet on. Power consumption for these types of heaters starts at around a mere 70 watts or so. Compare that to the common 2400 watt fan heater—that's a huge reduction in energy consumption.

Insulate

There are still many homes out there that are either not insulated at all, or are poorly insulated and could do with improvement. Really, you should be looking for an equivalent of R2 in the walls and R3 or more in the ceiling. A combination of batts or other bulk fill material in the ceiling, and foil insulation just under the roofing material

Personal heaters have very low energy use compared to space heaters, and are ideal for people who are fairly stationary in the home. This one is rated at 160 watts.

seems to be the best combination, with the bulk fill material doing most of the work in winter.

Also it is important that there are as few breaks or holes in the insulation as possible. Recessed downlight fittings, exhaust fans and other ceiling-mounted devices cause these holes, so try to avoid installing them if possible. If you have recessed downlights, then you must make sure that you don't cover them up with insulation—to do so is a fire hazard. They need 100mm clearance around the fitting for safety. However, there is nothing stopping you from removing them, filling the holes in the ceiling and insulation, and putting in more versatile light fittings that don't require you to have large holes in the ceiling thermal barrier.

One company makes covers for halogen downlight fittings to reduce thermal losses (as well as reducing fire risk). It is called the Isolite, and is available through major electrical wholesalers.

Plug those draughts

Air passing around windows and doors can have a huge effect on your winter heating energy use. Draught excluders are low cost and very effective and are one of the simplest ways to reduce energy use. There are many forms, including foam door and window seals, and under-door strips that reduce airflow.

However, don't forget the less obvious problems, such as permanently open windows in toilets, for example. If your toilet has a fixed louvre or similar window that is always open to the outside, then keep the toilet door closed and fit draught excluders to the door.

Do a walk-around through your home and look for anywhere there might be air ingress. If you can seal the gaps, then do so. Don't forget gaps between walls and skirting boards, and even the gaps between floorboards—these gaps may be small, but put together they can make for a great deal of cold air entering the house, especially when it is windy outside.

Double glazing

Double glazing can reduce conductive losses through windows and glass panelled doors by two-thirds or more. However, it can be expensive to install double-glazed windows throughout an entire home. There are alternatives to complete double-glazed window systems. These usually involve an inner secondary layer of glass or plastic that is held to the inner window frames by various methods. One example is the magnetic window coverings called

Pelmets and curtains can reduce the energy losses through windows. Unprotected bare glass is not much better than a hole in the wall!

The Draft Stoppa (left) is designed to eliminate hot air rising through open exhaust fans, while the Isolite (right) safely seals halogen downlight fittings. You would be surprised how much energy can be wasted through the loss of hot air this way.

Magnetite (see Products in *ReNew 88* or www.magnetite.com.au), which is an acrylic sheet, held in place by magnetic strips, that can simply be pulled off for cleaning. Clear Comfort is another example—it consists of a heat shrink clear plastic film that is stuck to the window frame with double-sided tape. You just cut the film to size, stick it down and hit it with a hair dryer to shrink it to a nice tight finish.

These products, like double glazing, work by trapping a layer of air between the two layers of glazing. This layer of air is too small for convective currents to circulate in, so it acts more like insulation, thus reducing heat transfer. Double glazing doesn't reduce radiation losses, however, only conductive and convective losses.

Pelmets and curtains

Heavy curtains will reduce heat loss by acting as an insulation material, as well as by reducing convective currents.

However, curtains without full pelmets can actually create convective currents. This happens when the air between the curtain and the glass cools down through contact with the glass. The cooled air falls, sucking warm air into the top of the space between the glass and curtain. This sets up a convective current that can cause rapid heat loss from a room. Pelmets help solve this problem by obstructing airflow into the top of the space between curtain and window. Having the curtains reach all the way to the floor will also reduce this problem.

Seal exhaust fans and vents

Open vents and exhaust fans can allow huge amounts of warm air to escape into the roof cavity or the outside air. If you can, replace the vents with closeable ones. For exhaust fans, an automatic system like the Draft Stoppa, available from hardware stores, is simple and effective.

Let in the sun

If your house has blinds or shutters, open them on sunny days to let the sun in. You will be amazed how quickly the sun can warm a home, and it can even replace your heating system altogether on some days.

Heat only where necessary

If you are only using one or two rooms for most of the time, then it is a waste of energy to heat the entire house. Rooms such as the bathroom and toilet don't need to be heated.

For bathrooms, use radiant heaters only while you are in there. A radiant heater of between 250 to 500 watts will keep you nice and toasty while you are in the bathroom, without running up huge energy bills. Of course, make sure you turn the heating off when you leave!

If you have central heating with closable vents, seal off the vents in rooms not being used.

Turn down the heat

If your heater is set at a level that allows you to sit around in T-shirt and shorts, then it is set way too high. The ideal ambient temperature for humans is around 23°C, but this doesn't mean that the thermostat should be set that high. Indeed, the basic rule is that, for every degree you set it above 20°C, energy use increases by around 15%. So setting a thermostat at 23°C instead of 20°C will mean that you will use around 50% more energy to heat your home!

Keep the thermostat setting below 20°C if you can (older people, or those with arthritis or other medical conditions, may not be able to tolerate the house so cool) and you will save a great deal of money, and prevent a lot of greenhouse gas generation as well!

Useful resources

Websites:

www.greenpower.com.au
www.greenhouse.gov.au
www.seav.vic.gov.au
www.deus.nsw.gov.au
www.clearcomfort.com.au
www.wers.net

Books:

Your Home Technical Manual
available from the ATA shop
ph: (03)9419 2440, www.ata.org.au

***ReNew* resources:**

Insulation buyers guide, ReNew 88
Green heating options, ReNew 88

A shelter from the cold

In the depths of winter, Mt Wellington, Hobart, is a delightfully warm place to sit and read a book. Well, if you have a solar house, that is. Mark Loveridge takes us on a tour of his home

We were told solar wouldn't work in Tasmania, but with determination, and good design on our side, we have ended up with a comfortable, easy to maintain, low energy house.

The heating and cooling of the house is largely accomplished by passive, natural means. Compared with many Tasmanian houses, it feels warmer and the sun-space is a delight to be in, especially on even marginally sunny winter days.

The house is also a useful space to dry clothes in, if the extendable porch washing line does not do the trick. And to the surprise of many, bare feet are the norm at our place!

Location, location, location

Our house is one of five passive solar houses located on co-housing development Cascade Co-housing, in Hobart. The house site is located on the eastern flanks of Mount Wellington. It's beautiful, even when katabatic (downhill flowing) winds roar down the mountain.

The initial house design was done by architect Detlev Geard, and in the meantime I undertook the Adult Education Solar House Design course. Armed with knowledge, input from other homeowners and tours through several houses, I sat down and contemplated 'the big project'.

One of the fundamental aims was to produce a passive solar house that was quite energy efficient, aesthetically appealing and functional (optional). Lighting, appliances, finishes and water collection are all important parts of the house, but in this article, we're focusing on the housing envelope.

Maximising the sun

The external part of the house is relatively unmodified from the original design, but the rooms were altered to suit my lifestyle. I wanted to maximise functional space and minimise energy expended in doing tasks, particularly in the kitchen.

The kitchen/lounge area is the most used and must therefore be warmest. It's located in the north-facing part of

The sunroom adds warmth to the home and makes a great place to relax on sunny winter days—and to dry clothes!

the house. Similarly, the two upstairs rooms are also north facing. The master bedroom upstairs is south-east facing for views and to gain early morning light via a dormer window. The lounge area was made as large as practicable as it is the major area where energy from solar warmth would be collected. A bathroom with a spa needs a good view, so I put it in the south-east corner of the house to look towards the trees. It also obtains some morning sun to reduce mould formation. The toilet and laundry are placed to act as buffers to the cold south side. They are made cheerier by leadlight windows and translucent glass blocks.

We didn't forget the garden—the rear garden is full of natives: hakeas, tea trees, a pencil pine, huon pine and she-oak. A frog pond has finally sprouted lots of tadpoles after some very loud croaking!

Excavation and footings

Concrete-filled Besser blocks were used at this level to form the footings for the cellar/workshop and the lounge/laundry/toilet. The latter area was filled in with slag.

In any passive solar house, design and implementation care must be taken to minimise thermal leakages. Since the lounge floor is used as a solar collector, it was insulated underneath and at the edges with 50mm polystyrene foam board, carefully sealed to minimise thermal losses. Two coiled, 50 metre lengths of 19mm polypipe were installed 'at the last minute' within the steel reinforcement grids to facilitate underfloor heating. Concrete was poured to form an insulated suspended slab under the main part of the house to a thickness of 140mm.

For the walls it was decided to use Hebel block, which is an aerated concrete having a good R-value to the extent that no extra internal insulation was deemed necessary in most areas. It is also lightweight, easy to lay, has good compression characteristics and is easy to carve into various shapes, such as arches. On the negative side, it cracks like chalk, so construction methods have to be well thought out.

In many European countries Hebel is interfaced with a similar material such as concrete, but as we found out, it can be interfaced with timber if care and appropriate fixing methods are used. It is also relatively expensive.

Timber beams were constructed to bear the weight of the roof and the hot water tank. The roof was pitched at a steep 45° in keeping with the alpine style of the house. The roof was chosen to be a darker colorbond colour to aid with heat assimilation.

Insulation

Insulation is important in this climate and we used a combination of materials to produce best results. The Hebel block walls provide some thermal resistance. On the south side, an internal

The leadlight bathroom window adds to the artistic feel of the bathroom.

plasterboard lining was added. On the north side, upstairs, standard Baltic pine weatherboards with both flat RFL and 'concertina' foil insulation were used, with plasterboard internally.

We used standard colorbond roofing with foil underneath, then wool batts and roll insulation, and finally, straw ceiling panels, to provide at least R3.5 insulation. Polyester batts and carpet and timber flooring materials have been used to dampen sound and to reduce both up and down thermal flow. On the ground floor, cork and timber flooring materials and reflective foil batts have been used in the kitchen and bathroom areas. The lounge and laundry/toilet are slate on insulated slab.

Windows

All windows are double-glazed and fitted with thermally backed pelmeted curtains where possible. Window frames are constructed of Western Red Cedar.

Unfortunately a number of north-facing double-glazed windows have failed due to condensation entry from high thermal differentials or poor construction methods.

The upstairs south-facing bay window was designed for views, and although it is not energy efficient it does give excellent cooling breezes year round. It also provides a roof over the back porch and takes the 'squareness' out of the south wall.

The upstairs east-facing window was designed for morning sun. The upstairs north-facing windows provide solar input to the upstairs front rooms, and by convection vents to the master bedroom behind.

Downstairs, the kitchen window area is as large as practicable to provide warming to this room. The sunroom 'glasshouse' has floor to ceiling windows and a glass roof to allow solar input during any season from about 10am to 3pm.

Warmth from the sun is collected by the windows in the lounge area, making for a cosy and comfortable home with minimal extra heating required for much of the year.

At the top of the sunroom are a couple of convection vents into the north-west bedroom to allow extra warming of that room.

Heating and cooling

Even after several days of little or no sun and outside temperatures of zero to 5°C, the internal temperature has never been noted to fall below 12°C on winter mornings and 15 to 17°C in Autumn and Spring. With several very hot days the internal temperature never rose above 27°C.

The thermal energy stored in the slab keeps the building and its occupants warm. In mid-winter, the sun heats the lounge wall and floor, and some of the sunroom floor. In mid-summer, only the sunroom floor is heated. A similar effect occurs upstairs.

Psychological warmth is important in this climate so we chose an electric pseudo-log heater. It uses 2.0, 1.0 or 0.04 kilowatts ('flames' only) when running, is thermostatically controlled and is so realistic that I've even absent-mindedly opened the door to throw paper in it to burn!

The water tank is discretely tucked away under the porch.

Cooling, which may be needed in summer (yes, even in this climate) is easily accomplished using a properly located, reversible ceiling fan. The door and hinged windows allow cross-ventilation when needed and these, coupled with the back 'horsebox' door allow wonderful cooling through-ventilation on hot summer days.

Slab hydronic heating

The hydronic heating is clever, but currently needs to be used in conjunction with another heat source. Fresh, or clean solar-heated bath wastewater, stored in a 200 litre tank, is boosted to a nominal 25°C and may be pumped through the front of the slate-tiled lounge area, and/or through the back half of the house to keep the floor cosy warm if there has been little or no sun for a few days.

An internal thermostat will turn the heating/pump system off if solar input heats the room above the set temperature. This is nominally set at 17°C.

After 24 hours of pumping, the tank has slowly trickle-emptied into the frog pond in the back garden. The overflow from this waters the burgeoning 'bonsai' rainforest.

Solar hot water does work in Tassie!

Most people said that solar hot water won't work in Hobart—think again. There are more sunlight hours and greater solar input due to our clear skies than in many other places in Australia.

The fact that a solar hot water system doesn't depend upon direct sunlight, but will work even on overcast days, is a bonus.

The two standard Edwards solar collectors are located on the upper part of the north-facing sunroom roof, and thermosiphon hot water to a 370 litre Beasley, low-pressure, gravity-feed tank.

The system adds a significant amount of heat to the water for eight to nine months of the year and even enough in winter for one to two energy aware people, if the weather is sunny. For four to six months of the year the electric booster is off. The electrical booster is on a timer so that power is only available to the tank from around 4pm until 9pm. All pipes are insulated, especially hot water pipes. I would recommend selectively coated panels because they are a better absorber material for this climate. Also the collectors could be pitched another 15° (ie a 55° tilt) to improve effectiveness.

Water collection

Water is collected from one-half of the roof via a custom T-piece 'gunge' remover, which allows only relatively clean water to enter the tank via a fly-screen mesh.

Excess water in the tank overflows to storm-water drainage. A manual caravan pump enables this to be drawn up to the kitchen for cooking and drinking. Gutters are washed every six months or so, and possums discouraged!

Finishings

Externally, the Hebel block is rendered with Hebel cement and then with our own custom blend of limewash, which incorporates slaked lime, sand, bondcrete and crushed ochre from the block. It cost just $25 to do the whole house!

The timberwork has had Sceney's natural oil applied to it. This worked okay, but needs to be reapplied occasionally. The south side, even with mould inhibitor added, had grown mould over time, so that now it is keeping well with a few coats of paint instead.

Internally, some limewash was used in the master bedroom, but low-toxicity, water-based acrylics have recently been used throughout.

The floors have Bio oils on them: Bio-varnish (upstairs), Bio-wax (on the slate) and Bio-floor varnish (on the cork and bench-tops).

Timber shelves and cupboards are made from left-over floorboards (Tasmanian Oak) and Macrocarpa.

Lighting

Apart from two 50 watt quartz-halogen spot task-lighting lamps in the kitchen, a single 375 watt (dimmable) heat lamp in the bathroom, a 150 watt reflective spot lamp on the outside porch and a five by 25 watt bulb (total 125 watts) dimmable chandelier lamp in the lounge, all lighting is seven to 21 watt compact fluoro lamps.

Energy bills

On average, we use about 0.73kWh per day of electricity in summer. This increases a little in spring/autumn to an average of 1.6kWh per day.

In winter, it is about 4.5kWh per day with no underfloor heating or 17kWh per day with thermostatically controlled underfloor heating on during all of the winter quarter.

Now that's a funky spa!

If I could do it again

There are a number of things I would do differently including making the upstairs front wall a trombe wall, with smaller windows for light. I would also like to have warm air pumped into a rock bed or water storage beneath the ground floor to further reduce dependence on imported energy. Also, I'd build the master bedroom bay window from Hebel block so there is no external timber on the south side. More north-facing roof area for PV panels would be good—it is currently only large enough for up to 600 watts or so.

But all in all, we're happy, warm and in one of the best spots in Australia!

ATA Turns 25!

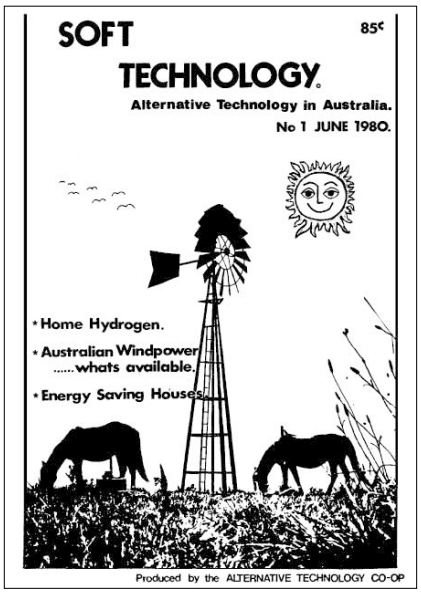
It's been 25 years since the ATA (publishers of *ReNew*) came into being, and what better way to celebrate than with a get-together of association members, new and old. Olivia Neville-Smith reflects on ATA's history

The ATA is celebrating its 25 birthday this year and at a celebration in May, many of the original founding members were in attendance. It was great to acknowledge ATA's early beginnings and to see how much it has grown!

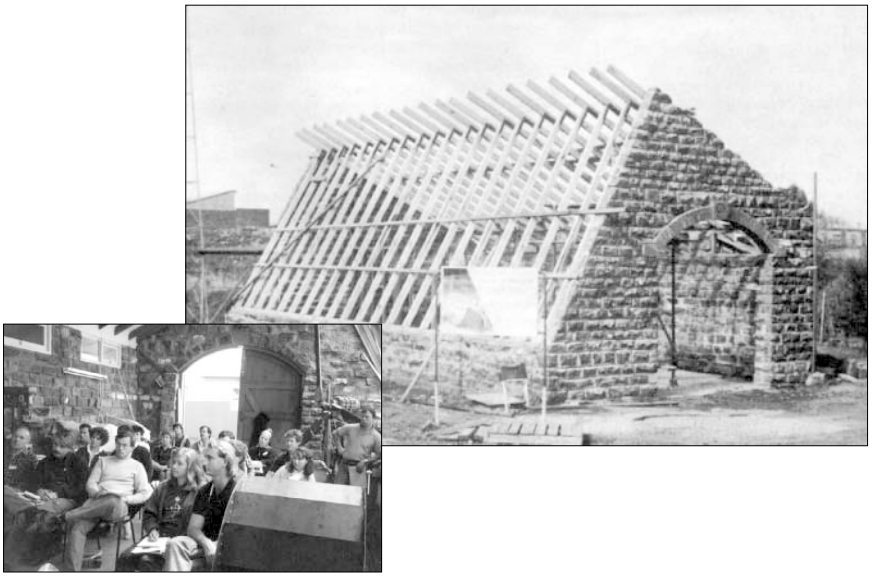
ATA's early beginnings

In the 1970s, a group of 200 people met at a church hall to discuss ways in which they could put practical conservation into action. This group became the 'Alternative Technology Cooperative' and was housed by Friends of the Earth for several years.

In order to share skills and knowledge, the group held field trips to a variety of homes and renewable energy sites, as well as setting up a trading network which eventually branched off as Going Solar.



The first issue of ATA's magazine, then called Soft Technology, was an 18 page photocopied affair and sold for 85 cents!



The Solar Workshop, located at the CERES environment park in East Brunswick, VIC, was built by volunteering ATA members. The Workshop was host to courses and ATA meetings, and later became the ATA's head office for four years.

Field trips

At the celebration, Mick Harris, a founding member and first editor of *ReNew* (then known as *Soft Technology)*, brought along some early super eight film of a few field trips (circa 1983). It was a delight to see the early innovations in the homes, as a lot of the technology is still current—though it was fun to have a giggle at some of the pioneering solar hot water systems!

In the early days of the ATA, going on field trips was a way for the members to demonstrate what could be achieved, and of course this information sharing is still at the core of what ATA does best.

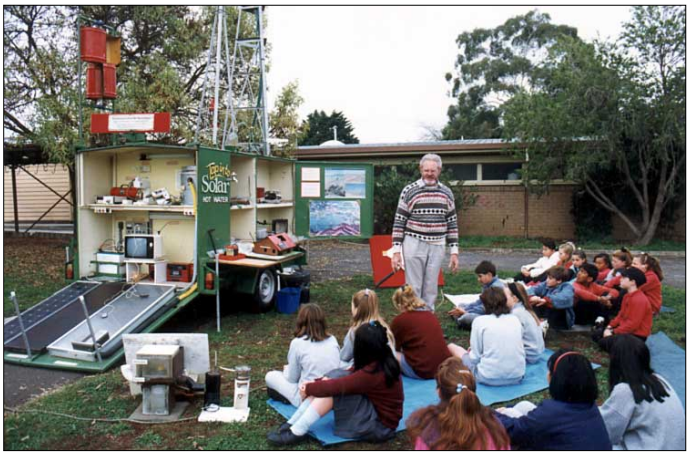
Among the homes filmed, there were some innovative solutions to common problems, such as a small round hole cut into the floor at the base of a main stair well, which when opened brought fresh air into the room via a pipe from outdoors.

There was a hand-operated washing machine shaped like a rocket, as well as a few solar hot water systems of the remote-coupled kind. While most of the homes were beautiful, some of the technology was a little dated and amusing!

Stories told

Other memorabilia of ATA's early days were also gathered for the evening including the first issue of Soft Technology. Initially only 100 copies of the 18 page, hand stapled issue were printed. Fast forward to today, where 20,000 copies of *ReNew* are printed and distributed to over 3000 newsagents and thousands of members and subscribers!

Interestingly, one of the homes on the home movie featured a top-opening chest style fridge not unlike the



ATA's first mobile educational display, 'the green trailer' (left) brought renewable energy to students and the general public. This was followed by the Energymobile (right), a 12 metre long semi trailer that toured around Australia. After that came the Solar Shuttle, which replaced the green trailer, and also the recycle factory, which contained numerous interactive recycling displays.

fridge-to-freezer conversion featured in *ReNew 90*.

Practical innovators

One of the anecdotes on the night s revealed that ATA's first computer, used to manage the members database, was built by one of the members.

While many organisations and businesses exist today to promote sustainable living, none have this extensive practical experience. We are still supporting real-world solutions in homes and letting others benefit from this knowledge.

Things are a changing

Only now we have not only the inventors, but also more of the less technically minded who have joined ATA's ranks in wanting a better home—and perhaps a better world.

In many ways, ATA has helped achieve much in 25 years and it brings to mind that classic quote by US anthropologist Margaret Mead (1901 to 1978) 'Never doubt that a small group of thoughtful, committed citizens can change the world. Indeed, it is the only thing that ever has.'

It would be hard to calculate the number of households that, inspired by the ATA, have adopted energy-saving practices and technologies—from the small scale of installing compact fluorescent lights and water-efficient shower heads, to the full blown passive solar designed homes built from scratch, with solar hot water systems, solar power, composting toilets and grey water systems.

As scientists confirm we are feeling the effects of global warming already, ATA's work is more important than ever. While most governments now acknowledge the reality of climate change we need to ensure that real sustainable technologies and practice are encouraged and supported.

Lets hope that in another 25 years that sustainable homes are the norm and that Australia has a healthy renewable energy industry.

Now that would be a great 50 birthday present!

Win a selection of LED products valued at over $100

We are looking for good build-it-yourself style articles, and will award a package of LEDs and/or LED products (of our choice) to the author of the best article we receive.

You don't have to be a tech-head, just have a project—simple or complex, electrical or mechanical—that has appeal to do-it-yourselfers and involves renewable energy or appropriate technology in some form. Entries must describe completed working projects.

Send your ideas to: *ReNew*, PO Box 2919, Fitzroy VIC 3065, email: renew@ata.org.au
Competition closes Friday 5 August 2005.

Renewable energy in a remote New Zealand community

When money's tight, how do you supply a remote NZ community with renewable energy? EcoInnovation's Michael Lawley shares his experience

EcoInnovation had a task: supply and install a renewable energy system to cover the basic needs for Waipoua Settlement, a remote community in Northland, New Zealand. The budget would be around NZ$50,000.

Waipoua Settlement, consisting of 10 homes and a marae (Maori meeting house), did not have any communal power source, although some houses had petrol generators and two had small photovoltaic (PV) systems.

Initially we visited the site to look at the options. Wind was ruled out, as the forest environment was not appropriate, and a suitable coastal site was several kilometres away. A cost analysis showed that wind power would be too expensive when compared to alternatives.

There were several small streams in the area plus a larger river. All these waterways were surveyed for flow and fall. We prepared a report outlining the options for hydro, wind and solar PV and concluded that micro hydro was by far the most cost effective, with solar PV second and wind third.

Using the limited funds we decided to:

- Install a 350 watt hydro system using a local stream with a 55-metre fall and a flow of two litres per second
- Connect this scheme to three nearby houses using 230 volts AC from an inverter
- Erect a powerhouse that would house batteries, inverter, battery chargers, and two large communal freezers
- Install six small solar PV systems on houses far away from the hydro powerhouse (the cable costs were too high to hook all houses directly to the hydro-powered inverter)
- Install a larger PV system with generator backup on the marae building that had a large freezer.

Installing the solar panels on the marae, the community meeting house.

The houses that were earmarked for solar PV systems were at a distinct disadvantage, and in unfavourable conditions would struggle. So we decided to install two battery chargers at the hydro building and make the battery packs for these houses portable so they could be recharged from the hydro when required.

Resource consent

We applied to the Northland Regional Council for resource consent (the flow rate that is allowed to be diverted from the river for use in the hydro system) and it was approved at two litres per second diversion without any restrictions.

Average flows in the river were in the range of four to six litres per second but flows would occasionally drop close to the consent limit. As the stream is not a significant one in the area and an existing road culvert prevents fish passage, the environmental effect of taking two litres per second from it was considered minor.

Hydro system

Originally we had planned to pipe the

Left: The intake screen is positioned in the culvert, excess water flows over the screen keeping it free of leaves and other debris. Right: Everbody lends a hand to help install the piping.

water down the valley of the stream and then install a power cable from the turbine to the community. However, this was very problematic as the power cable ran through plantation forest that would be felled at some future date. This option entailed a 600-metre cable run from the turbine to the community, which was also costly.

We decided to take a longer route with the poly pipe, with the water being piped directly to the community to avoid the cable cost. The exhaust water was returned to the river though an existing drain in the Waipoua Settlement. It worked out cheaper to pipe the water than to use a cable for electricity.

Adjusting the speed for maximum efficiency.

The 50mm pipeline also formed the basis of an improved water supply line to the houses resulting in much better water pressure, thus serving a dual purpose.

When laying the pipe we spent a few hours deciding upon the best route, (this was not the route the community had already started to cut through the bush for the pipe). Initially the pipe followed the bank of the river for about 300 metres before rising briefly and escaping the confines of the river valley.

We exited the river valley at a point where the banks were lower than on other parts of the river. This exit entailed a short uphill rise of about three metres—at the top of the rise we put a plug into the pipe joiner that could be used to insert a 'riser' in the event of air-locking problems.

Collecting the water

Careful selection and instalment of the intake for a small hydro scheme is cru-

cial if you want the system to run trouble-free for years to come. The intake needs to be:

- Strong enough to withstand assault from flood flows, rocks and debris
- Self-cleaning (using excess water)
- Screened with fine stainless steel mesh to keep out debris and aquatic life
- Easy to access.

For this job we used an old stainless steel spouting intake box that we found at a scrap yard for $30, and modified it. We placed a thick stainless steel perforated plate over the top (to withstand impact forces) and then covered this in fine 1.5mm stainless steel mesh.

The intake screen was bolted into place inside a large forestry road culvert pipe, which is an ideal foundation for attaching the screen. Excess water flows over the screen, keeping it free of leaves and other debris.

Purging and jet sizing

To purge the pipe of all air we flushed water through the pipe and let it flow out of the jet at the hydro turbine. Letting this run overnight removes most or all of the air. A simple way to tell if there is still air in the pipe is by measuring the pressure at the turbine jet with the flow stopped.

The pressure should read 10kPa for every metre of head. If it is lower than this, you probably have air in the lines. By walking along the pipe and lifting it at the high points, you can tell where the air is—if the pipe feels light at a high point, it is because it is full of air, not water. Installing a riser and vent at this point allows air to be purged.

We aimed for a running head pressure of around two-thirds of the static pressure. As our static pressure was 550kPa (equating to the head height of 55 metres), we wanted a running pressure of around 370kPa, which meant a jet size of around 9.3mm.

In order to get the maximum power output from the 50mm line, the tapered plastic jet was progressively cut back, and after each cut the effective 'running head' shown on the pressure gauge was noted. If you do not have sufficient water then you must set the jet size accordingly—this will vary from season to season.

Turbine adjustment

The turbine needs to run at a speed that will allow maximum efficiency. For a particular water flow, turbine speed can be adjusted by packing out the magnetic rotor away from the stator windings slightly. We achieved 360 watts from the unit—13 amps at 27.7 volts—a little more than the calculated output.

The powerhouse

An electrician wired up the various system components. We used a Xantrex C40 regulator connected to an air-resistive load which turns surplus power into heat. The regulator controls the energy as it is fed into twelve Trojan T105 batteries (6 volts each), which are wired into three banks of 24 volts to provide DC storage for the system.

The batteries power the inverter, which is a Latronic 1.5kW pure sine-wave unit that is powering the two freezers and the nearest house. The Elcold freezers were the largest we could find.

Houses are limited to energy-efficient lights and small appliances and have to coordinate usage of appliances to avoid overload tripping. The community is hoping to install a second inverter so that the consequences of inverter failure are reduced. All users could then plug into the remaining inverter while the other is being repaired.

After two intense days of getting the pipe in and the system running, we were able to enjoy a cold beer from the freezer! Two houses were connected to power for the first time. A third house is to follow shortly when the second inverter arrives.

Left: The turbine is tested and protected from damaging UV rays. Right: Jet and pressure guage is mounted on the line .

Six small PV systems

We then installed small solar PV systems on six houses. Each PV system consisted of:

- Invertek 600 watt sine wave inverter
- 10 amp regulator with digital display
- two Trojan T105 batteries
- one 120 watt solar PV panel.

These small systems are designed to provide basic lighting and appliance needs in the home.

Should overcast conditions prevail for several days, the batteries can be transported to the powerhouse where they can be recharged.

Owners of these small systems can upgrade them as their need and finances allow.

Right: The micro-hydro system powers the large communal freezer.

Marae PV system

The marae had always been powered by a generator, but it doesn't make good sense to run a 5kW generator to power a few lights. We installed a 720 watt PV array on the roof, pitched at 45 degrees and facing directly into the midday sun.

The marae inverter is a 3kW Invertek with a 70 amp (1800 watt) battery charger. The unit also has a 30 amp in-built solar regulator, but this was not used. Instead, we installed a TS60 Morningstar solar regulator with digital display and kilowatt-hour meter so that we could monitor the energy generated each day.

We installed the inverter using a plug-based system so that it could be easily removed for servicing and replaced with the generator.

The marae building also has another large Elcold freezer installed.

As a family lives in the upper floor of the marae, the PV system was only designed to power the freezer and lights in the building. During large gatherings generator backup will be required.

Six of the houses now have their own PV system, large enough to power lighting and appliances.

Getting results

The small hydro system will generate twice the power of all 12 of the 120 watt PV panels used in the other systems, and it will generate the same amount of energy every day, making managing supply and demand easier.

The total cost for the hydro installation, including approvals, pipes, inverter, regulator, freezers, batteries and labour, was less than $15,000. The hydro was about a third of the cost of all the PV-based systems. Small-scale hydro is therefore about one sixth of the price of solar PV for power on this site.

The system is intended only to meet the basic electrical needs of the com-

The PV panels on the roof of the marae face directly into the midday sun.

munity, which includes energy-efficient lighting, freezers, washing machines and small appliances.

By providing three large communal freezers, the intention is for the community to use large chilly bins and ice blocks to provide house refrigeration.

There is still other hydro potential in the community and this system could be upgraded with a second pipeline to double the output power when there is sufficient water. There is also one other stream that has potential, though the summer flows are less than the one initially developed.

In the meantime, the people of Waipoua, have their own source of renewable power provided by the surrounding elements.

For further information go to www.ecoinn.co.nz

Pumping water with less energy

Collyn Rivers explains some of the issues with water pumping, and how he greatly reduced energy use in some of his pumping systems

Experience with our 1.8kW solar power system north of Broome showed up an unexpected issue. It relates to the huge energy losses that can occur in systems like ours where water must be pressure fed from a tank to the house.

Our domestic water supply is pumped from a 100,000-litre rainwater tank that is on much the same level as the house. It supplies all of our needs including toilet flushing, the dishwasher and the washing machine. The extensive irrigation system and newly built swimming pool is supplied from our almost saline-free bore.

The energy problem surfaced when visitors started to stay. Despite no additional major energy-consuming devices being used, energy consumption soared. A few checks showed that the increased water consumption was responsible—but the energy increase seemed out of all proportion to the extra water used—even by water hungry city types!

The matter was urgent. We needed to extend the irrigation system, and to provide energy for power tools in our new workshop. We were already close to the limit of the existing system but, rather than adding extra solar capacity, I sought to increase usage efficiency by a hoped for 30%, regardless of visitors!

The original system

Our first water system used the conventional approach whereby the pump switch is actuated by line pressure as taps are turned on and off. The consequently changing pressure is smoothed by a small air/water pressure tank between pump and outlets. Such tanks contain a balloon inflated to some 15kPa (kilopascals) below the switch cut-in level. Water pumped into the tank initially compresses the balloon to the closed tap pressure; when a tap is opened, pressure drops, allowing the balloon to expand and continue to exert pressure on the water. Eventually the balloon pressure, and hence general system pressure, drops below the cut-in point and the pump restarts the cycle.

Through some modification of his water pumping systems, for his home, swimming pool and irrigation, Collyn has cut his energy use by over 2.5KWh a day.

The net effect is that the pump cycles for longer but less often. Energy consumption is reduced because turning a tap on will not cause the pump to start until two or three litres have been drawn—but the pump still starts and stops at least a hundred times a day. Such systems are simple and reliable but the ongoing and still rapid pressure changes cause havoc with temperature regulation in showers and with dishwashers and washing machines. Ours did just that.

Constant pressure

Following the pump-maker's advice, but without adequately researching the consequences, we modified the pumps to 'constant pressure' control. This cured the changing pressure problems but unfortunately I had not understood that the pump maintains constant pressure by circulating large amounts of water internally and supplying whatever is required to the outlets. Because of this, a trickle, or even a dripping tap, will cause the pump to operate close to maximum output until the draw (no matter how small) ceases. This system maintains pressure extremely well, but in our case at least, it consumed a huge amount of energy in doing so.

At first, there seemed to be no readily available solution. It then occurred to me that if one reverted to the previous on/off system but, instead of the typical

This solar array is all that was needed to run the pool-pumping system.

five/ten litre-pressure tank, we used a seriously big one (such as several hundreds of litres, of which about half is water capacity) this would require the pump to run only for the few minutes required to renew the pressure tank's water content. Further, that pump would be running at maximum efficiency, and water would be delivered at only very slowly falling pressure.

Serious tanks

I found that seriously big pressure tanks were rare, but the estimable Ken at KP Pumps & Irrigation (in Broome) located some big reinforced fibreglass tanks in the USA. I ordered a 450-litre unit, buried it deeply in the sand (for cyclone protection) and set up the pressure control using a standard irrigation pressure switch that I re-adjusted to cut in at 245kPa and out at 350kPa.

The results were almost dramatically effective. Now, instead of the pump starting and stopping every time a tap is turned on for longer than a few seconds, the loo flushed, or the Asko washing machine and dishwasher draw water in their complex (albeit efficient) cycles, those demands are supplied by the air-maintained water pressure in the system. With our typical 220-litre daily usage, the pump runs for just under three minutes, and usually only once every 24 hours. There is a gradual drop in pressure throughout the day but it is barely discernable. It bothers neither the washing machine nor the dishwasher. Nor us.

The energy saving is remarkable. This simple (and under $1000) modification slashed energy usage by over 1.5kWh per day. Furthermore, when visitors stay there is negligible increase in energy consumption.

Irrigation

I looked next at the bore water system. This runs from the main solar system and uses a Grundfoss SQ5 bore pump. This supplies 4000 to 5000 litres a day, requiring about two hours of pumping.

Our original distribution system used passive but automatic water delivery from a slightly elevated 23,000-litre tank. It worked well and ultra-reliably, but I felt we could gain greater flexibility by feeding directly from the bore pump and a further 450-litre pressure tank, with irrigation timed via a manifold of conventional (Nelson) 'one-shot' control valves.

Here too, the pressure tank enables the bore pump to run at full capacity or not at all. As the irrigation demand is well under half the bore pump's ability to supply it, this reduced pump running time by about 55%. The pressure tank also enables more than 200 litres to be drawn from garden taps et cetera before the bore pump kicks in.

A minor problem was that the 350kPa pressure needed for cleaning and fire hoses et cetera, was too high for extensive drip-feed irrigation. We solved this by installing a special pressure reducing valve that enables the high-pressure outlets to remain at 350kPa, but feeds everything upstream at 140kPa.

The 23,000-litre tank, that originally stored and gravity fed the pumped up irrigation water, now provides back up in the event of bore pump failure. It is connected into the pressure bore system via a hydro/mechanical gate valve that (in the same way as does a toilet cistern float valve) shuts the water off when the tank is full. Water from this tank can be pumped into the main irrigation system, if and when required, via an independent pressure pump.

Making these changes to the bore/irrigation system saved an additional 1kWh each day.

Further energy savings

Replacing the existing 240-volt Grundig pressure pumps with 24-volt or 48-volt pumps with brushless DC motors could make considerable further energy savings. But whilst, as with all induction-motored pumps, the Grundigs score few brownie points for efficiency, they are affordable, very reliable and can readily be replaced—even in a town

as small and remote as Broome. For these reasons, we will either retain the existing pumps, or install a Grundig bore pump (the SQ range is far more efficient) within the main rainwater storage tank.

Swimming pool

With our domestic and irrigation systems now working efficiently, the next item for attention was our just-completed 31,000-litre swimming pool. Having a close-to-pathological aversion to diesel generators, we sought to run the pool pump and sterilising equipment from solar. Several solar equipment suppliers in this field, however, deemed this impracticable—at least without a second and dedicated solar energy system of 1.25 to 1.5kW capacity.

And indeed it was—using the conventional approach that the suppliers were only prepared to consider. So we did it ourselves, and in a different way.

We were planning to extend irrigation to an area several metres below pool level so it made sense to pump that water via the pool—thus turning over about 10% of the pool water each day. This required us only to extend the high-pressure side of the bore supply up to the pool. There, a couple of jets (at the southern end) spurt the water into the pool, via an automatic timer, for about 30 minutes morning and evening. A 40mm outlet pipe at the northern end extends from close to the bottom of the pool wall and upwards to a few millimetres above the pool's normal water level. There is a short level section before the pipe extends down again and into the irrigation system.

The incoming water raises the water level in the pool and water begins to exit via the irrigation pipe—thus maintaining a constant pool level. An unexpected problem was that wind-induced waves on the pool surface initiated siphoning that, unless stopped, would eventually empty the pool—and began to do so the first windy day! This was readily fixed by inserting a 25mm breather in the horizontal section of the outlet pipe.

The MPPT and pump system for the swimming pool.

Using pool water for irrigation precludes normal chlorine levels and most alternatives use more electrical energy than we were prepared to commit. This was overcome by using a solar-driven Floatron device that floats in the pool, and uses an inbuilt solar module and copper electrode to ionize the water to about 0.3ppm. Some chlorine is still required—but only about 5% of normal usage.

The vendors of this and similar devices are currently being hassled by a weird interpretation of Australian agricultural regulations that has seemingly been extended to hinder or prevent the sale of the expendable copper electrodes. As the Floatron sells in 22 countries worldwide one hopes that sanity may yet prevail. If it doesn't, one presumably buys the electrodes from New Zealand or the USA!

The obligatory circulation of pool water is effected by an 18 to 60-volt brushless DC motor Badu top pump driven via a Bernt Lorenz MPPT (Maximum Power Point Tracker). This (non-battery) system pumps all day, typically circulating 4000 litres per hour. To optimise efficiency (by reducing head loss) we used larger diameter water pipes and a cartridge filter intended for pools many times the size.

It's relatively simple, extremely effective, virtually silent and, now it is installed, cost-free!

What's next?

The next step on the quest for efficiency is to series/parallel our 32-module main solar array for 96-volts output and feed this through an Outback Power MPPT. This should hopefully increase output by around 15%—or well over if one believes the promotional material. For readers unfamiliar with the technology, an MPPT is a DC to DC con-

A breather in the overflow pipe was needed to stop the siphon effect from emptying the pool!

verter that juggles incoming volts and amps to better match the typical 80-volt solar module output to the nominal 48-volt load. Or, putting it another way, enables the solar modules to deliver wattage closer to what is suggested in the advertising.

We don't really need this additional power (the water system changes resulted in greater energy saving than we sought) but it's comforting to have a good margin—and it gives the batteries an even easier time.

Non-RAPS

We did all of the above without seeking a Remote Area Power Supply (RAPS) Program rebate. We did this to save money. Here's how and why. The following mainly relates to the swimming pool part of the job alone, but the thinking and reality applies to all three systems.

The specialist RAPS installers that we initially approached were prepared only to consider conventional approaches—ie, add enough solar capacity to drive the conventional and massively inefficient 240-volt induction-motored swimming pool pump (ditto for the domestic water pressure system).

The swimming pool component alone would have necessitated 1250 to 1500 watts of extra solar capacity, a big mob of extra batteries, and a (at least) 1500 watt inverter. For this, a couple of specialist suppliers quoted $23,000 and $25,000 respectively. By using more appropriate technology, I needed only 480 watts of (dedicated) extra solar capacity and no batteries at all, plus the specialised MPPT and pump.

A further consideration was that everything specified for a RAPS installation mysteriously escalates in price. And by up to 50%. The swimming pool job took about half a day to research, plus a couple of short emails to Rainbow Power for equipment prices. It took me a further day or so to install. The total cost of this part of the job was a tad under $6000, including the cyclone-resistant solar module installation. Had I elected to go for a RAPS-rebate-eligible system, it would have cost me an extraordinary two-and-a-half times more!

Just imagine the cost of solving the rainwater and bore water energy pumping shortfalls via the RAPS route! An additional 2.5kWhr a day in solar capacity, a corresponding increase in battery capacity, plus a new $7000 or so inverter.

Yet those problems were solved equally quickly and cheaply. The major cost of doing so (for two 450-litre pressure tanks, and a handful of valves and gauges) was about $3000. All in all we saved enough money to buy a brand-new tractor. ✲

Collyn Rivers is the author of several books on all aspects of caravans and motorhomes, especially their electrical and solar systems. Available from the ATA shop: www.ata.org.au

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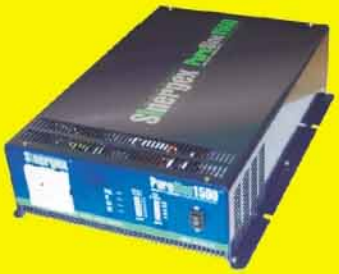

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Sustainable buildings, sustainable communities

Left out in the cold, community buildings can be a drain on the grid. Mara Ripani explains how one Melbourne shire pulled together for energy efficient outcomes

Community buildings, like schools and churches, can be sites of significant energy waste; people come and go, often unaware how much their activities affect communal energy costs.

Unfortunately, it is difficult for communities to implement energy saving initiatives as these things take time and money—two things such organisations lack. If community buildings are to reach sustainable energy goals, the wider community needs to pull together and offer some practical support.

One program in Melbourne's northern suburbs has been trying to do just that. Banyule City Council's *Sustainable Communities* program—funded through the Victorian Government's *Community Action Fund*—has worked with a number of local groups, including several churches, schools and a community learning centre, to help make their buildings more sustainable and comfortable.

From left, Energy Doctor Bruce Rowse with Veronica and Peter at Macleod College discuss solutions for reducing electricity waste.

The *Sustainable Communities* program

One of the key elements of the program is its two-pronged approach to sustainable energy use. It's not enough to simply identify key energy efficiency problems and offer technological solutions, without backing that up with education to ensure long-term behavioural change.

Step one: the technical fix

To get the ball rolling, Banyule Council Greenhouse Officers visited community leaders, building managers and building maintenance staff to discuss what could be achieved.

From the start it was important that the people who managed the buildings, and building committee members, were involved in the process and prepared to undertake work to improve the buildings. Building maintenance workers were key to the project's success. The maintenance staff's knowledge of the buildings and the groups that used them was vital when making decisions that would affect users.

Bruce Rowse, the 'Energy Doctor', came on board and assessed the energy performance of the buildings, working with maintenance workers to identify a whole range of issues.

The investigation produced a simple, accessible report that showed energy use, the costs of energy use and what needed to be done to reduce energy waste. Project officers then visited building administrators to discuss the report's findings.

Finally, Melbourne Electrical Specialists (MES) went in and made the necessary changes.

Macleod College

Cost of works: $19,963
Cost of energy assessment: $792
Funding: Macleod College, Sustainable Energy Authority Victoria and Community Action Fund.

Twenty-eight run-out timers were installed around the college in areas where lights or appliances were generally used for short times or in unpredictable patterns. Run-out timers were also used for air-conditioning units. A push button allows the unit to operate for one hour before turning itself off.

A 12 amp Fluorosave was installed adjacent to the school switchboard. The Fluorosave is a microprocessor-controlled energy-saving unit for fluorescent lighting, which supplies mains voltage to fluorescent lights for ignition.There is a short time delay to ensure stable operation of the fluorescent lights before Fluorosave switches to a lower voltage. Fluorosave continuously monitors the variation in the output of the current and mains voltage.

When additional lights within the network are switched on Fluorosave will revert back to mains voltage for ignition and wait for the current to re-stabilise before returning to the energy-saving mode. Power savings of 30% can be achieved with little discernable loss in light levels.

All of the twin 36 watt fluoro tubes were replaced with one 36 watt triphosphor tube and reflector. The reflectors greatly increase light output from the triphosphor tubes. Triphosphor tubes also last longer and provide more light. The result is that power usage is being halved while the quality of light is increased by 10%.

Macleod College has three computer rooms with a total of 24 computers. When computers are turned off, but still plugged in, they draw 10 watts of energy each. This equates to 240 watts or 1 amp. In each computer room a master switch was installed with a neon light at the entrance. This means that the last person can turn off the entire computer system with a single master switch.

Stand-alone shutdown software was installed on all computers so that any computer not shut down by the network at 4pm would be shut down by the software. Computers were also programmed to go into stand-by mode after 15 minutes of inactivity. This reduces the energy use of a typical computer monitor with an active screen from 110 watts to less than 10 watts, or a computer monitor with a blank screen from 55 watts to less than 10 watts.

Sean replacing two fluoro tubes with one 36 watt triphosphor tube and reflector.

A light level occupancy sensor was installed in the staffroom. The sensor has two purposes. First it detects if the room has adequate natural light. If the light levels are too low the lights will turn on. If there is enough natural light the inside lights will turn off. The occupancy sensors will only keep the lights on for around 15 minutes if movement is not detected in the room.

Timers were installed on instantaneous hot water urns. The timers are set to run 10 hours a day, five days a week, instead of 24 hours, seven days a week. Timers were also installed on water coolers and vending machines. Wrapping the urn with special insulation is a simple method of reducing the energy consumption.

Three old hot water systems were replaced with efficient newer ones and hot water supply was disconnected from areas where users identified little-to-no-use for hot water.

The next stage for Macleod College is to develop a holiday shutdown checklist to capture savings during the long school holiday periods.

Step two: Long-term goals

Banyule Council conducted a number of training workshops at CERES Environmental Park in Brunswick to train IT staff, building maintenance officers, community coordinators and school principals.

The council will be conducting further workshops to teach other staff and the broader communities associated with the buildings.

Schools will be supported to develop curriculum activities that engage children in energy conservation. For example, Haig St Primary School have produced energy efficiency signage for their classrooms. A holiday shutdown checklist will be designed in collaboration with school maintanance staff, so that energy savings can be maximised during the long summer holidays.

Finally, Banyule City Council will support schools to develop energy efficiency policy for community buildings to ensure future decisions incorporate energy conservation principles.

By the end of the program, *Sustainable Communities* will have collectively saved 100 tonnes of greenhouse gases and $8000 in power bills per annum. ✶

With contributions from Sean Moore and Tim Green from Melbourne Electrical Specialists. For further information please contact Mara Ripani at Banyule City Council on ph: (03) 9457 9821 or email: mara.ripani@banyule.vic.gov.au

Ivanhoe Uniting Church

Approximate cost of works $1877
Energy Assessment $396

The church room at Ivanhoe Uniting Church had 10 heaters that were switched on and off individually. It would have taken users a considerable time to switch heaters off when they left, as the church room is large and the heaters were dotted throughout. So heaters were often accidentally left on until the room was used again.

To overcome this problem the electricians installed two contactors (remotely controlled switches that can cope with high current loads) that the 10 heaters draw power through. These are wired into a neon-lit master switch located near the main exit point. As the last person leaves they can turn off all 10 heaters using one switch.

This means that by simply looking at the neon switch on the wall at the entrance, it would be easy to see if the heaters are switched on or off.

To install the new system the electricians had to get under the floorboards. In some areas of the building there was very little space to crawl under. One hundred years worth of accumulated dust didn't help either.

At one stage the only way the cables could be pulled through such a small space was by tying them together with a long cable and then pulling the cable through a space that was made in the floorboards further down.

The master switch installed at Ivanhoe Uniting Church turns off all the heaters in one go!

Bill Rewell, church maintenance officer, bought timers and installed them on hot water units to ensure the units would automatically turn off after hours.

In the church kindergarten room a security television was being left on 24 hours a day seven days a week because users could not reach the power point to switch it off. Bill resolved this simply by connecting a power board with an extension lead.

Four bar fridges were found to be operating with little to nothing in them. After fridge users were consulted two of the fridges were removed.

Finally, compact fluorescent light globes were installed in outdoor areas where lights were being left on for security reasons.

Haig Street Primary School

Cost of works $11,031
Cost of audit $572
Funding: Australian Greenhouse Office (AGO), Sustainable Energy Authority Victoria and Community Action Fund.

Haig Street Primary School had some of the same changes as Macleod College, and in addition the school installed movement sensors in the toilets and occupancy/light sensors in all classrooms.

Infrascan sensors in classrooms mean that as long as someone is in the room the lights stay on, but if no movement is detected the lights switch off (something unlikely to happen in a room full of primary school students).

A Fluorosave voltage reduction unit was installed in the hallways to reduce power use.

The project was completed over the school holidays, which made life easier for all concerned.

The airways need an eco voice

The ending of ABC radio's long-running national environment program, *Earthbeat*, has left a gap in the reporting of Australia's top environmental issues. Juliet Fox reports

Well you could be forgiven for not knowing that Radio National's Australia-wide environment program, *Earthbeat*, has finished. With the final show broadcast at the end of January, the cut ends nearly two decades of dedicated environment programming including *Earthworm* and *Green and Practical*.

Alexandra de Blas presented *Earthbeat* for the last seven and a half years and now produces environment packages for the new Saturday morning line-up hosted by Geraldine Doogue. Radio National's website states that *Earthbeat* can now be heard at 8.30am on a Saturday, but this in fact only refers to environment stories within a broader magazine-style show. The change leaves the national broadcaster without a dedicated radio program on environmental issues.

Many people are concerned about this loss, including James Porteous, Editor of ECOS—a national magazine on sustainability published by CSIRO. He's been gauging public opinion about the change and raising questions with Radio National management as to why they made the cut. 'From the responses I've had from people working in civic organisations, education, broader industry and not-for-profits, people relied on *Earthbeat* as a source of information not just in the immediate programs but also in the extensive archive of information that it has there which is very well cross linked—that archive still exists by the way.'

James says that people relied on '*Earthbeat* as a really good, reliable source of information every Saturday morning for the emerging issues in the environmental agenda. And there aren't enough places in Australia where you can go for that information. So for the national broadcaster to have closed that source down—it has impacted people.'

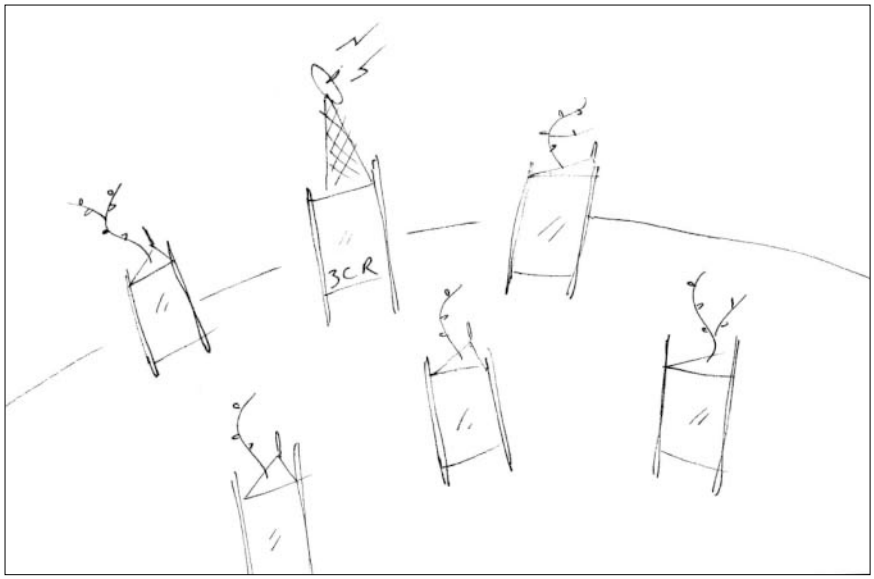

Image byDarby Hudson.

'Given where we're going and the sorts of issues that are emerging, there's a greater need for environmental programming right in the mainstream as a way to connect the public's everyday decision making and living, to the broader issues that are happening out there in the environment that are largely out of sight and out of mind. And if you don't have that connection you can't expect people to change or to understand the impact of their choices.' said James.

Freelance environmental journalist and editor of *SourceWatch*, Bob Burton, is also concerned about the change.'I think it's a bit of an alarming signal about the retreat of mainstream reporting from quite important topics. The role of the ABC is as a national broadcaster; it was a program that was on Radio National, covering an issue that all opinion polls indicate a very high percentage of Australians care deeply about. There's a critical role for specialist reporting in this area and if the ABC's not going to do it, then who is?

'If there aren't the people out there asking the questions—and well informed questions—then people in positions of power, whether it's in governments or corporations, are going to feel somewhat more emboldened and less likely that they're going to face any form of public accountability and scrutiny of what they're doing and I think that's not a good thing for a healthy democracy.' ✲

To join an email list regarding the fate of *Earthbeat* send an email to James Porteous at ecos@csiro.au

Juliet Fox is a producer/presenter of *Earth Matters*. This weekly program is broadcast nationally via the Community Radio Network on Fridays at 4pm. Juliet can be contacted at 3CR on ph:(03)9419 8377 or earthmatters_3cr@yahoo.com.au

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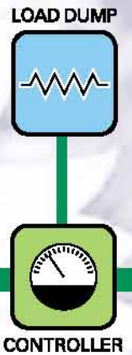

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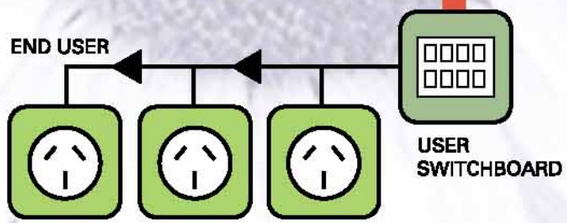

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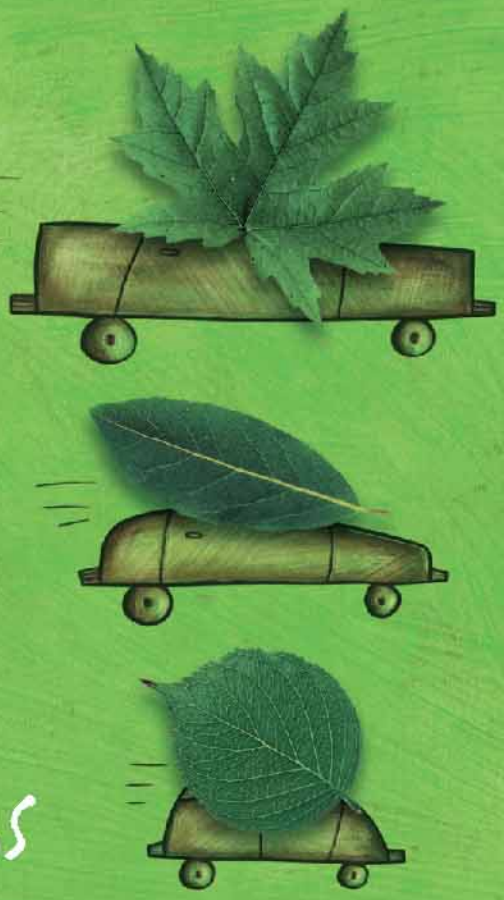

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Finding the ideal thermostat

The freezer-to-fridge conversion article in *ReNew 88* sparked a number of enquiries about where to get a suitable thermostat. Ross Dannecker shows us how to use a readily available off-the-shelf unit for this purpose

For my fridge-to-freezer conversion I used a thermostat that I bought from Jaycar Electronics—part number QT7200—at a cost of $39.95.

This unit is actually designed to replace a mechanical thermostat in a heating system. For that use, it can be programmed to switch on a heater if the temperature falls below a preset value, which can be from 5°C to 35°C.

The thermostat contains a small semiconductor thermistor for temperature sensing, some electronics, an LCD and a magnetic latching relay with one set of changeover contacts rated for 240 volts AC at 3.5 amps. It is powered by two AAA cells.

Making a few changes

Connecting the thermostat to the fridge is simple. You just break the active lead in the 240-volt cable that goes to the fridge and wire the two ends to the common and normally open contacts of the relay, which appear on a screw terminal block inside the unit. See the photo below.

As both the normally closed and the normally open contacts appear on the terminal block, it is possible to wire the two active wires to the common and normally open contacts. This will create a temperature controller which switches on the appliance connected to it if the temperature rises above the preset value.

Sensing the temperature

The device in the thermostat that senses the temperature, the thermistor, is mounted on the circuit board. This is fine for a thermostat where you are just measuring the ambient temperature in a room, but not much use for a fridge thermostat, where you need to measure the temperature inside the fridge compartment!

However, it is very easy to solve this problem—just remove the thermistor from the circuit board and connect it back to the board via a length of double-insulated twin-core cable.

Start by unsoldering the thermistor from the circuit board, then solder the ends of the cable to the board where the thermistor was. Now run the wires inside the fridge, carefully weaving them behind anything in there that will hold the cable in place. Then solder the thermistor on to the end of the wires and encapsulate the thermistor in hot melt glue. You now have a temperature controller for a freezer-to-fridge conversion.

The results

By setting the controller to its lowest value of 5°C, the controller itself turns the fridge compressor on at 5.5°C, and off at 4.5°C. However, the thermal inertia of the fridge and of the encapsulated thermistor results in the temperature in the fridge dropping to between 3°C and 3.5°C before it starts to rise again. The average fridge temperature is therefore maintained at a little above 4°C. A little experimentation with thermistor

Here you can see the thermostat with the cover removed. Note how the active line of the fridge cord is cut and inserted into the terminal block. Note that all of the exposed cables are encased in the thermostat housing when it is assembled and mounted.

Warning!

Any project involving 240 volt mains wiring should be considered dangerous if suitable safety precautions are not taken. When working on this or similar projects make sure you do not come into contact with 240 volt AC voltages. If you are not confident about working with such voltages then you are strongly advised not to attempt projects that involve mains wiring. The author and *ReNew* disclaim any liability should anyone be injured or killed working on this project.

placement may be required to optimise the operation of the fridge.

The measured current drawn from the two AAA cells is about 0.000005A (5uA) when quiescent (when the relay isn't operating). When the relay switches on or off, it draws a brief pulse of much higher current (not measured) and the current then drops again to the quiescent value. The battery lifetime should therefore be quite long. Permanent magnets in the relay hold the contacts in the required position—this is known as a latching relay, and requires no power once it has switched.

No information was supplied on the expected number of relay contact operations before failure—most relays are rated in the 10s to 100s of thousands of operations, or even into the millions.

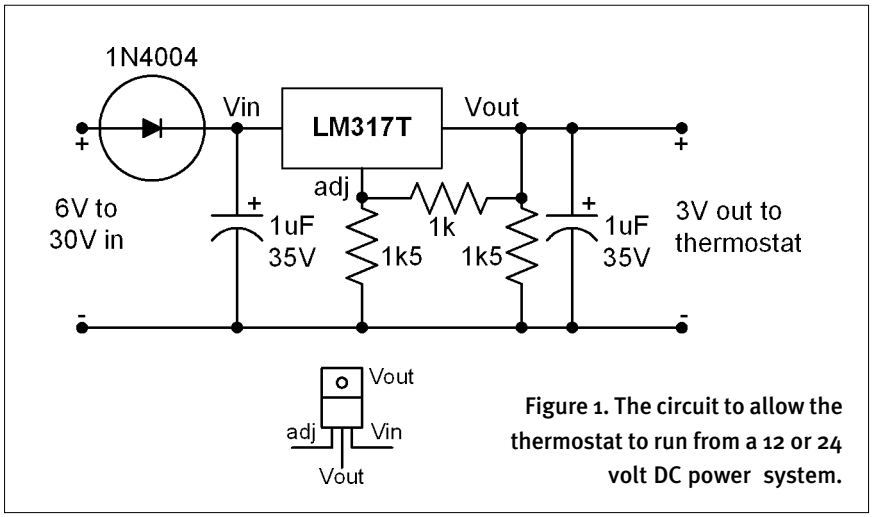


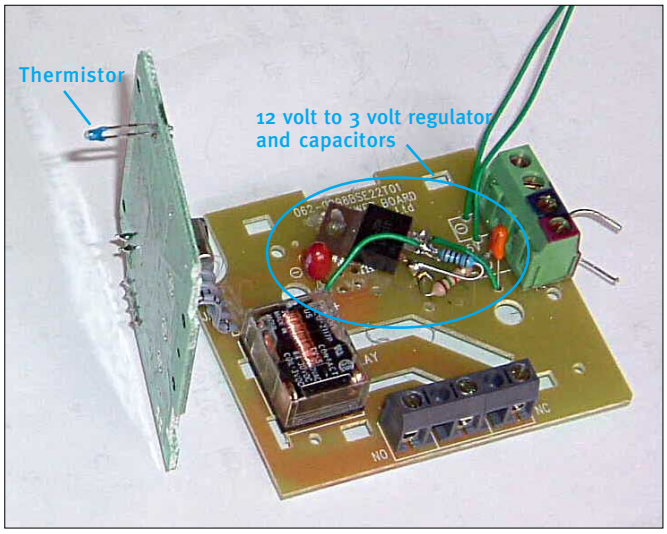
Figure 1. The circuit to allow the thermostat to run from a 12 or 24 volt DC power system.

RAPs system applications

For people like me with a 12 or 24 volt battery system and a 240 volt inverter, it is fairly easy to modify the unit by building a small voltage regulator into it to drop the battery voltage to 3 volts. The circuit to do this can be seen in Figure 1. I built my regulator inside the case of the thermostat itself (see the photo below).

For the technically minded, there has to be a few milliamps drawn by the load for the regulator to operate correctly. The current drain of the regulator is about 4mA at 13 volts. That's around 1 watt-hour per day of energy, which is pretty insignificant compared to the fridge consumption of 100 to 500 watt-hours per day.

For safety reasons, fuse both the positive and negative wires to the battery with 0.5 amp fast blow fuses. Again for safety reasons, don't use a unit modified for use with a 12 volt power supply to switch a fridge powered by mains electricity—stick with the AAA cells. ✱



Left: The thermistor that you have to remove from the top circuit board, and the new regulator that was fitted to allow the thermostat to run from a DC system.

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Tap your onsite power resources

The last time we looked at the micro-hydro market was in *ReNew* 72, so we thought it was about time we looked at them again to see what's new

While there are not many hydro turbine manufacturers in Australia, there is still an excellent range of turbines available in the under-20 kilowatt class, in both AC and DC output models.

Why buy a micro-hydro?

The potential energy stored in water situated above sea level is considerable. You just need to look at the deep pools often found below large waterfalls or how the rocks in a creek are worn smooth, to be awed by its power.

Harnessing the power of water is by no means a new concept. Waterwheels have been used for centuries for milling, grinding and other types of mechanical work. Turbines came in to play to replace waterwheels and to power electric generators in remote areas in the mid 19th century.

Nowadays, water turbines are increasingly being used in developing countries due to their relatively low cost, comparatively simple maintenance, clean renewable nature and the abundance of suitable hydro sites. With environmental awareness increasing, the push is away from big centralised power sources and back towards energy systems that use local natural resources.

All that aside, if you have a remote property and need to supply reliable power, then in some cases a micro-hydro turbine will be the best option.

Turbine types and siting

The basic layout of most micro-hydro systems involves a turbine, mounted at some low point on the creek or river, being fed by pipes running from a much higher point in the water source. The weight of water in the pipes causes a relatively high water pressure at the turbine end of the pipe, thus providing a means of driving the turbine. To get an idea of the forces involved, try aiming the jet from an ordinary garden hose at your hand. You will feel the force of the water striking your hand and being deflected. This is how many turbines work, in a round-about way.

Flow rate (in litres per second of water flowing through the unit) and head (the vertical height that the water falls) are the two major factors governing the amount of power available from a site. Several different types of turbines have been developed to cope with a variety of situations, such as a high head with a low flow rate, or a low head with a high flow rate.

The turbines available generally fall into one of two categories—impulse turbines or reaction turbines.

The Platypus Power range is available in DC battery charging and AC output designs. Here you can see a DC output M1-125 unit, as well as the stainless steel hybrid runner (right).

Impulse turbines

Examples of impulse turbines include Pelton, Turgo and Banki Crossflow. The water is directed through one or more nozzles and onto the 'runner' (turbine wheel). This rotates above the level of the water source, and the water falls below the turbine to the tail water, usually flowing from there back into the creek.

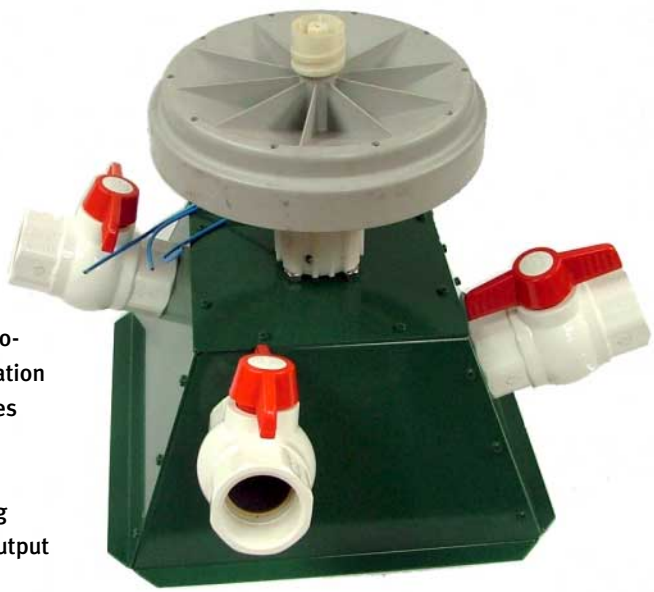
This turbine won't function submerged in water, so it must be situated above the maximum flood level that the water source may reach. This often leads to significant loss of head, which is one reason why this sort of turbine isn't used in low-head applications.

The Pelton wheel is probably the best known and most commonly used of the impulse turbines. The Turgo is very similar, but has a slightly higher effi-

ciency. Both types run at relatively high speeds, allowing them to be directly coupled to a high-speed generator, but Turgos will spin at a greater rpm for the same size jet diameter.

Turgo turbines can also be arranged to spin at half speed, allowing efficient operation at low heads.

The Crossflow turbine is somewhat different. It uses a cylindrical type rotor through which the water passes twice. It can be used with virtually any head (1 to 200 metres). These systems are good for water pumping, and the Planetary Power machines are sometimes used this way.



A new player in the micro-hydro market, EcoInnovation from New Zealand, makes this turbine that uses a Turgo runner to drive a Fisher & Paykel washing machine motor. Power output is up to 1kW.

Reaction turbines

This class of turbine includes the Francis and Kaplan types. The blades on these turbines are submerged in the water itself. As the water flows over them, lift forces are created, similar to the way lift is generated by the wings of an aircraft. These forces cause the turbine blades to rotate. The water exiting the turbine is discharged via a draft tube which creates a negative pressure on that side of the turbine. This means that the fall of water after the turbine can also be included in the net head, which is very significant if there is not a lot of head to begin with. The Francis turbines are the most efficient of the reaction turbines but are generally more expensive.

A novel form of reaction turbine can be seen on the next page—the Aquair generator is designed to be fully submerged in a water flow to generate electricity.

Reaction turbines tend to be bigger and are more expensive than impulse types, so if you're lucky enough to have a choice between a high head, low flow site or a low head, high flow site it's best economically to opt for the former.

Other things to consider if you're thinking about installing a micro-hydro system are generators, load regulation, civil works and electrical work.

AC or DC?

There are two common systems available—DC, or battery-charging turbines, and AC turbines.

The DC turbines are designed to feed their power into a battery bank for use at a later stage. These are well suited to sites that may not flow all of the time, but do have regular or seasonal flows. Some installations use micro-hydro turbines to provide power during the winter months, when water is most abundant, and rely on other power sources, such as the sun, during the hotter, dry part of the year.

If you have a good flow of water all year round, then an AC turbine may be the best option. These produce power at 240 volts AC, just like mains power, so you can draw power from the turbine directly, without the need for batteries, inverters and the like. An excellent example of this type of system is the 13kW turbine at Stevensons Falls, near Marysville in Victoria. This turbine supplies power directly to lights used to illuminate the falls at night.

The disadvantage with this system is that you are limited in the amount of instantaneous power you can draw from the turbine. For example, if you have a 1.2kW system, then that is the most power you can draw from the turbine. Loads larger than this will need to be powered from some other source. You can, of course, use an AC turbine to charge a battery bank, just like a DC turbine.

Power control

Load regulation of most turbines usually occurs by 'dumping' the excess energy into some form of load. This is often a series of light globes or heating elements, such as in a hot water system. Regulation is required to avoid large voltage fluctuations, and to keep the turbine running at a near-constant speed. There are several types of regulation systems, from simple on/off switching to variable load dumping, where the load dump connected to the turbine varies inversely proportionate to the main load.

As an example, if you have a 1kW turbine, and you are using 200 watts from it, then the other 800 watts will be fed

into the load dump. If your load increases to 650 watts, then the excess 350 watts will be dumped. This system can be achieved in several ways, but a commonly used method is to switch in load dump elements of varying sizes in the right combinations to form a load dump of the correct size.

A novel approach to regulation has been taken by Tamar. It has developed a water economiser that varies the water flow through the turbine, depending on the load. This reduces the power produced by the turbine, reducing the power dissipated by the dump loads. This system suits sites where the flow is intermittent or where water storage in a weir or dam is used.

Tamar has another device, 'Automatic Start' which actually stops the turbine if the load falls below 40 watts. When a load of 40 watts or greater is applied the machine automatically starts in a few seconds. It is designed to help the system cope with intermittent power requirements such as a refrigerator.

Civil works

This refers to the other parts of the system, including head (penstock) and tail (draft) pipes, dams and other parts of the water supply system. Civil works may involve as little as a couple of hundred metres of plastic piping with a screen filter at the collection point, right through to construction of a large weir or dam, along with the other associated parts. These include trash racks, which deflect solid material from entering the feed pipe, control valves, and even flood control systems. Be sure not to underestimate the effect the civil works will have on the cost of the system—it can become very expensive if you can't do it yourself.

Some councils charge a fee for water taken from a stream, even if it is returned at a later stage. Check with your council before planning a system.

The Aquair UW is designed to be submerged in a fast flowing river or stream and will generate up to 100 watts.

Buying a turbine

This can be a complex process, as you have to determine head, flow rate at the selected site, ease of access, type and amount of power required from the turbine and possible environmental disruption to the area. Remember that to minimise the effect you have on the local ecosystem, you must not divert all of the water from the source to run through your system. If you are unsure, set yourself a limit of, say, 50 per cent of the total flow at the lowest flow rate period, usually during summer or the dry season.

Once you have these details worked out, you can then start thinking about the type of turbine you want. See the table at the end of this article for the turbine most suitable for your requirements. If more than one turbine seems ideal, then you will have to look at other factors, including price and maintenance requirements, though you should also look at these initially. It all depends on your priorities.

Other turbines

We have covered the most common commercially available turbine types, but there are others you may want to consider. These are mainly used in direct flow applications, such as waterwheels.

Waterwheels are usually undershot, where the lower paddles of the wheel are simply placed in the flow of a river or stream, or an overshot wheel, where waterflow is directed from the source to the top of the wheel. The weight of the water in the wheel 'buckets' pulls the wheel around.

Floods can be a problem for undershot wheels, as they need to be placed in the water source directly, but overshot wheels can be located in safer areas and have water diverted to them.

While there are no commercial manufacturers of waterwheels that we know of, they are quite a simple device to make. There have been several designs for waterwheels published in previous issues of *ReNew*. If you are of the do-it-yourself persuasion and have a useful creek with good flow but little head (common on small properties), then a waterwheel may be the best option—though for electricity generation some form of gearing up is needed.

[Buyer's guide]

Brand (Made in)	Model	Rotor type	Rotor material	Voltage	Power (kW)	Head range (metres)	Flow range (litres/sec)	Generator type	Regulation	Warranty (years)	RRP Inc GST ($)	Comments	Company details
Aquair (United Kingdom)	Aquair UW	Reaction		12, 24VDC	0.1	NA	NA	Permanent magnet	NA	2	$2,080	Immersion turbine suitable for medium to fast flowing streams and rivers	Energy Today PO Box 340, Botany NSW 2019 ph:(02) 9700 0960, fax:(02) 9700 0964 energytoday@quirks.com.au www.quirks.com.au
EcoInnovation (New Zealand)	Turgo	Turgo	Stainless steel	12, 24, 48VDC or 240 to 500VAC with transformer/rectifier pack to 24 or 48VDC	Up to 1000 watt	3 to 20	8 to 25. For lower flows use our Pelton turbine	Rewired Smart Drive permanent magnet	External voltage regulator and diversion load sold separately	2yrs full warranty. From 2 to 5yrs will repair for no more than $100 per part	From $1,100 delivered, $1,500 with regulator and load	Suitable for sites as low as 3m of head. Uses Smart Drive parts that are cost effective and plentiful. On low head sites turbine can only do 300-500 watts. Conversion efficiency on low head site is 40% water to wire	EcoInnovation 671 Kent Rd, RD1 New Plymouth New Zealand ph:(06) 752 2765, fax:(06) 752 2768 www.ecoinn.co.nz ecoinn@paradise.net.nz
	Pelton	Pelton	Plastic. Removable spoons. Spare set provided			10 to 100	0.25 to 8. For higher flows use our Turgo turbine					Suitable for heads as low as 10m. Uses common Smart Drive parts that are cost effective and plentiful. Conversion efficiency is 45-54% water to wire depending upon site parameters, power output and voltage of unit	
Pelena Energy (Australia)	PCFT-1 (1 nozzle)	Crossflow	Stainless Steel	See comments	2 to 87	4 to 50	80 to 250	Any - see notes	Electronic, grid connected or manual	1	POA	Generator options are DC, AC (synchronous stand-alone), AC (asynchronous/induction - grid connected) 1 or 3 phase 50/60Hz. Units have standardised bearings, seals and belts (if needed). 95% stainless steel	Pelena Energy ph:(03) 4342 6520 www.pelena.com.au
	PCFT-2 (2 nozzle)				2 to 175		170 to 500						
	PCFT-3 (3 nozzle)				10 to 250		260 to 730						
	PPT-1 (1 nozzle)	Pelton	Stainless steel with replaceable cast iron buckets		2 to 150	25 to 140	12 to 125						
	PPT-2 (2 nozzle)				2 to 250		12 to 225						
Platypus Power (Australia)	PM1000	Hybrid impulse	Stainless	12, 24, 48VDC	0.75	8 to 100	0.5 to 15	Permanent magnet	Plat 20/40	2	$3,878		Platypus Power PO Box 538 Smithfield QLD 4878 ph:(07) 4055 8057 plapower@netc.net.au www.platypuspower.com.au
	U3000			12, 24, 48, 110VDC	1	4 to 50	1 to 30		Plat 20/40		$5,276	Ideal for long transmission	
	Q2/150			240VAC	1.8	20 to 80	3 to 12	Induction	SG104		$5,325		
	Q3/150				2.3	20 to 90	3 to 15		SG104		$6,820		
	Q4/150				3.2	20 to 90	5 to 45		SG104		$8,140		
	PP5/150				5	25 to 110	7 to 48		SG104		$9,355		
	PP7/150				7	25 to 110	7 to 55		SG104		$11,720		
	PP10/200				10	40 to 110	16 to 60		SG104		$12,870		
Rainbow Hydro (Australia)	HYD-200	Pelton	Epoxy compound	12 or 24VDC	0.3	7 to 100	0.2 to 100	3 phase induction	PL20	1	$3,300	Regulator included	Rainbow Power Company PO Box 240, Nimbin NSW 2480 www.rpc.com.au
Stream Engine (Canada)	HYD-060	Turgo	Bronze	12, 24, 48VDC	1.9	5 to 150	1 to 9	Permanent magnet	PL20/40	1	$3,300	Regulator extra	Rainbow Power Company PO Box 240, Nimbin NSW 2480 www.rpc.com.au
Tyco Tamar (Australia)	2.5kWE Pelton	Pelton	Bronze	240V single phase	2.5	75	6.5	Synchronous	Shunt load governor	1	$21,000	Tyco Tamar manufacture a wide range of turbines, from small 100 watt DC sets for battery charging, through to turbine powered pumps, 240V single phase, 415V 3 phase and induction sets for grid connection. Specifications and prices are approximate only. To provide a firm price, they require further details of the site, which can be entered into the form on their website	Tyco Tamar 67 Main Rd, Exeter TAS 7275 ph:(03) 6394 3132 tamar@tamar.com.au www.tamar.com.au
	2.5kWE Turgo Impulse	Turgo Impulse			2.5	36	13.8				$22,500		
	2.5kWE Francis	Francis	Bronze and stainless steel		2.5	10	43.9				$49,000		
	2.5kWE Kaplan	Kaplan			2.5	5.2	85				$50,000		
	4.0kWE Pelton	Pelton	Bronze and stainless steel		4	75	10.5				$27,000		
	4.0kWE Turgo Impulse	Turgo Impulse	Bronze		4	50	14.9				$24,000		
	4.0kWE Turgo Impulse	Turgo Impulse			4	36	20.3				$27,500		
	4.0kWE Turgo Impulse	Turgo Impulse			4	28	29				$28,500		
	4.0kWE Francis	Francis	Bronze and stainless steel		4	14	58				$53,000		
	4.0kWE Kaplan	Kaplan			4	7	100				$56,000		
	10kWE Pelton	Pelton	Bronze or stainless steel	240V single phase or 415V 3 phase	10	95	18.8				$34,000		
	10kWE Turgo Impulse	Turgo Impulse	Bronze		10	65	27.3				$30,000		
	10kWE Turgo Impulse	Turgo Impulse			10	46	37.2				$38,000		
	10kWE Twin Jet Turgo Impulse	Twin Jet Turgo Impulse			10	36	49				$39,000		
	10kWE Francis	Francis	Bronze and stainless steel		10	12	142				$86,500		
	10kWE Kaplan	Kaplan			10	12	142				$85,000		
Walsh River Micro-Hydro (Australia)	LH6-180	Banki-crossflow	All welded mild steel	DC battery charging, switch selectable from 12 to 108VDC	25W to 1.6kW depending on site	0.8 to 8	6 to 18 @ 1m head, 9 to 32 @ 3m head, 14 to 52 @ 8m head	Baldor CDP series DC generator	Linear series regulation using AERL Hydromax controller	2	$3,500 to $4,900 depending on configuration	Developed by Planetary Power in 1991 to provide economical and reliable micro-hydro power for very low head sites	Planetary Power PO Box 198 Herberton 4887 ph:(07) 4096 2420 info@planetarypower.com.au www.planetarypower.com.au
	LH6-300				40W to 600W depending on site	0.8 to 3	10 to 31 @ 1m head, 14 to 43 @ 2m head, 16 to 53 @ 3m head						
Water Baby (Canada)	HYD-062	Turgo	Bronze	12, 24, 48VDC	0.5	15 to 150	0.2-2	Permanent magnet	PL20/40	1	$1,980	Regulator extra	Rainbow Power Company PO Box 240, Nimbin NSW 2480 www.rpc.com.au

Bumpy ride for renewables companies

Michael Walsh looks at ethical investment options

While renewable energy companies have raised their share of new capital, most shareholders are yet to see a return. Many stock market followers are now calling the end of a solid bull market (when the share prices are on the rise) for Australian shares. And any bull market also means an increase in capital-raising activity, mainly through Initial Public Offers (IPOs) followed by a new stock exchange listing. On the Australian market, mining, energy and exploration companies are seeking to take advantage of a rising demand for minerals and oil.

The renewable energy sector has also managed to gain its share of investor support with IPOs, recapitalisations and other capital-raising deals completed by more than 10 Australian Stock Exchange (ASX) listed companies over the last year. Unfortunately, competition from better prices for oil, gas and coal, combined with a general lack of profitability, sees most companies' share prices now languishing well below their 12-month high. That is of course apart from Pacific Hydro which is in the process of being taken over.

The most recent new green energy float was electricity storage battery developer ZBB Energy Corporation, which raised $11.5 million in shares and convertible notes before completing its ASX listing in March. Despite this, the company's shares have traded below their issue price of 50 cents, valuing the company at $25 million.

ZBB Energy is developing and commercialising its patented zinc/bromine battery technology. According to the announcement, these electricity storage batteries have proven their performance in lengthy testing in the United States and have also been used by United Energy in Melbourne. The biggest benefit of ZBB's batteries is power shaving, the ability to provide high volume reserve power for peak electricity periods.

Another new renewable energy development start-up preferred a private offer to raise capital. Atlantis Energy Systems is now developing its wave energy based Aquanator system despite calling off its $5 million capital raising last November. Tim Cornelius, Atlantis' Chief Executive Officer, said the company is in negotiations with several energy retail organisations in Queensland, the Northern Territory and Victoria regarding the installation of Aquanator units at remote diesel-reliant communities. With the assistance of an environmentally focused seed investment fund Cornelius hopes to be able to announce the location for the first commercial 90 kilowatt trial unit sometime this year.

But several businesses also achieved listed company status through the 'back door', by having a virtually defunct ASX-listed company acquire its business, along with, of course, a new capital raising.

One Lazarus effort was the revamp of clean power company EnviroStar, which went into voluntary administration in October 2002. The company was renamed Green Pacific Energy and readmitted to the ASX in March last year. Meanwhile it raised $1 million in a private placement, and secured debt finance facilities of $103.5 million to build six municipal waste-to-energy power plants. Its existing plant is in Stapylton, Queensland, and the company says it plans to boost its output to 200 megawatts over the next five years. After initially trading up to 42.5 cents from a re-listing price of 29 cents, the share price drifted to below 10 cents in May.

Then there are the newcomers to the hot rocks geothermal energy sector, perhaps looking for the popularity of sector leader Geodynamics, which claimed a first in April with its testing for continuous hot rocks steam flow proving successful and producing 10 megawatts of power and an immediate 30% share hike. Newly listed Petratherm, which raised $6 million before listing last July, has seen its share price also experience the bumpy ride, trading currently at 32 cents, the middle of a range of 20 to 40 cents since its July listing last year. But it's drilling as usual, with Petratherm commencing a two-well geothermal evaluation program in South Australia.

For investors looking at renewable energy sector companies there are a few lessons here. First, be prepared for a bumpy ride. Second, watch the moves of institutional investors whose support can be an indicator of a company with better near-term prospects. And third, the imperative of a shift to renewable energy is not yet being translated into good investment returns, at least while others are making a buck out of fossil fuels. ✶

Michael Walsh is the editor of *Ethical Investor* magazine
www.ethicalinvestor.com.au

The national picture

ReNew's regular policy columnist Alan Pears looks at some new initiatives and a not so renewable future

Recent developments show a very mixed picture for sustainable energy. On one hand, there is the vigorous bidding for ownership of Pacific Hydro, one of Australia's largest renewable energy companies.

On the other hand, the Hazelwood power station has been given approval by the Victorian Government to emit an additional 250 million tonnes of carbon dioxide, and the Productivity Commission has released its draft report on energy efficiency, which calls for a stop to many programs.

There have also been close calls—imminent threats of closure or cutbacks—for a number of renewable energy incentive schemes, including the solar photovoltaic rebate scheme and several state-based solar hot water incentives.

Add to this the concern for the future of renewable energy as the Mandatory Renewable Energy Target (MRET) faces a premature cap on its achievements. We have also seen a build-up of the ongoing campaign by the nuclear industry to position itself as 'the answer' to satisfying ongoing growth in energy demand while cutting greenhouse gas emissions.

NSW schemes for energy and water

The New South Wales government has introduced a range of measures applying to both water and energy. First, energy and water savings funds are being established, with funding from water and energy network providers and government. The network providers will be able to pass the cost through to customers.

The aim of the Energy Saving Fund is to encourage energy savings, address peak energy demand, stimulate investment in innovative energy saving measures, increase community awareness and cut greenhouse gas emissions. This approach has been modelled on successful US demand-side management funds, where a levy is applied to utilities. Those wishing to implement energy efficiency measures then bid for financial support. This could provide a real boost to energy efficiency in NSW.

The second NSW scheme involves state legislation that allows the government to require large energy and water users to prepare 'savings action plans'. The top 200 energy users in NSW are initially targeted. The proposed legislation will also require water and energy providers to release information about large consumers and their consumption. This will presumably allow them to be identified and targeted, with further regulation directing implementation of these action plans.

These 'savings action plans' seem similar to the Energy Efficiency Opportunity (EEO) measure announced by the federal government in last year's *Energy White Paper.* They do go one step further. Unlike the EEO, the 'savings action plans' make provision to require implementation of those identified energy savings measures.

The new NSW savings action plans, therefore, appear to match the Victorian government's existing EPA program. The EPA program requires large greenhouse gas emitters to carry out energy audits and implement all identified measures that have a three-year or less payback period.

Recent Victorian government reports indicate that, already, the EPA scheme is delivering over a million tonnes of carbon dioxide reductions and effectively saving tens of millions of dollars on business energy bills. Not bad for 'blunt and inefficient regulation'.

Productivity Commission energy efficiency inquiry

When this inquiry was announced in last year's federal government *Energy White Paper*, sceptics suggested that it was likely to be a 'hatchet job' on energy efficiency (see my column in *ReNew 90*). Now that the draft report has been released it's difficult to disagree with that view (available at www.pc.gov.au).

The Productivity Commission claims that 'the benefits of energy efficiency may be overstated and the costs of adoption underestimated. The real gap is likely to be much smaller than it appears.' In other words, the commission considers that energy efficiency has been oversold.

But a recent Regulatory Impact Statement for energy measures for non-

residential buildings (scheduled for introduction in mid-2006) shows a benefit:cost ratio of 4:6:1, when a ratio of 1:1 is cost-neutral.

The report does accept that information failures and split incentives (where people making the decisions about energy use cannot capture the benefits, while those who might benefit aren't involved in the decisions—such as tenants and landlords) do exist, and that some 'light-handed' regulatory responses may be appropriate.

The recommendation of most immediate concern is the report's proposal that the National Framework for Energy Efficiency measures endorsed last year by the federal and all state energy ministers should be deferred pending further independent evaluation of existing programs.

The commission's usual anti-regulatory, anti-intervention philosophy is very evident in the report. For example, its view on appliance energy labelling and Minimum Energy Performance Standards (MEPS) is that they *may* be cost-effective. Yet these programs are recognised by many as extremely cost-effective, delivering greenhouse abatement at minus $23 per tonne. That is, they save money, and reduce greenhouse emissions.

The report relies on just one submission to question the whole basis of the home energy rating schemes and associated regulation. It dismisses decades of economic evaluation in the US on energy efficiency schemes by simply stating that they used too low a discount rate. A low discount rate allows greater emphasis on future savings achievable by energy efficiency.

The commission's proposed use of a higher discount rate in economic analysis rapidly reduces the value of future savings and tends to reduce the perceived benefit of measures that have up-front costs and long-term benefits, such as energy efficiency.

The commission also criticises the Australian Building Codes Board (ABCB) for using low discount rates and for inadequate evaluation of proposed new building energy regulations. The discount rates applied by the ABCB were the outcome of extensive consultation, research and reference to Department of Finance guidelines. Further, all of the ABCB regulations are actually approved by the Office of Regulation Review, which is part of the Productivity Commission!

It's interesting to note that the one public comment from the federal government I could find (*Financial Review*, 21/4) shows the government distancing itself from the Productivity Commission's view.

A spokeswoman for Federal Energy Minister Ian Macfarlane is quoted as saying 'We're looking at a broader situation here: it's about education and it's about changing energy practices. We do not apologise for getting business to rethink how they use energy.'

Submissions were due late May. Let's hope they educate the Productivity Commission.

Nuclear campaign needed

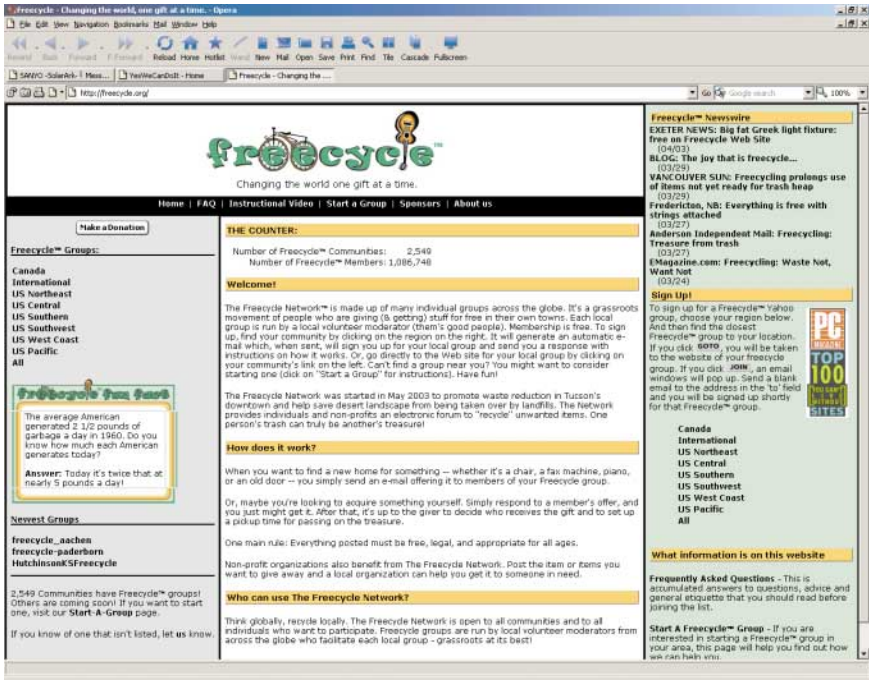
The nuclear industry now sees a great opportunity to paint itself as the solution to climate change. The industry's great advantage is that it builds big centralised power stations that are just like coal plants but don't emit greenhouse gas. Politicians and business leaders can understand such a simple alternative. It's a vision the uranium industry is clearly spending a lot of money to drive.

But both the nuclear and the coal visions are based on the same assumption: that we want and need large amounts of electricity from centralised sources to underpin economic growth. That has been the case in the past, and 'doing more of the same' usually looks easiest and simplest.

If we are to avoid a nuclear/coal future, we really have to deliver some big cuts in energy use through energy efficiency improvement, and we have to aggressively roll out decentralised renewable energy. Without strong and consistent government policies and widespread community commitment, this may not happen.

And until we can show we have a viable package that can underpin ongoing improvement in community welfare and economic development, the nuclear and coal industries will have fertile ground to plough.

www.freecycle.org



No, this isn't a website where you can find free bicycles, well, not just bicycles, but almost anything that anyone wants to give away.

The freecycle 'communities' are groups of people who list items they have but no longer need. The only requirement is that the item must be absolutely free, no strings attached, other than collection requirements. People looking for items can also place an advert stating what they need.

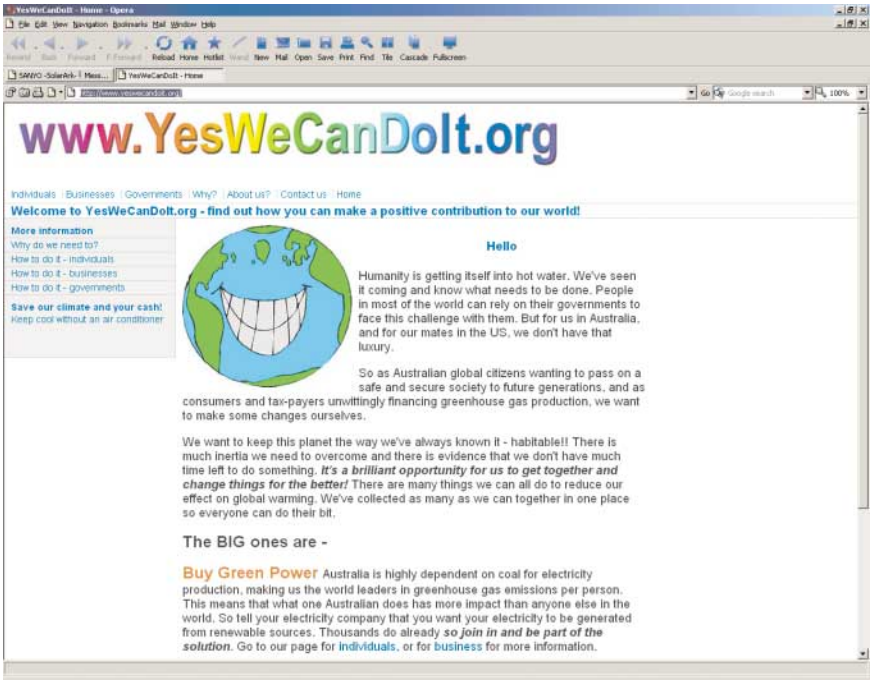
There are freecycle communities all over the world, including plenty in Australia and New Zealand. The listings are in the form of Yahoo! newsgroups. To read the listings, and to place your own ads, you need to have a Yahoo! username and password, which you can sign up for on the spot when you go to the listings.

You can either have the listings emailed to you each day, or you can just view them online.

The freecycle system is a great way to prevent useful items going to landfill, so if you have stuff you have been thinking about throwing out, try your local freecycle group instead—your 'junk' might just be useful to someone!

www.yeswecandoit.org

This website is a classic example of everyday people who are concerned about the environment and the direction the world is headed actually doing something about it. It was set up by two sisters, Hazel and Janet, who welcome any positive input that anyone cares to share with them.



Still in its infancy, the site contains information on simple things that can be done to reduce greenhouse emissions and the load on the earth's ecosystems. From simply buying greenpower from your electricity retailer, or more involved actions like lobbying governments, changing travel habits and planting trees, are all suggested. There is also a great idea for making your house cooler using the cool air from under the house in conjunction with a ventilation fan to reduce roof space temperatures.

The site includes sections for individuals, for businesses, and even suggestions for governments—if only they would take note!

While content is limited at present, the site will be added to on a regular basis, and there is also a useful links page with connections to help you reduce your impact on the planet.

Things of stone, wood and mud

Wood heating is a topic that arouses strong feelings in many *ReNew* readers. Frith Kennedy visits a retreat that is using wood sustainably as its main resource for heating and cooking

Crunching through wet gravel on the way to Hesket House, I reflect that even four layers of clothing is not quite enough for this brisk Victorian weather. So imagine my surprise as the door opens, I step into the corridor and the tip of my nose immediately starts to thaw!

At first glance, this is not what you'd expect from a home that looks reasonably conventional, but if it were a conventional home, I wouldn't be here. Hesket House, a 75-square house that also operates as a retreat, is set on the only cleared area of 150 acres of native forest, which supplies all the fuel for the cooking, heating and hot water for the house.

Mead-hall chic!

Designer and owner-builder Peter Watsford planned the house less than a decade ago around an enormous industrial Passat boiler that supplies hydronic heating to the whole house. It came second-hand from Sunbury, just outside Melbourne, and really earns its place as the centre of the home!

As well as heating the washing water, there are nine bedrooms to keep at an even temperature. There's also the office, spa room and an enormous combined kitchen and lounge capable of seating fifty guests.

Apart from the massive Passat boiler, the other vital feature that inspired Peter's design of the house is the use of dozens of reclaimed hardwood sleepers. The sleepers form the basis for the rough, poured-earth walls, that give the shelter a very rustic-chic feel, as well as

Wood is stacked at the entrance to Hesket House.

adding to the impressive insulation ability of the poured earth.

The straw-board thatched ceiling and massive ironbark beams add further to the mead-hall feel.

Apart from a certain natural aesthetic, the Australian-made Solomit compressed straw sheets are light and easy to install, as well as having insulating, soundproofing and fire-resistant properties.

Even with such atypical building materials, the earth lodge took only a year to construct.

Hydronic heating system

When the house was built eight years ago the hydronic heating system cost around $4000 to set up.

The Danish Passat Energy boiler's maximum output —when run on wood —is 278,000 BTUs an hour (a BTU, or British Thermal Unit, is the amount of energy needed to raise the temperature of one pound of water by one degree Fahrenheit. A BTU is equal to 0.293 watt-hours, or 252 calories. One kilowatt-hour is equivalent to 3412 BTU).

However, in the warm months of the year heat output doesn't even get close to such a level. In spring and summer the hydronic pump is turned off and no hot water circulates through the floor pipes—the boiler only provides hot water for the kitchen and showers. At that time of year, they burn only two logs a day.

However, when the system's running at full capacity—usually from March to October—it takes around three barrows of wood a day to keep running consistently.

Initially, it takes about three days to warm the water in the floor pipes to the right temperature; from then on, the rooms average around 21°C.

Forest will provide

A huge fieldstone fireplace adds yet another level of wood heating to the vaulted main room.

Although only half of it was in use on the day I visited, the combination of the Aga oven in the kitchen area, the pipes under the painted slab floor and even half a fireplace made the enormous entertaining space so cosy I didn't want to go outside again!

Peter chose to use wood heating after settling in the forest and resolving to install a method that would be sustainable for the life of the house. Only fallen wood is collected, and Peter is careful not to remove too much wood that could be used by animals for habitat.

He finds the wood-fired system 'rather labour intensive—but because we

The boiler's firebox can use as little as two logs, or as much as three barrow fulls of wood per day, depending on the season.

Multiple circuits in the hydronic heating system allow control over which rooms are heated.

The hot water storage tank.

have the renewable resource it costs almost nothing to run.'

The cooking is all done on the large wood-fired Aga oven, which also boosts the hot water for the bathrooms.

The room that houses the huge boiler doubles as a drying room.

Watercourses

The image of the lake from the kitchen drew me outside against my more sensible principles. It's one of the elements of this rural shelter that tie it most closely to its environment.

For such a large building, it blends very nicely into the landscape, so well that it belies the fact it's only eight years old. The glorious lake at the back door has features beyond the aesthetic. Apart from being an obvious water source, it's a heat bank that considerably mitigates the surrounding environment.

Water can both absorb and release a great amount of energy with only a slight change in temperature. So the lake is warmed by the sun on clear days and loses heat at night, but remains reasonably stable over 24 hours.

The surrounding trees are predominantly the mountain ash and alpine ash of the area, whilst the landscaping around the lake is designed to attract both native and exotic birds. Even in winter when the main flowers appear to be banksias, the peacocks, swans, ducks and rosellas add extra colour and movement.

The eucalypt forest is allowed to regenerate, apart from the removal of a relatively small percentage of deadwood. There are certainly a number of huge old snags retained as habitat and sanctuary for the local wildlife.

Lush conservatory

A tropical conservatory features a watercourse that helps to keep the air mild and the plants luxuriant. This atrium provides a source of warm, moist air to the rest of the house. With the spa tucked away in amongst the foliage, I'd imagine it could get quite steamy!

Such lush living in an otherwise cold climate has to be applauded but Peter says it's the environment itself that has provided. He says this earth lodge's motto is 'the forest will provide' and it obviously provides in plenty.

Right: the lush conservatory also houses a spa.

The conservatory captures the winter sun.

Sustainable wood heating

Wood can be an excellent fuel because it is a renewable energy source, if sustainably harvested. However, air pollution from wood fires and the transport of firewood to urban areas are environmentally detrimental.

About 20% of Australian homes use wood for heating, but the wood is often obtained from unsustainable sources.

If you have a wood heater, use only sustainably-harvested wood to avoid habitat destruction and rare species extinction, and do not use treated timbers that may give off toxic pollutants when burned.

Burn wood only in high efficiency, low emission heaters. Open fireplaces lose up to 90% of the heat straight up the chimney, making them the least efficient of all heating technologies.

Even worse, the hot air rising up the chimney draws large amounts of cold air into the room to replace it, making whatever heating effect the fireplace has even less effective.

On the other hand, a well made and properly installed slow combustion heater can acheive up to 60% efficiency, assuming it is operated correctly.

The table below shows comparisons of various heating technologies and the pollutants they produce. Clearly, the worst by far, even when using sustainably harvested timber, is the open fireplace, which produces far higher levels of particulates (smoke) CO_2 and volatile organic compounds than any other form of heating, including natural gas and electricity.

However, a well operated slow combustion stove using properly dried wood competes well in most areas, with the lowest CO_2 emissions and low NO_x emissions. Particulates are still a problem, but are only a fraction of that produced by an open fireplace.

Of course, this assumes the wood heater is used correctly and clean, dry wood is used.

Operating a wood heater in an effective manner is just common sense. If you can see visible smoke emanating from your chimney or flue, then you are not using your heater efficiently.

Using wood for heating—what to do

- Use only an AS/NZS4013 approved slow combustion wood heater
- Use clean, dry wood from sustainable sources
- Keep the air damper open to allow the wood to burn efficiently with minimal pollutants
- Fill the firebox to a reasonable height to allow good airflow around the wood, making sure that there is at least a 25mm airgap between each log
- Keep the flue and the inside of the wood heater clear of ash, debris and creosote buildup
- Regularly check seals around the heater doors and ash removal trays.
- Close off flues and chimneys when they are not being used—this helps to prevent unwanted drafts.

What not to do

- Don't use damp or scrap wood that you happen to find lying around, without knowing its origins
- Never use treated pine or wood that may have been painted with toxic substances
- Don't overfill the firebox or else your wood won't burn efficiently
- Don't load up the firebox and turn the air damper down to let the fire smoulder all night
- Don't let the creosote build up in your flue—you risk having a flue fire.

Fire type	Efficiency	NOx	Particulates	CO_2	VOC
Open fireplace	up to 15%	0.53	7.125	52	47
Slow combustion	up to 70%	0.1	0.53	0.0075	0.65
Natural gas	up to 80%	0.068	0.0075	0.098	0.005
Electricity	100%	0.55	0.0275	0.39	0.0075
Heat pump	up to 300%	0.185	0.01	0.13	0.0025

Figures are in grams of pollutant produced per MJ of usable heat produced, and assumes the use of sustainably harvested firewood. Assumed heater efficiencies are: fireplace 15%; slow combustion 65%; natural gas 70%; electric heater 100%; heat pump 300%. NOx is nitrous oxides, VOC is volatile organic compounds. Source:Alan Pears, Sustainable Solutions P/L.

Green kitchen

My husband and I are moving to our country property (tree and sea change!) and are doing some renovations beforehand. One thing we will be doing is building a new kitchen. I am therefore trying to find out about environmentally-friendly materials to build this from. Can you provide any advice?

Tanya Roe,
troe.iclei@adelaidecitycouncil.com

The problem with modern materials used in kitchens (and other parts of your home), is they produce gases called volatile organic compounds (VOCs). These substances are easily evaporated at room temperature and include formaldehyde in particleboard, and solvents such as toluene and xylene in glues and paints.

Alternatives include hoop pine plywood and timber boards rather than particleboard. Brimsboard produces low formaldyhde emission particleboard and plywood. While there is still some emission from these products, they are a better option than most alternatives. Their website is at www.brims.com.au

With regards to finishes, there are a growing number of natural paint options. Bio Paints is the best known and is a good alternative. There are also other alternatives. You can find a list at http://timbershop.wild.net.au/product/other/

Mick Harris

Battery backup grid interactive systems

I am a building designer in Perth and would like to know if it is possible to have a home hooked up to the mains electricity grid but also have battery backup power generated from photovoltaic solar cells. It appears to me that you are either fully self sufficient or attached to the grid.

In WA we are subject to the one electricity supplier and having rolling blackouts makes running a business difficult and inconvenient, and it does not look like changing for some time.

Is it legal and or possible to have the best of both worlds, ie be able to switch from grid to self-generated power in the midst of a blackout.

Garreth Morris,
designsynergy@icenet.com.au

You don't have to have either one or the other, it is easy enough to have a grid-interactive system with battery backup. The ATA's solar workshop has such a system using a Trace (now Xantrex, sold through BP Solar distributors in Australia) sinewave inverter. There are some Australian made inverters that will do this too, PSA (Power Solutions Australia) make some, have a look at www.powersolution.com.au

With these inverters there is no need to do any switching, the inverter basically does everything once it is set up correctly, even control a backup generator for long periods of grid outage. For information on a range of inverters, see the sinewave inverter buyers' guide in ReNew 87.

Lance Turner

Running a water turbine from tank water

I was wondering if it is possible to run a water turbine from a water tank for short periods. During winter we often do not get enough sun to keep the batteries charged up and have to resort to using the generator. I was wondering if it is possible to run a small turbine from a 1000 gallon water tank, situated at the top of a hill with a fall of 20 meters through a 25mm pipe connected to a turbine. How long would it provide power?

Ian Annetts,
iannannetts@0014.com.au

You could certainly do it—over the years quite a few people have played around with the idea. However I think most people have not gone ahead with such a system. The reason why becomes a bit clearer when you crunch a few numbers.

The first point is that a 20 metre head is a bit on the low side. Most water turbines are designed to operate at heads of between 10 and 100 meters. Twenty metres would work but a higher head would be better. If you used a Platypus Power PM100, for example, you would consume something like five litres a second and you might get 200 to 300 watts of power, depending on the jets you fitted.

Based on that you would empty your 1000 gallon (4540 litre) tank in about 15 minutes. The turbine would cost you around $2500 plus the cost of the tank, piping and the pump to fill the tank in the first place. So your set up could easily cost around $4000. Sounds quite a lot for storing 15 minutes worth of power. There are cheaper turbines around that could do the job, and you may get the price down to $2000. However, you could use the same money for solar panels, a small wind turbine or some other alternative. If it comes down to value for money, such a hydro setup may not look so good.

Mick Harris

Hydronic in-slab heating

I have noticed a few articles and advertisements in *ReNew* regarding hydronic heating systems and have a question to ask. Can standard (garden grade) polypipe be used within a concrete slab for circulating hot water, or are special pipes required?

I am preparing to build a shed on a rural block to use as temporary housing so that I can sell our current home and use the funds to build a new home and begin our journey toward self sufficiency.

Having experienced a form of (accidental) hydronic heating in a concrete building in the past, I am aware of the greatly improved comfort levels that it provides over standard concrete floors and would like to include it in the shed for my family's immediate comfort. (It will also be a benefit when the shed assumes its final role as a workshop, and the hot water could also be used to heat a hot-house for growing some summer vegetables in winter if needed.)

Since this is only to be a temporary dwelling and the budget is tight, I would like to use easily obtained, cheap

materials if possible for this part of the project (I have already allowed for full insulation, rain water collection, sewage treatment and reuse) and install a home made system similar to that documented in *ReNew* 80. Will the polypipe survive this usage?

Stuart Brown,
stuvic@acay.com.au

Floor coils for slab heating tend to be very energy consuming—to have the house at the temperature one wants tends to require it to be heated over a 24 hour period. This is probably okay for people in the house all day, though personally I hate hot feet. For people who are away all day, this is not a good solution.

It is also not really suitable in autumn and spring when not much heating is required. Warm days with hot floors mean that the windows have to be opened to let the heat go—what a waste! Someone used to operating the system can control this fairly well but an automated system is just straight wasteful of energy.

Having said that, let's look at the installation details. The polypipe used in hydronic heating systems is low density polypipe (usually 20mm ID), not agricultural polypipe. The low density polypipe has thicker walls, is far more flexible and does not kink easily as does agricultural poly. It is probably designed to withstand the heat too, but that is just an assumption on my part. By using a thermal mixing valve, the temperature can be limited to a maximum of 45°C, eliminating that problem.

The coils must be roughly the same length (to balance the flow between circuits) and not be too long, otherwise the far end of a coil never gets any hot water, the heat having been lost towards the beginning of the run. The concrete slab needs to be an additional 25mm thicker than a normal slab.

I did some floor coil jobs with happy owners and others where the heat loss from the house was so great that the coils could not keep up with the losses, so the house was not at a comfortable temperature in the coldest weather.

Andrew Blair,
Swinburne University

Home brew solar fountain

I compared notes with your article on solar water features in the last edition.

My 'do it yourself system' started out as a 20 watt solar panel ($180) running a 'Whale' 12 volt DC submersible pump with a non-return valve (around $70), which was found at a local caravan shop, and is normally used to pump drinking water intermittently up to the tap inside a caravan. A three metre length of automotive cable between the panel and pump and my system was up and running, but only on sunny days.

To use it during winter and at nighttime meant I had to go shopping for a battery and a solar regulator. The battery I chose was a 12 volt, 40 amp-hour sealed type at $44 and the Solsun six amp charge controller with automatic low-voltage cutout was a bargain at just $33. The addition of a standard 10 amp AC circuit breaker, so the pump didn't run for hours on end, and a resin water feature ($50) meant the system was complete for less than $400.

The cost compares well with the 20 watt panel powered Aquasolar 1500 from your table. However, my pump is becoming noisy and I suspect it doesn't take kindly to running continuously for over one-hour periods. Would there be a better option for the DC water pump?

Ross Keane, Ardross WA

Ross, I have heard various stories about many pumps over the years, some cheap ones that have lasted years and expensive ones that have died in a few months. It seems to be the luck of the draw, unless you pay big dollars for a serious commercial pump, which is not realistic for most water features.

Many people have used the very cheap bilge pumps, available from marine suppliers, for their water features. These will last from months to years, depending on the water quality and the runtimes, and start at around $20.

It isn't necessary to run a battery to make the pump run in winter, just use a maximiser, which better matches the load of the pump to the output of the solar panel. The ATA's mini-maximiser kit works well for this use, and costs $45 ($40 for ATA members).

Lance Turner

Run an engine on ethanol

I am currently a member of your organisation and was hoping you could help me. I live in Brisbane and am interested in converting an engine to run on ethanol, and I also want to make my own ethanol, with the final goal to show the public it is possible to make your own fuel, generator and sustainable car.

Do you know of anyone in the area who has experience with ethanol, engines and rewiring motors, or perhaps someone further away that may have useful information on the subject?

Nathan Keilar
madteckhead@hotmail.com

The key to running an engine on ethanol is to modify the carburettor jets. Get some spare jets and experiment by enlarging the jets until it starts to run well. Best not to do this on a new or expensive engine. Better to experiment on something inexpensive so mistakes will not cost too much. Also be aware that the valves will run hotter and this can cause problems.

We do have information on rewiring motors. We have published a number of articles on this over the years, with recent articles on rewinding Fisher & Paykel washing machine motors, such as the one in ReNew 82.

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, PO Box 2919 Fitzroy VIC 3065, email: renew@ata.org.au

A simple DIY solar water heater collector

Klaus Pinker describes his very simple but effective solar water collector that also doubles as hot water storage and cost just $50!

It was the straw that broke the camel's back. My gas supplier introduced a sizeable fee for maintaining the 'wrapper' they deliver my LPG in, namely the cylinders. They alone possess these containers, manhandle and perhaps damage them. I not even as much as look at their gear, let alone compromise it, so why should I pay for its upkeep? In protest, I cancelled my LPG subscription and concentrated fully on solar energy in lieu of gas. Now I cook, dehydrate, even fry food, and wash my clothes courtesy of the sun.

The simplest gadget among my passive solar equipment is the hot water service. I'll describe it step by step, because it's cheap and easy to build.

I gave a plan (see Figure 1) to a sheet metal worker who cut and folded out of 2090 x 1060 x 20 gauge (1mm thick) galvanised steel a shallow box 1000mm x 1000mm x 30mm (See Figure 2). I screwed the overlapping 30mm edges together at maximum 50mm centres, but in hindsight the edges were better spot-welded. Then I soldered all joints at the corners and edges to make them water-tight, but this proved to be short lived because metal expansion and water pressure under solar heating caused it to spring a few leaks.

The completed solar collector on its simple stand.

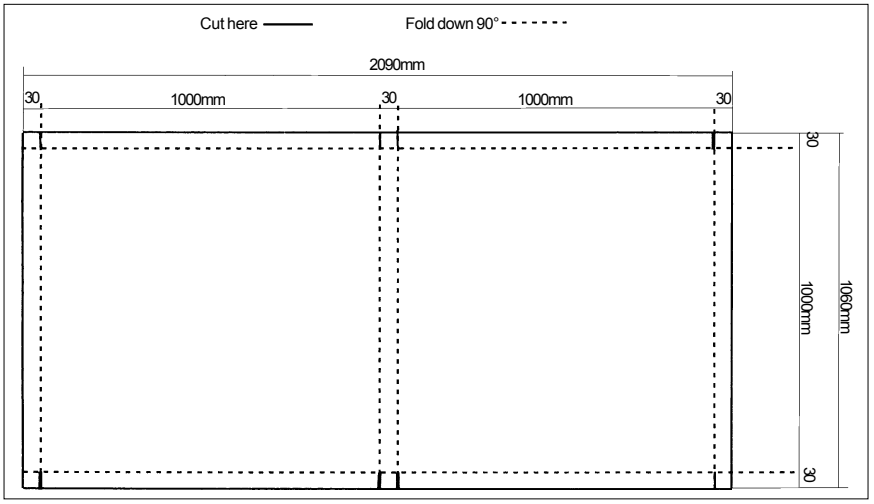


Figure 1. The cutting template for the sheet metal used to make the collector.

I quickly repaired these with an ample application of silicone sealant. Now I recommend you forget about soldering, but rather, seal all edges and corners with silicone sealant. Finally I painted the box flat black, the traditional solar collector colour. In a CSIRO report from some years ago, I read that green paint is just as effective, and it would blend better in a natural environment.

I drilled three 20 mm diameter holes through the edges for the outlet, inlet and overflow. Brass fittings (bushes or adaptors) were screwed into these holes to receive plastic slip-on junctions for garden hose connections.

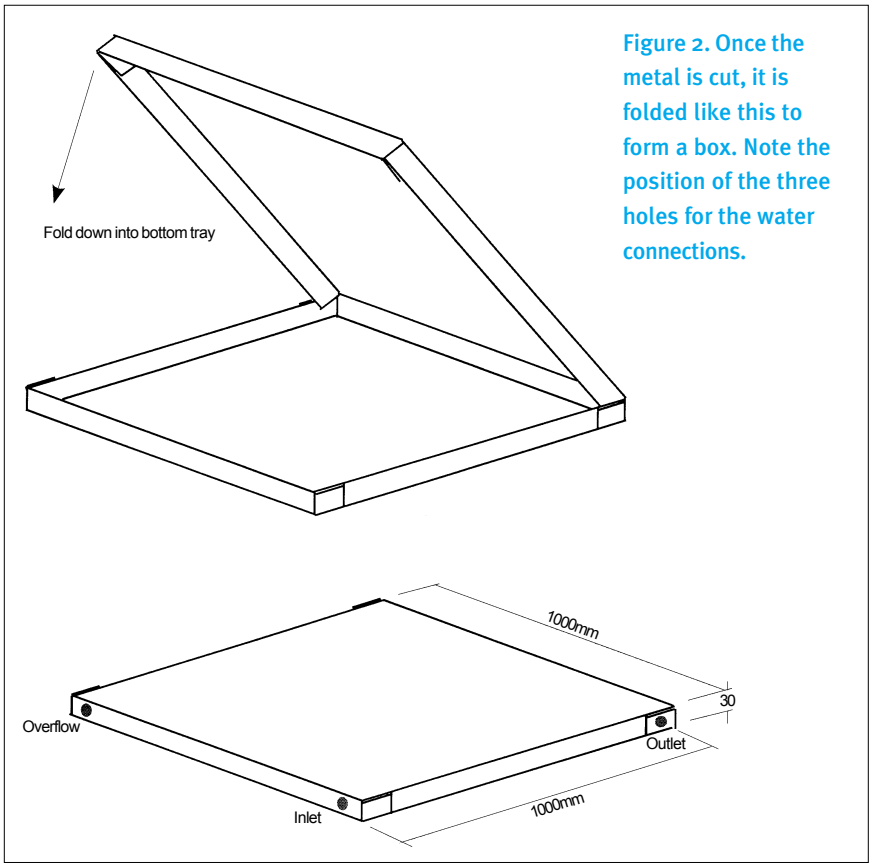


Figure 2. Once the metal is cut, it is folded like this to form a box. Note the position of the three holes for the water connections.

The black box was now ready to serve as a solar collector-cum-hot water storage.

Next I cobbled together a 1m x 1m square support frame from scavenged hardwood decking (see Figure 3). To the upper corners of the frame I fastened two sturdy secondhand aluminium extrusions, the lengths of which depend on your location—for example, from 400mm for Darwin up to 850mm at Hobart. They must swivel a little for strutting the frame at the correct angle of inclination, critical for the latitude of any geographical location. At Hobart this is 43°, at Melbourne 39°, Adelaide 35° , Sydney 34°, Perth 32°, Brisbane 28° and Darwin 12°. The base of the strut is tied with string or wire to the base of the frame to keep the correct distance. See Figure 4.

This frame is positioned in an unshaded spot facing dead north in the southern hemisphere, or dead south in the northern half of the globe. I am lucky to be able to place the frame on my roof-level terrace for convenient access. However, a horizontal platform on the roof itself would do.

As a non-essential extravagance I indulged in DIY insulation for the black box. One might be tempted to use styrene foam panels for insulation, but I learned from earlier projects that solar heat can melt and solidify this material. Instead I scrounged thick cardboard from the local whitegoods store (the shopkeepers are happy to get rid of the heavy packaging from washing machines and fridges) and cut lots of 1m x 1m squares until I had a stack of about 50mm thickness. This I wrapped up tightly in plastic tarpaulin and sealed it with duct tape to make it waterproof. I strapped the bundle to the frame and placed the black box on top of all. Make sure that the box has all silicon sealed edges accessible at the sides and the top, not at the bottom, otherwise leaks are difficult to detect and repair.

Now the hose reticulation with in-line stop cocks is installed. Quite simply, cold water from the mains or pump enters at one top point, hot water flows out at bottom by gravity, and the overflow at another top point carries any overfill to a flowerbed. Not a drop is wasted (see Figure 5).

In my case I added a welcome bonus: while the solar collector sits on the roof terrace I tapped cold and hot water via a

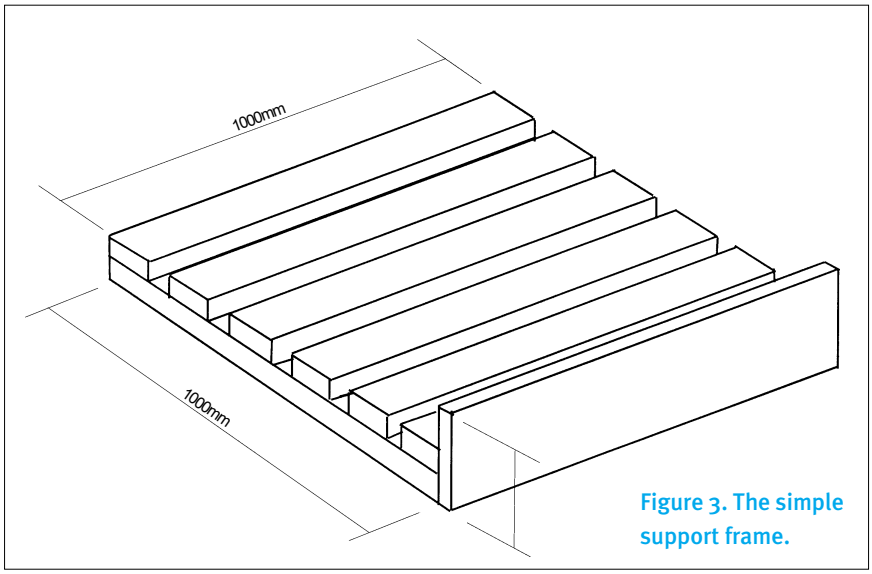


Figure 3. The simple support frame.

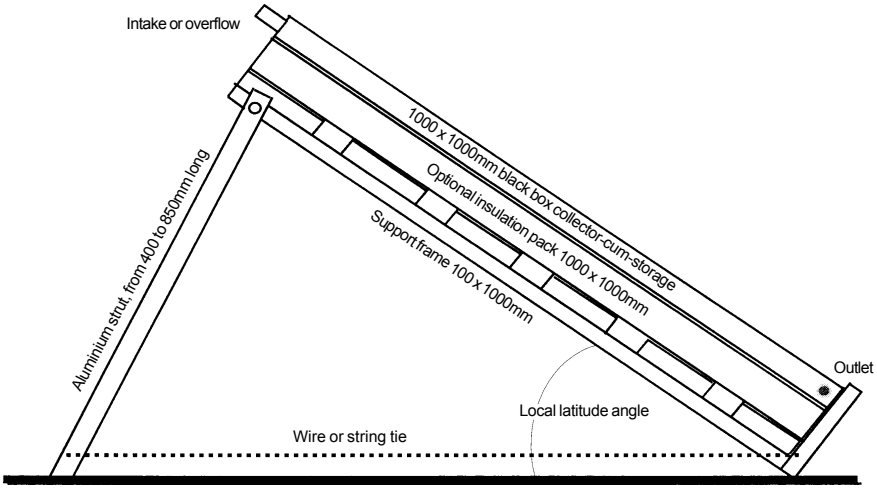


Figure 4. Side view of the rigged collector and support assembly.

Closeup showing the collector panel on top of the frame, with the insulation pack between them.

Y-junction to a shower rose underneath for a splendid al fresco splash. In future I might add a heavily insulated decommissioned hot water cylinder as long-term extra storage to the system (see Figure 6).

Here are the benefits of my design:

• Most materials are recycled, second-hand, or waste offcuts. I paid the metal worker for 2.22m² of galvanised steel sheet and folding. I bought a tube of silicon sealant, three brass fittings, garden hose slip-on gadgets and plastic irrigation in-line taps. Total cost was about $50.

• I no longer pay a single cent for hot water energy. The sun does not charge maintenance fees.

• Two hours after sunrise I have 30 litres of warm water. After two more hours of full sun the water is scalding hot (take that as a dire warning).

• The heat recovery is very fast if the black box is topped up after every use.

• 30 litres of hot water daily serves two persons who practice water saving policies.

The drawbacks of my system are:

• No sunshine, no hot water.

• No mains pressure hot water, gravity feed only.

• No overnight warm water storage, but that can be remedied—see below.

Possible improvements

• Long-term hot water availability can be achieved by incorporating a decommissioned insulated hot water storage cylinder with pressure relief valve deactivated.

• Family households could install multiple 30 litre black boxes in parallel. For ease of handling and fast temperature gain I advise against enlarging the size or volume of the given black box dimensions.

• Apply thermal insulation to the reticulated hot water hose lines. ✳

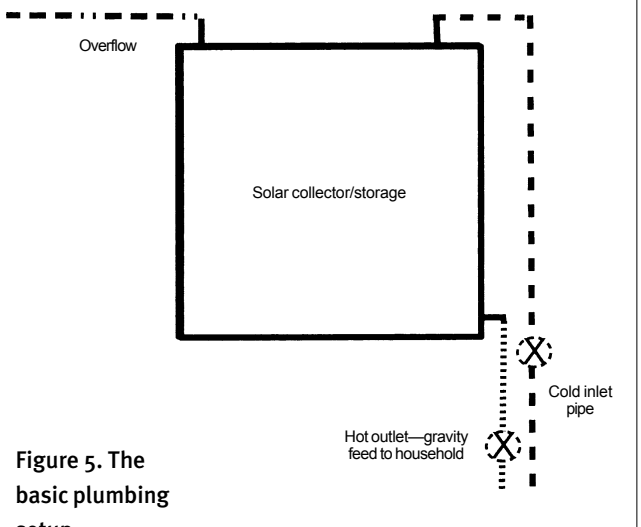


Figure 5. The basic plumbing setup.

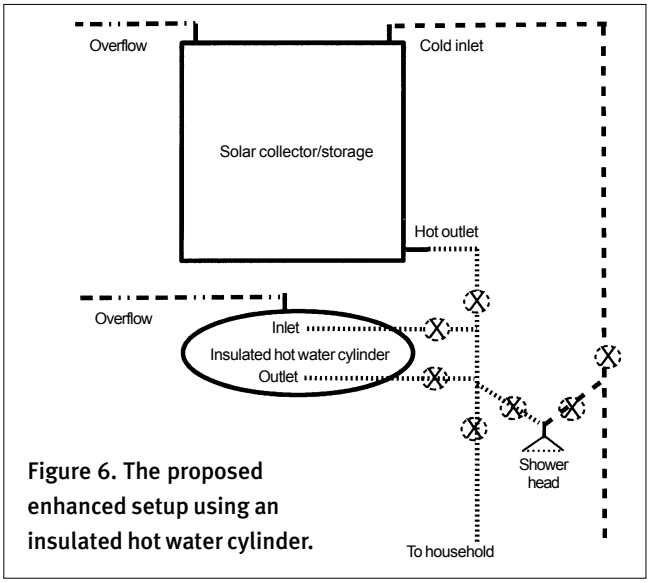


Figure 6. The proposed enhanced setup using an insulated hot water cylinder.

Noel's Treasures from Trash

Make a simple 'camera' optical device

To make your own pinhole camera you will need:

- A piece of cardboard (breakfast cereal carton) 300 x 155mm and two extra pieces 120 x 110mm each
- a 25mm square of aluminium foil
- an 80 x 70mm piece of tracing paper
- black poster paint and craft glue
- some paper clips and a small pin
- a ruler, scissors and a craft knife

Before portable cameras were invented, the camera was just a dark room with a hole in one wall which let in a small amount of light and formed an upside-down picture of what was outside on the opposite wall. Later, lenses were added to clarify the picture and cameras were made portable.

Our pinhole camera works because light travels in straight lines. Light coming from the top of a tree, for instance, goes through the pin hole and lands at the bottom of the screen. If we use our camera in a dark room to reduce the interference of too much light, we get a clear picture.

Making the camera

Rule lines across the larger piece of cardboard at 75mm, 140mm, 215mm and 280mm from one short side. This divides the card into four sections, which become the four sides of a square tube. The extra 20mm strip along one edge is a gluing strip. You can see how to do this in Figure 1.

Now make these folds in the cardboard by folding it over the straight edge of a table. Form the folded card into a square tube, then flatten the tube back out somewhat so that you can paint all of the inside surface with the poster paint. When the paint is dry, fold up the tube again and glue together, holding it in place with paper clips while the glue dries.

Next, mark in 22mm from all edges on each of the smaller pieces of cardboard. This will make small squares in each corner. Make a cut in each corner—the squares will be used as gluing flaps (see Figure 2). On one of these smaller pieces, cut a 15mm x 10mm hole in the centre with the craft knife. In the other piece cut a 65 x 55mm hole in the centre (you may need an adult to help you with the cutting). Crease the cardboard along the lines and then paint with the poster paint. When dry, fold the edges up to make the ends of the camera and glue the flaps in place, using paper clips to hold the flaps in place while the glue dries.

Now, glue the aluminium foil over the smaller hole and the tracing paper over the larger hole. When dry, put the ends on the box, they should just slide on nicely. Make a small pin hole in the foil, point the foil end towards a brightly lit object and you should see the inverted picture on the tracing paper screen. Darken the room to make the picture clearer. ✲

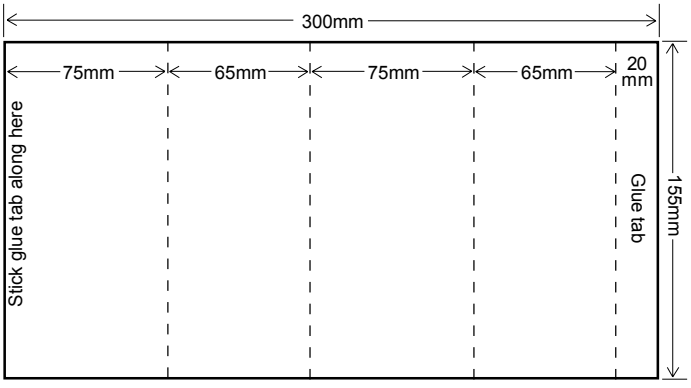


Figure 1. Mark the larger piece of cardboard like this, and fold at the lines 90°.

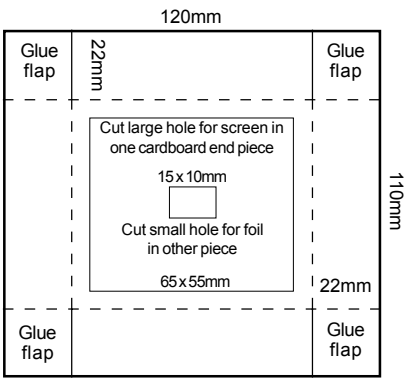


Figure 2. Mark the smaller pieces, cut along the solid lines and fold on the dotted lines.

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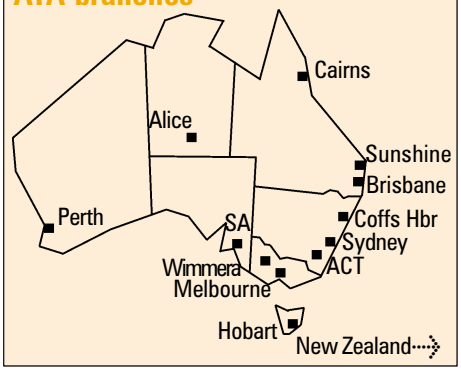

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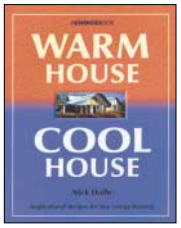

Warm House, Cool House

Author: Nick Hollo
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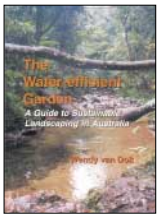
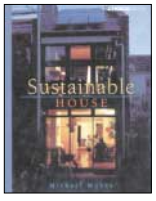
The Water-efficient Garden

Author: Wendy van Dok
Price: $25, As reviewed in *ReNew* issue 81



Practical and detailed information on planning and design of a water-efficient garden, including use of greywater on the garden. *Item code: WEG*



Sustainable House

Author: Michael Mobbs
Price: $38.50, Paperback, 188pp
The sustainable house in Sydney provides all of its own power and waste water recycling on-site. Contains many great ideas on how to make your house less of a burden on the planet. *Item code: SHB*

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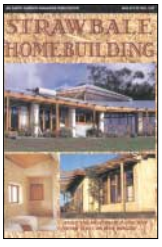

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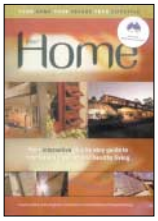

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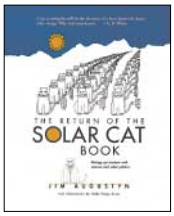
Solar Cat book



Price: $32.95 ($31.95 for ATA members).
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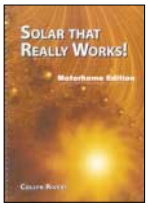

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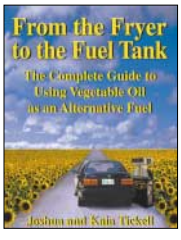

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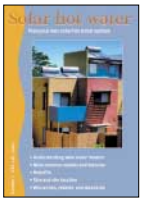
Brisbane Institute of TAFE has published a range of renewable technology resource books.

Introduction to Renewable Energy Technologies	$78.95	*Item code: IRET*
Solar Water Heating Systems Resource Book	$89.95	*Item code: SWHSRB*
Photovoltaic Power Systems Resource Book	$87.95	*Item code: PVPSRB*
Energy Efficient Building Design Resource Book	$67.95	*Item code: EEBD*
Wind Energy Conversion Systems	$93.95	*Item code: WECS*
Hybrid Energy Systems	$74.95	*Item code: HES*

Solar hot water



ATA Booklets series: Solar Hot Water

Price $10 each inc postage ($9 for ATA members)

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.

Solar electricity

ATA Booklets series: Solar Electricity

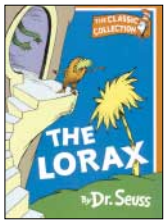
Price $10 each inc postage ($9 for ATA members)

Covers all the basics you need to know when designing a solar power system.

The Lorax book and tape

Price: Book only: $8.95 ($8.00 for ATA members); Book and tape: $14.95 ($13.95 for ATA members).

This Dr Zeuss classic is a great story teaching kids about the need to care for the environment. Available as the book only, or both book and cassette tape. The tape is read by Rik Mayall.



ATA Booklets series: Wind Power

Price $10 each inc postage ($9 for ATA members)

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.

Kits, LEDs and energy efficient lighting

Dynamo torch

Price: $29.95 ($28 for ATA members).

This is a super-bright LED wind-up torch that will provide light anywhere, anytime, without requiring batteries or an external power source. One minute of winding provides light for up to 30 minutes, and you can switch between one or all three LEDs. Ideal for emergency use. *Item code: TORCH_DYNAMO*

Aluminium 4 LED torch

Price: $8 ($6 for ATA members).

This machined black finished aluminium torch uses 3 AA-cell batteries (supplied) to drive four 5mm LEDs. Never be stuck with a blown bulb again! The torch is water resistant and very robust. What's more, a set of alkaline batteries should give at at least 24 hours of usable light.

Solar powered flasher

Price: $24.95 ($23 for ATA members).

This multi-purpose solar-powered warning light has six high brightness red LEDs. Ideal for bicycle lights, emergency warning lights or personal emergency lights for walking or hiking. Comes with a magnetic stand, belt clip, elastic strap and clip and a bicycle mounting bracket. *Item code: SOLAR_FLASHER*

1-wire weather monitoring kit

Price: $200.

The 1-wire weather station connects to a PC to measure wind speed, wind direction and temperature. Use it to monitor the weather, or log a possible site for wind turbine suitability. *Item code: WEATHER-AAG*

LED halogen replacement globes

Price: $25 ($20.00 for ATA members)

These 5mm LED lamps have 21 narrow angle (25 degree) LEDs and are suitable for highlighting, task lighting and general illumination. They will run from either AC or DC and so can be plugged straight into existing halogen fittings. Note that the rounded shape of the 5mm bulbs might prevent them being used in some fittings. **To prevent damaging these bulbs with excessive voltage, we strongly recommend you replace your halogen lamp transformers with the 1 amp plugpack below.**

Aluminium 9 LED torch

($25 for ATA members).

This is a machined aluminium torch that uses 3 D-cell batteries to drive nine 5mm LEDs. Never be stuck with a blown bulb again! The torch is water resistant and very robust (we have drop tested it onto concrete!). What's more, a set of alkaline batteries should give at least 48 hours of usable light. Price: $30 **Note: Actual stock is silver in colour.**

Nightstar kinetic torch

Price: $70 ($65 for ATA members)

This amazing torch uses no batteries and no incandescent globes, yet will provide light when you want it with total reliability. The Nightstar uses a high power rare-earth magnet passing through a wire coil to provide the electricity to charge a super capacitor that drives the white LED lamp. Around 30 to 60 seconds of gentle shaking gives 5 minutes of full light and a steadily reducing level for another 15 minutes. *Item code: NIGHTSTAR*

12 volt, 1 amp switchmode plugpack

Price: $25 ($23 for ATA members)

This plugpack is ideal for running our LED halogen bulbs or LED halogen replacement kit. Use it to replace the inefficient transformer supplied with most halogen fittings, or wherever you need an efficient 12 volt plugpack. *Item code: SMPLUGPACK*

Greywater Diverter

Price: $33.00 plus $8 postage

Don't send that water down the drain, use it to water your garden! Fits standard 50mm pipes, or other sizes with appropriate adaptors. *Item code: DIVERTER*

Cool new products

Wireless weather station

Price: $249 ($239 for ATA members)

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*

Miniature wind turbine kit

Price: $49.95 ($47.95 for ATA members)

This great little kit allows you to make a tiny wind turbine that is both educational, as well as a functioning turbine that can produce power. Maximum output is up to 10 watts, though we would rate it more like a watt or two realistically. *Item code: WINDKIT*

LED bike light

Price: $29.95 ($28.95 for ATA members)

This light has five white superbright LEDs and is powered by four AAA batteries. The light has two modes—continuously on and flashing—and is waterproof to 20 metres.

The light comes with a slide locking handlebar clamp to allow easy removal of the light from the bike to prevent theft. This means that the light can also be used as a general purpose torch and even a diving torch, providing you don't exceed the 20 metre rating. *Item code: BIKELIGHT5LED*

More cool products

Shake-powered calculator

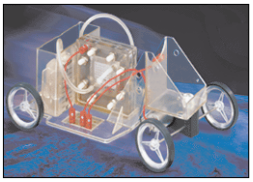
Price: $14.90 ($13.90 for ATA members)

You will no longer have to buy replacement batteries for your calculator or put up with fading calculator screens. The battery free calculator is powered by shaking the calculator side to side.

Electricity is generated by a magnet passing through a coil of wire. If the screen starts to fade, just shake it again for power.

The calculator features an eight-digit screen and a clear plastic body so you can see the workings. *Item code: CALCULATOR*

Fuel cell car kit



Price: $290 ($280 for ATA members)

The Fuel Cell Car and Experiment Kit provides an introduction to the technology of fuel cells. With this unique kit, you can build your own experimental reversible fuel cell car to learn more about this energy source. With more than 30 experiments and demonstrations, users will learn how a reversible fuel cell works to perform electrolysis as well as to create energy. The electricity required to activate electrolysis is created by a solar panel included with the kit.

The 96-page, full colour Experiment Manual offers over 30 experiments, including: how to build a solar-powered car, effects of direct and indirect radiation, characteristics of a solar module, electrolysis and its effect on water, oxy-hydrogen test, how to construct and load a reversible fuel cell, decomposition of water in the fuel cell, qualitative and quantitative analysis of gas in a fuel cell, how efficient is electrolysis?, how light influences electrolysis, solar electrolysis, and making a fuel cell-powered car. *Item code: FUELCELLCAR*

Windup radio torch

Price: $33.90 ($32.90 for ATA members)

This is an AM/FM radio which is compact, portable, splash proof and best of all it can operate without batteries! The radio can be powered three ways: built-in lithium battery (wind it up for 90 seconds for 20 minutes of use); two AAA batteries; or an optional DC adaptor

The unit also features an LED torch. The unit's casing is water resistant so it is ideal for use outdoors as well as in. *Item code: DYNAMORADIO*

Power House kit

Price: $290 ($280 for ATA members)

Make a renewable energy powered model home!

The kit focuses on the heat and light energy from the sun, the energy from the wind, as well as with electrochemical and plant energy.

With the Power House kit you can build a model house complete with solar panels, windturbine, greenhouse and desalination system. You can build and operate an electric train, windmill, solar cooker, solar hot water tank, hygrometer, electric motor, power hoist, sail car, and more! Plant watercress, prepare sauerkraut, and make chewing gum. Learn how plants convert sunlight into energy for your body and your engines.

Over 20 different building projects in one kit, including Power House, wind-powered generator, solar collector, solar oven, solar power station, greenhouse, current indicator, oil press, sail car, hygrometer, refrigerator, thumbtack scale, electric motor, electric crane, electric train, lemon Battery, oil lamp, light telescope, rice cooker, electric switch experiments.

Includes a 96-page full colour manual. *Item code: POWERHOUSE*

Power Mate power energy meter

Price: 10 amp version is $380 ($360 for ATA members); 15 amp version is $480 ($460 for ATA members)

We have been selling the German-made SparOmeter energy meter for some time, but while it does a good job, we have been looking for a locally produced equivalent or better meter for general household use, and finally we have found it!

The Power Mate has all the functions of the SparOmeter, as well as quite a few extras. The unit 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. The meter can tell you the minimum, maximum as well as instantaneous readings.

The meter can also tell you: 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. *Item code: POWERMATE*

We also have a PowerMate for hire for $50 a week!

1 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.
With over twice the current draw and twice the voltage of a 1 watt LED, each single 5 watt LED is equivalent to up to 50 or more high-brightness 5mm LEDs in light output. Available in blue, green, cyan and 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 website at www.ata.org.au or call the ATA on (03)9419 2440.
Now available: 3 watt LEDs and 1 watt warm white LEDs! See our webshop for details.

Luxeon optical collimators

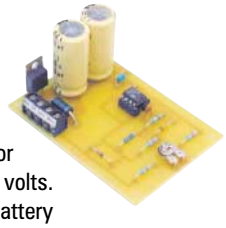
Price: $10 each
This 25mm optic with holder solves the problem of how to attach the optics to the LEDs! Available in wide, medium and narrow versions.

Simple 1 amp rectifier kit

This very simple kit allows you to build a rectifier for use with our 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.

$5.
Item code: RECKIT

Mini-maximiser kit



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! Price: $45 ($40 for ATA members). *Item code: MINIMAX*

30 amp speed controller kit

Price: $45 ($40 for ATA members)
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: SPEEDCON

Hexagonal lens/holders for Luxeon LEDs

Price: $6
These assemblies consist of a 20mm diameter lens in a hexagonal holder which is designed to fit to 3 and 5 watt Luxeon star LEDs.
They come in 6, 15 and 25 degree angles and the 4 x 25 degree line optic. *Item code: LED_OP6DEG, LED_OP15DEG, LED_OP25DEG, LED_OPLINE.*

LED halogen conversion kit

Price: $22.00 each without LEDs ($20 for ATA members), or $60 including three white Luxeon Stars ($55 for members)
This kit uses three of the 1 watt Luxeon Star LEDs, and includes a rectifier and constant current circuit to drive the LEDs at the correct current.
Note that the light output won't be equivalent to a 50 watt halogen lamp, but then, the kit only uses 4 watts! Also note that you may need to replace your halogen transformers, as they often need a minimum load of 20 watts.
Item code: LEDHALKIT.
To prevent possibly damaging these bulb kits with excessive voltage, we strongly recommend you replace your halogen lamp transformers with our 1 amp switchmode plugpack.

Constant current circuit kit

Price: $8
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: CCBOARDxxx where xxx is the current rating in mA (020, 050, 300 or 650).

Superflux LEDs

Price: Red and amber: $2 each, green, blue and cyan: $3 each
The Superflux LEDs are about the best value for money available in LEDs today. Each 8mm square Superflux LED has the equivalent light output of several of the best 5mm LEDs, for the same or less cost as a single 5mm device! Available in red, green, cyan, blue and amber.

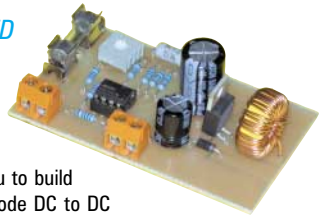
Chinese Superflux LEDs

Price: Red and amber: $0.50 each, white, green, blue and cyan: $1 each
These are a cheaper Asian-sourced Superflux LED which are the same size and shape as the Lumileds Superflux, but not as expensive. Although they probably won't last as long as the Lumileds LEDs, they should be great for most uses.

Maxi-maximiser kit

Price: 12 amp: $70 ($65 for ATA members), 20 amp: $80 ($75 for ATA members)
A larger version of the mini-maximiser which is available in 12 and 20 amp versions. The kit allows you to build the unit for use on either 12 or 24 volts. You must specify current rating when ordering. Note: not suitable for battery charging use!
Item code: MAXIMAX

Switchmode LED driver kit



Price: $30 ($25 for ATA members)
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: SWITCHMODE.

Expand your *ReNew* collection

All available back issues up to issue *ReNew* 76 $7.50 inc. postage within Australia. *ReNew* issue 78 onwards $8.50 inc. postage. 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 46, 47, 48, 49, 50, 51, 52, 53, 54, 55 and 56. *ReNew* issues 57, 58, 61, 62, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90 and 91.

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ATA, PO Box 2919, Fitzroy VIC 3065, fax:(03) 9419 2441

Note: Please allow up to 21 days for delivery.

We do not disclose private information to anyone unless legally obliged to do so. To view our privacy policy, see our website.

92/05

Largest compost plant in the southern hemisphere

What happens to your kitchen scraps and garden waste? Some lucky Perth residents are now able to dispose of their compost and help to produce new crops

Go west, wheelie bin! And help 150,000 Perth households turn their household rubbish into industrial-grade compost.

Each year, the residents of seven councils in Perth's south produce more than 1.4 million tonnes of waste. The Southern Metropolitan Regional Council (SMRC) is aiming to cut their landfill by an impressive 85%.

The Council's Communications Manager, Chuck Ellis, says 'we try to get across to the householders that instead of a rubbish bin and a recycling bin, now they have two recycling bins—one for compost and one for hard recycling materials.'

'This was a community-driven program,' says Mr Ellis, 'and only part of what we call the Regional Resource Recovery Cycle.'

The area has an integrated 'rubbish' collection system. Every week the councils collect the 240 litre mobile bins which contain general household waste including food and small pieces of green, garden waste.

Once a fortnight there's another 240 litre bin for 'co-mingled dry recyclables' like glass and plastic.

Top: The compost is used to fertilise a range of crops including wheat, barley, avocados and olives.

Above: The mature compost is put through a filter before being distributed to the farms.

Three times a year there are roadside green-waste collections for larger objects like tree limbs, and an annual hard-rubbish collection.

Giant compost heap

The compost wheelie bins are taken to the Farm Compost Demonstration site—the biggest compost trial in the country. At its heart is the largest composting vessel in the southern hemisphere—one of only three such processors in Australia. This produces more than 60,000 tonnes of farm-grade compost each year.

First, the raw material spends three days in the 'digester', then it takes another 28 days to mature. The system is even powered by methane gas from the old tip next door!

Although initially it is more expensive than landfill, Mr Ellis says 'the problems are there, we can either deal with them now, or later. We're running out of space.'

The council expects they'll be able to keep processing costs stable over the next decade. The compost is being used on 50 farms on the outskirts of Perth.

The compost is initially put through a giant digester, the largest in the southern hemisphere.

And is the compost being appreciated on the farms? Well, most of the properties involved want even more compost this year, after starting the trial last year.

That's around twenty broad-acre farms growing wheat, barley, oats and canola using SMRC compost and their normal fertiliser program. Another 25 horticultural properties growing wine and table grapes, stone fruit, apples, pears, avocados, olives, turf and citrus have included the compost into their fertiliser program.

We'll dig to that!

For further info go to www.smrc.com.au

The benefits of composting

Environmental

Disposal of household waste into landfill is regarded as one of the worst environmental problems today. Compost produced from municipal solid waste means the demand on scarce landfill is greatly reduced.

Economic

Compost is cost effective. The soil enrichment benefits can lead to cost savings in reduced irrigation or increased moisture retention in broad-acre farming, as well as reduced fertiliser and pesticide use. There is also the potential for increased yields in some crops.

Agricultural

Compost adds physical, chemical and biological benefits to soil. Compost is about soil building. Over time, compost improves the soil's organic life, nutrient content, soil structure and moisture retention capacity. It contains nutrients and trace elements essential for healthy plant growth. As the compost breaks down, nutrients are released into the soil, providing a slow release 'fertiliser' for the soil. Compost can aid in suppressing plant diseases and pests. Organisms in compost protect plants from disease-causing organisms by competing with them for food, space and water. Consequently, the use of compost as part of a farming system has the potential to reduce the use of pesticides and fungicides in agriculture.

Courtesy of Southern Metropolitan Regional Council

[Book review]

Practical straw bale building

Murray Hollis
RRP: $29.95
Published by Landlinks Press
ISBN: 0643069771

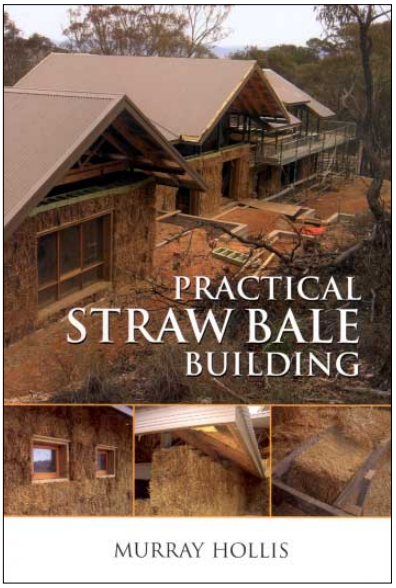
In his book, Hollis describes the basics of strawbale building and introduces the main components and tools. This includes the preparation of bales, stacking, tying and plastering, and briefly covers issues like waterproofing, building codes, storage and making 'creative shapes'.

Rather than provide a comprehensive overview of strawbale construction techniques, the author has concentrated on techniques he believes may be accepted by the mainstream building industry. About a third of the book is devoted to the author's proposal for a 'new' strawbale construction system.

It is good to see contributions to the development of strawbale building but the merits of the author's new methods are asserted rather than substantiated. No reference is given to actual buildings or case studies and the few buildings that are shown are not credited. It would have assisted the author's case if it had been made more clear what is well proven and what is experimental.

Photographs and diagrams illustrate several details, tools and techniques but it would have been helpful if Hollis had identified which techniques are used by whom, or where, or for what buildings.

A short 'how-to' book of this kind is always welcome, but I would like to have seen the author provide some points of connection with the highly active and diverse strawbale building community. To enhance this book's usefulness as a practical introduction to a way of building that has thousands of adherents and hundreds of practitioners around the world, perhaps it would be good to include a bibliography or references. This would make it easier for the interested reader to do further research.



Review by Dr Paul Downton of Ecopolis Architects Pty Ltd. Paul is the author of the fact sheet on strawbale construction in the *Your Home Technical Manual*.

New solar panel range

We see new solar panel ranges on a regular basis nowadays, and the STA series modules from Suntech Australia are another recently introduced range. Available in sizes ranging from 2 to 165 watts, the panels are composed of either monocrystalline or polycrystalline silicon solar cells surrounded by an anodised aluminium frame. The panels are covered by 3mm-thick tempered low-iron glass on the front and have the common glass/EVA/tedlar construction.

RRP: From $61 for the 2 watt module through to $1223 for the 165 watt module, excluding GST.

Available from Suntech Australia Pty Ltd, 2/21 Simcock St, Somerville VIC 3912, ph:(03) 5977 9489, fax:(03) 5977 6124, email: info@suntechaustralia.com.au, www.suntechaustralia.com.au

New amorphous panels too!

Another recently introduced range is the Kaneka amorphous panels from Japan. According to Kaneka, their panels use 1/2000th of the silicon of a crystalline panel, and they have a lower embodied energy as the manufacturing process is done at a lower temperature than for crystalline panels.

Kaneka also has translucent solar panels—these are currently being used on a project in Adelaide.

The panels are rated at +10%/-5% tolerance, and have a power coefficient of -0.26%/°C compared to crystalline, which are around -0.5%/°C, which means that the panels suffer less output power loss than crystalline panels do at high panel temperatures typically found in Australia.

RRP: $583 for the 60 watt GEA panel.

Available from The Solar Shop, 134 Payneham Road, Stepney SA 5069, ph:(08) 8362 9992, fax:(08) 8362 8866, email: adrian@solarshop.com.au, www.solarshop.com.au

LED lighting strips

We keep coming across new forms of LED lighting, but most are not made in Australia. Well here's a product made locally: the AL400 from Morbelle is a new lighting strip designed for architectural lighting requirements. The AL400 comes in the form of a 14.5mm x 25mm profile aluminium strip 400mm long. This allows the light strips to be mounted in places normal lighting just won't fit—they can even be recessed into 18mm thick panels for use inside and under cupboards and cabinets. They are suitable for display cabinets, under-bar lighting, under-cabinet lighting, shop fitting, border lighting, architecturally designed home lighting, automotive and marine uses et cetera.

The light strips are available in two versions—a 130 lumen, 6 watt cool white, which has two 3 watt cool white Luxeon LEDs, or a 40 lumen, 2 watt warm white, which has a pair of 1 watt warm white Luxeons. As the lights are based on LEDs, they should run continuously for more than 10 years!

The light strips are also available in custom lengths and shapes as per customers' specifications, subject to engineering requirements. They can also be connected to make light strips up to 2.4 metres long, and up to six strips can be powered by one power supply.

RRP: $150 per strip.

Manufactured by Morbelle Pty Ltd, PO BOX 3334, North Strathfield NSW 2137, ph:(02) 8756 5385, fax:(02) 8756 5010, email: mail@morbelle.com.au, www.morbelle.com.au

Not just grocery bags

Many people are starting to get the message and are changing over to reusable grocery bags, but why stop there? If you own a shop, it doesn't have to be a supermarket for you to be supplying your customers with reusable bags.

The seeitgreen range of bags from JMP Holdings includes not only grocery bags, but many others, such as bottle bags (two and four bottle versions), tote bags, boutique bags, zipper bags, dufflebags/backpacks, velcro-sealed carry-all bags and even a bag that folds back into a small 110 x 200mm pocket on the side of the bag! Other bags include drawstring bags, suit bags (take note, dry cleaners!), reusable cloth bags, recycled and recyclable paper bags and even biodegradeable plastic shopping bags.

Available from JMP Holdings Pty Ltd, 50 Bond Street, Mordialloc VIC 3195, ph:(03) 9588 2229, fax:(03) 9588 2209, email: info@jmpholdings.com.au, www.jmpholdings.com.au

Treat timber more naturally

You don't need to use toxic, environmentally damaging timber treatments like polyurethane to preserve the timber in your home, or to use CCA (chromated copper arsenate) treated timber for outdoor use.

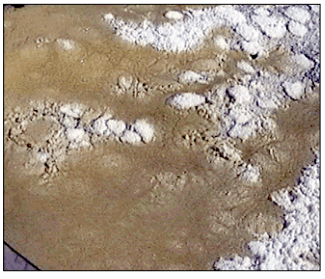
Instead of using toxic chemicals to kill or repel threats to timber, TimberTreat, from Cooee Distribution Australia, uses two protection principles—waterproofing with a deeply penetrating waxy emulsion, combined with low-dose anti-microbial and anti-mould treatment. The timber is not poisoned, but rather, it becomes unattractive and indigestible to organisms that would like to eat it.

The TimberTreat range includes PreTreatment (a primer), Natural, which allows the timber to naturally age and grey, and five timber colours designed to provide UV protection. When Natural is applied over PreTreatment, greying is inhibited, and the natural timber look is preserved for longer, according to the manufacturer.

Cooee also has other non-toxic formulations for other uses, such as road sealing and dust binding, mould control, soil-wetting agents, spray lubricants, stone and masonry sealants et cetera.

Available from Cooee Distribution Australia Pty Ltd, PO Box 489, Capalaba QLD 4157, ph:(07) 3390 3433, fax:(07) 3390 3423, email: sales@cooeesales.com.au, www.cooeesales.com.au

Simple oil recovery



Recovering spilled oil can be a messy and difficult task, especially when it is spilled into waterways or the ocean. Many oil recovery systems can only absorb a few times their weight in oil, and often the oil is not recoverable from the absorbant medium.

Recoverit is a dry non-toxic granule which is easily applied to oil spills, either on land or in water. The powder combines with the oil to form a thick gel that can simply be swept up or lifted from the water. Once the gel has been recovered, it can be placed in a centrifuge which separates the oil from the Recoverit so the oil can be recycled and the Recoverit can be reused.

Recoverit can absorb up to 25 times its weight in oil, with 10 times being a typical figure. It is very light and so can easily be transported to the spill site. What's more, the material is biodegradeable under UV light, so any unused Recoverit breaks down into water and ash after several days.

Available from RFP Manufacturing Pty Ltd, 251 Fallon Street, Albury NSW 2640, ph:(02) 6040 2001, fax:(02) 6025 2125, email: recoverit@bigpond.com, www.recoverit.biz

Bollards!

Now that the powers that be have finally started to realise that treated pine products are unsafe, especially near playgrounds and schools, at least one commonly found treated pine object—the humble bollard—can now be replaced with bollards made from a much safer material.

Repeat Products has added two new styles to its bollard range. The first is a direct replacement for the common metal marine bollards. This is a free-standing device just under a metre high that weighs in at 15kg. It is made from recycled plastic and waste toner from laser printers, and is available in black only.

The other bollard, called the ECO Bollard, was developed specifically for schools and is the same size and shape (150mm diameter by 1.5 metres long with a simple rounded top) as the commonly used treated pine bollards. It weighs in at 10kg and is designed to be set into the ground like most other bollards. It is available in either black or green.

List price: $45 for the black round bollard, $55 for the green version. $140 for the marine bollard. All prices exclude GST.

Manufactured by Repeat Products, ph:(03) 8790 8888, www.repeatproducts.com.au

Solar balls!

We have seen quite a few solar garden lights, but this one really caught our eye. It is a strong clear plastic sphere which contains a solar panel, rechargeable batteries, and a LED. The solar panel charges the batteries by day, and at night the LED comes on and runs all night. Twelve hours of charging gives 24 hours of run time, so these should run all night after a sunny day.

The balls are available with red, blue and white LEDs, are fully waterproof, have a small hanging eye at the top, and are weighted so that they float upright in swimming pools and ponds. The ball measures 110mm in diameter.

RRP: $24.95 ($23.95 for ATA members).

Available from the ATA, PO Box 2919, Fitzroy VIc 3065, ph:(03) 9419 2440, fax:(03) 9419 2440, email: orders@ata.org.au, www.ata.org.au

Split system solar hot water

Split system solar water heaters allow you to mount the panels on the roof while keeping the tank on the ground. This streamlines the appearance of the panels on the roof, which is an important consideration for some installations, such as in heritage areas.

The Solarpower solar hot water system is one such split system. It consists of two roof-mounted solar collector panels that heat water from the 400 litre storage tank. Water is circulated from the tank through the panels and back to the tank by a differential controller and pump system.

The system has Australian Standards approvals and is eligible for solar hot water rebates in some states. The system comes with a five-year warranty and is eligible for 39 RECs (renewable energy certificates).

RRP: $2695 before government rebates.

Available from Designeco.net (QLD), mob: 0432 887 590, email: office@designeco.net, www.designeco.net

Wireless weather station

We have sold a couple of weather stations in the past, but both required wiring back to the display or a computer. 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 stores the information and gives averages, accumulated totals, maximums, minimums and trends of the various data.

The transmitter requires two AA batteries (lithium types recommended) 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, making it great value for the price.

RRP: $249 ($239 for ATA members).

Available from the ATA, PO Box 2919, Fitzroy VIC 3065, ph:(03) 9419 2440, fax:(03) 9419 2440, email: orders@ata.org.au, www.ata.org.au

Blinds for the sun

Many solar hot water systems have enough panel area to provide adequate hot water during the cooler months, but this means they often overproduce hot water in the warmer months. This causes the solar hot water system to dump excess hot water for safety purposes, resulting in wasted water and sometimes even not enough hot water at the end of the day!

The Solar Blind looks at this problem from a different angle. Rather than dump water already heated, it prevents the water being overheated in the first place. It is, in effect, a blind for the solar collectors of the solar water heater. It is available in three models: a manual model that requires the user to adjust the amount of shading on a day-to-day basis; a remote control model that also requires the user to adjust the shade daily, but it is done with a remote control; and a fully automatic model, which adjusts the amount of shading according to the weather conditions and hot water demand.

RRP: from $480 for the single blind manual model, to $1780 for the fully automatic model, not including installation.

For further information contact The Solar Blind on ph:(03) 9874 8651 or email: b.fenwick@optusnet.com.au

On yer bike!

LED bike lights are becoming very popular, so we thought we would add one to our lineup. This light has five white superbright LEDs and is powered by four AAA batteries. The light has two modes—continuously on and flashing—and is waterproof to 20 metres.

The light comes with a slide locking handlebar clamp to allow easy removal of the light from the bike to prevent theft. This means that the light can also be used as a general purpose torch and even a diving torch, providing you don't exceed the 20-metre rating.

RRP: $29.95 ($28.95 for ATA members).

Available from the ATA, PO Box 2919, Fitzroy VIC 3065, ph:(03) 9419 2440, fax:(03) 9419 2440, email: orders@ata.org.au, www.ata.org.au

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

For Sale: Land for private sale, Balnarring. 833sq metre block. Established native and fruit trees. Ideal for couple with young family who are looking to establish in coastal village. $225,000 *Ph: (03) 5983 5080, dolittlefarm@pac.com.au*

For Sale: Passive solar Hamlan 3 bed brick home on 838m². Highton, Geelong. Master with E/S and WIR, others with BIR. Study. Established orchard, fenced vege garden and chook yard. 3x3m shed. Double LU garage with access, lge laundry. 10 yrs old. $304,000. *Doug, gecko@pipeline.com.au ph 0438 411 761.*

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Home exterior/ interior

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ARCHITECT: Ecopolis Architects P/L: City or country, strawbale or steel – leading edge ecological architecture for healthy living. Paul F Downton BSc(Hons) BArch(Wales) PhD ARAIA. *123 Sturt St., Adelaide 5000. Ph:(08) 8410 9218, www.ecopolis.com.au*

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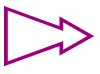

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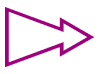

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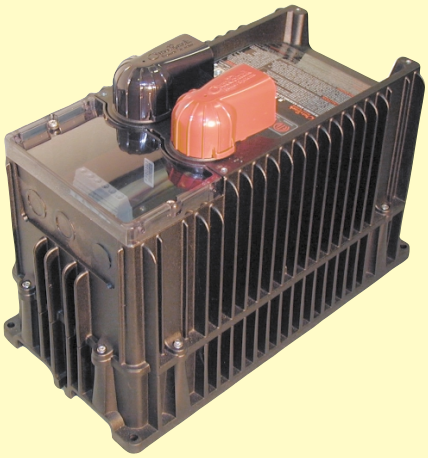

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