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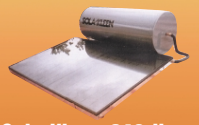

Sola Kleen 240 litre all-copper solar water heater (see page 5 for details)

Lessons from Arnhem Land

Designing appropriate greywater systems

Deciduous planting for passive solar design

Solar and wind powered mobile cinema

Energy-saving home retrofits

Renewable energy investments

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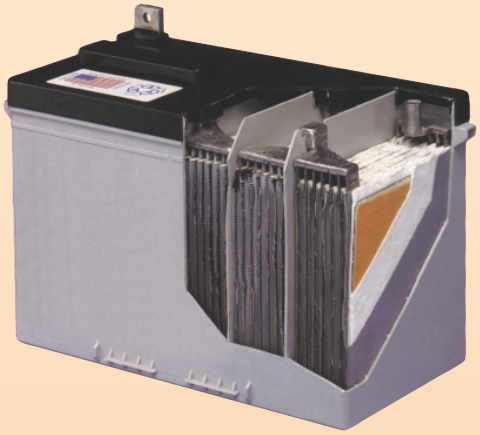

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features

Cover story: Banana and paw paw trees are an essential design feature for Arnhem Land's greywater systems. Story page 14. Cover photo: Glenn Marshall

Above: Deciduous fruit trees are a delicious and practical passive solar design feature. Page 40.

Left: These polished stainless steel solar reflectors are one retrofitter's method for ensuring the south-facing rooms of his home receive sunlight year-round. Page 21.

You don't have to start from scratch to live in a sustainable house. See page 26 for retrofit tips, and features to look for if you are looking to rent or buy.

As a first step towards a full home renewable set-up, Andrew Moore solar powered his home entertainment system. Page 34.

regulars

This lamp makes electricity from its own waste heat! See Products page 72.

Serious fun for the kids! Noel's Treasures from Trash steps you through the process of building a mini solar water heater. Page 68.

About ReNew

Formerly titled *Soft Technology*, *ReNew* is published by the (Australian) 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 $45 per year, and offers a range of other benefits.

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editorial

Clean energy future raises new community challenges

The eight-month appeal process to determine the future of Stanwell Corporation's bid to build a large-scale wind farm in South Gippsland, Victoria, reached a conclusion in April, with the Victorian Civil and Administrative Tribunal's decision to issue a planning permit for its construction. The permit for the $39 million, 12-turbine wind farm was issued with 31 conditions, most of which relate to objections submitted by a number of local residents with concerns about the potential visual, noise and environmental impacts of the proposal, among other issues.

The decision is great news for the industry and the environment, and sets a precedent for future decisions on the development of wind farms in the region. But whether it heralds further favourable decisions on wind farm proposals on the southern coast is impossible to predict in the current political and social climate.

While most Australians voice strong support for increasing our reliance on renewable energy generators, rather than continuing to travel the path towards a fossil-fuel dependent future, finding acceptable and 'appropriate' locations for wind farms, and other renewable generators such as biomass plants, is not as easy as one might expect. As international experiences indicate, the success of a wind proposals in Australia hinges on *local* community acceptance and support.

Decisions about wind farms are made on a site-by-site basis, and planning applications are presided over by responsible authorities which often have limited, if any, experience of processing applications for large-scale renewable energy developments. Affected local communities, too, are usually inexperienced at dealing with such proposals and are unsure of the possible implications. In the case of the Toora decision, it was only the second time VCAT had determined the future of a wind farm. The first was the 1999 decision to deny a permit for the Energy Equity application to construct a wind farm on Cape Bridgewater in Victoria's south west.

While the majority of wind farm applications in Australia have eventually been given the go-ahead by the local responsible authorities, not all of them have been smooth sailing for the companies or communities involved. In planning terms, wind farms are usually an 'unspecified use' of an area and therefore are in a league of their own when it comes to gaining relevant approvals. This causes some processes to be long, expensive and to involve exhaustive consultation. Local opposition to Western Power's (now almost complete) Albany wind farm saw it go through an appeals process, and Pacific Hydro's 150 megawatt Portland Wind Energy Project is currently undergoing an Environmental Effects Statement to be completed in July 2001. Significant community concerns about the PWEP planned location of turbines on Cape Bridgewater and Cape Nelson have already been recorded.

Increasing the amount of renewable energy generation in Australia is a significant and long-term priority. It is becoming clear, though, that a green energy future brings with it new challenges that planning policy, specific communities and wind energy companies will need to deal with.

Kulja Coulston

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Conditions and how to enter

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

(2) The prize is not redeemable for cash.

(3) The winner will need to pay the cost of installation.

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

(5) The competition runs from 1 March 2001 to 27 July 2001. Subscriptions/memberships must be paid by 5pm on Friday 27 July 2001 to be eligible.

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

(7) *ReNew* subscriptions cost $24 per year. ATA membership costs $45 per year ($33 concession). Overseas subscriptions cost AUD$29 in NZ and PNG, AUD$36 elsewhere. Two-year subscriptions and memberships are also eligible.

(8) To subscribe or join the ATA, use the subscription form on page 58 of this magazine (or a copy of it), or call the ATA on (03) 9388 9311 to pay by credit card.

(9) The competition is open to *ReNew* readers in any country. Sola-Kleen will pay 50% of freight costs inside Australia. Winners outside Australia will be responsible for any additional freight charges.

To help us speed the processing of postal entries, PLEASE print your name and address on the back of the envelope

The *ReNew*/Sola-Kleen/Smalls Solar subscriber competition is proudly sponsored by Sola-Kleen/Smalls Solar. For more information Sola-Kleen/Smalls Solar can be contacted on ph:(08)9271 5725 fax:(08)5271 3136, email: sola@sola-kleen.com.au, web site: www.sola-kleen.com.au

SHW system owners paid up to $855 for CO2 savings

If you have put off installing a solar water heater due to the upfront cost of the unit, it may be time to redo your maths. Not only are many Australians eligible for state government rebates on solar water heaters, but Queensland utility Energex will pay up to $855 for the Renewable Energy Credits (REC) your water heater will earn over its lifetime.

Energex introduced the Solar Certificated Program on 17 April 2001 as a way of meeting its Mandatory Renewable Energy Target commitments of sourcing an additional two per cent of their electricity from renewable energy sources.

One REC is granted for every MWH of electricity generated by a renewable energy source. The energy saved by installing a solar water heater can be calculated as an REC. Energex will pay $24.43 per REC under the program.

The number of RECs a system will earn depends on the size of the system, the solar radiation zone where it will be installed, the water heater it replaced (it must be electric) and, most importantly, the type of fossil fuel it will offset. Tasmanians will not be eligible for RECs because the state's power is sourced from hydro which is already considered renewable.

In a town like Alice Springs a 400 litre solar water heater replacing an electric heater would earn 35 RECs, and therefore the maximum payment of $855 from Energex.

There are solar hot water rebates available in Victoria (up to $1500), New South Wales ($500) and Queensland ($750). There are no rebates available in the Northern Territory, South Australia and Western Australia.

If you accept a rebate in NSW or Victoria the RECs automatically belong to the state government. In Queensland, however, you are eligible for both the the rebate and Energex's program.

Solahart is the first solar water heater manufacturer to participate in the program but Energex is negotiating with the other Australian manufacturers Edwards and Beasley.

New power plants to meet summer peaks

Victoria and South Australia will have summer electricity generating shortfalls of up to 500 megawatts by 2003–2004 due to the increased use of airconditiong systems, according to NEMMCo, the national energy market manager. But rather than promoting widespread energy conservation measures to avoid summer blackouts, there are a number of new power plants being built to meet increased peak demand.

Edison Mission Energy is building a 300MW gas-fired power station in the La Trobe valley to be completed by February 2002. AGL's has plans for a 150MW plant in Melbourne's west, Origin intends to install 95MW of capacity in South Australia and Victoria, AES Transpower proposes to build a plant near Ballarat by January 2003 and the Pelican Point power station is expected to be upgraded. AMCOR will also help meet peak demand by generating an additional 9.5MW electricity at its fibre-packing mill in Fairfield.

Source: ***The Age, EcoGeneration***

Grass is greener

A new 'green' suburb comprising 8000 homes will be constructed in Melbourne's north. The Epping North development is being constructed by Urban Land Corporation, will cost $1.8 million and will be able to house 25,000 people. Waterrecycling, energy efficiency, waste reduction and reducing car dependence are to be the main environmental features. The project will completed over the next 10 years.

PV industry in NZ

A steering group to investigate and develop an industry association to promote solar photovoltaic technology has been established in New Zealand. For more information contact the steering group secretary Ian Shearer on ph:+64 4 470 2214, email: ian.shearer@eeca.govt.nz

ReNew prize winner

In March 2001 new ATA member David Harris of Dubbo happily took delivery of our subscriber prize for issues 72–74 of *ReNew*—a $3570 RGS battery charge system and Federal Batteries battery bank. Congratulations David, and thank you Ryde Batteries and RGS Technology for your support for *ReNew* subscriber prize.

RAPS funding at last!

Funds from the Commonwealth's $264 million Renewable Remote Power Generation Program, which was introduced on 1 July 2000, are finally starting to flow. Government programs in South Australia, the Northern Territory, Western Australia and Queensland have now been approved under the four-year program.

People eligible for funds under the RRPGP in South Australia began receiving rebates in March 2001. Significant rebates from Western Australia, Queensland's $12 million Working Properties Rebate Scheme, the $38 million Northern Territory Renewable Energy Rebate Program and the $8.4 million Indigenous Communities Support Program are 'imminently' available. More programs will soon be announced.

RRPGP is administered by the Australian Greenhouse Office to approved state-based programs. It is funded from the Diesel Fuel Excise paid by publicly-owned power utilities and supports the installation of renewable energy systems in remote areas of Australia as a way of reducing diesel-based electricity generation.

World's first commercial wave power station

The world's first commercial wave power station is successfully feeding electricity into the UK national grid, on the Scottish island of Islay. The station has secured a 15-year power purchase agreement with Scottish and Southern Energy and Scottish Power.

Thje LIMPET (Land Installed Marine Powered Energy Transformer) wave power generator was jointly developed by WAVEGEN and Queen's University Belfast (QUB). The LIMPET is rated at 500kW and is able to provide enough electricity for about 400 local homes.

LIMPET uses an oscillating water column (OWC) to drive a pair of Wells Turbines which are in turn coupled to a pair of 250kW induction alternators. The water column consists of an inclined concrete tube with its opening below the water level. External wave action causes the water level in the collector to rise and fall. This variation in water level alternately compresses and decompresses the trapped air above, causing air to flow backwards and forwards through the pair of contra-rotating Wells turbines. Wells Turbines are self-rectifying: they turn in the same direction irrespective of the direction of the airflow.

With modular construction and simple operation, it is hoped the Limpet will fulfil a growing need for coastal communities all around the world, especially islands seeking to replace diesel generation with clean renewable power. Commercial potential for this technology has been acknowledged by the securing of a further 5 million pounds funding.

Fuel crops provide hope for radiation-contaminated farmland

Oil seed fuel crops planted on radiation contaminated farm lands in Belarus may provide a much-needed new income source for local farmers who have suffered under the dark cloud of Chernobyl since the meltdown of 1986. More than one million hectares of agricultural lands were contaminated to some degree by radionuclides in Belarus alone, leaving many local farmers without income due to depressed agricultural markets.

Trial crops of certain species of rapeseed have demonstrated that some varieties take up and store radionuclides, in this case caesium-137 and strontium-90, from the soil in their stalks and seed coats, but not in the seeds. This is exciting news for farmers in Belarus and Ukraine as it may offer a future option for recovering their lands for safe and productive uses.

Rapeseed contains 'colza' oil which can be processed into machine oils, machine lubricants and cooking oils—products which are largely imported into the region.

More than 50,000 hectares of oil-seed crops have already been sown in Belarus in preparation for trials. A pilot plant for processing lubricants from the rapeseed crops was launched in April 2001.

The International Atomic Energy Association and the United Nations Food and Agriculture Organization are behind the trials and said they will be analysing the raw materials and end products in line with international standards.

Although it has been 15 years since the Chernobyl disaster, the plant was decommissioned only this year. There are still a number of similarly-designed nuclear power plants being used throughout Lithuania, Bulgaria, Slovakia and in the Russian Federation.

Source: Radio National, IAEA

Introducing Australia's first buses running on 100 per cent ethanol fuel

Catching public transport is already the more sustainable option for travelling around inner-city areas, and if you travel in the eastern suburbs of the Melbourne you could earn yourself another few environmental brownie points by patronising ethanol-fuelled buses.

Ventura Bus Lines has introduced Australia's first two totally renewable fuelled buses to its fleet and has had nothing but praise from commuters. The buses run on 100 per cent ethanol made from molasses, a by-product of sugar milling by CSR Distilleries. The ethanol is produced in the sugar belt of Queensland and shipped to Yarraville in Victoria for refining. It is then delivered to the Ventura depot in South Oakleigh VIC.

The buses are boldly painted with explanatory signage about the fuel and its environmental benefits. The bus drivers are happy too. Apparently they are keen to drive the ethanol buses due to their better performance, even when compared with their newest Euro II buses. The engine is marginally quieter and the morning start-up crew has reported huge fume advantages when starting the ethanol buses compared to other low-emissions models.

Ethanol is usually a waste byproduct. As a fuel it has a lower energy rating than diesel, which means that the buses burn larger quantities of it. But due to the 20 cents per litre Commonwealth Diesel and Alternative Fuel Grant the operating cost is similar to diesel buses.

Ventura has installed customised fuelling stations for the ethanol buses, enough to cater for another 30. They have already decided to purchase a third bus to be on the road in late 2001.

Source: Ventura ph:(03)3579 4811

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SEA 035

Australian wind update...

Albany WA

Western Power's 21.6MW Albany wind farm which was approved for construction last year after 10 years of investigation, is on schedule to be completed by July 2001. Twelve 1.8MW Enercon E66 turbines with a rotor diameter of 70 metres (35m blades) will be installed atop 65-metre towers. The wind farm is located on coastal hinterland 12 kilometres south west of the city centre. The wind farm will save approximately 77,000 tonnes of greenhouse gases each year as it will reduce the amount of gas and coal Western Power will need to burn to supply electricity to the area. The power generated will supply 15,000 average Western Australian homes or 75 per cent of the City of Albany's electricity requirements.

Codrington VIC

Pacific Hydro's Codrington wind farm, located near Port Fairy on Victoria's south-west coast, is to be the first large wind farm in the state. Comprising fourteen 1.3MW AN Bonus turbines, the project will have a combined capacity of 18.2MW and abate approximately 76,000 tonnes of CO_2. Construction began in October 2000 and will be complete by July 2001 at a cost of $33 million. It is the largest privately-owned wind farm in Australia. The turbines will generate enough electricity for about 14,000 homes.

Toora VIC

Following a favourable Victorian Civil and Administrative Tribunal decision on 11 April 2001, Stanwell Corporation has been given the go-ahead to construct a 12-turbine, 22MW wind farm in Toora, South Gippsland. After 10 years in the planning, a wind farm will finally be located at the Silcocks Hill site which was identified as a 'Windfarm Area' in the early 1990s following extensive surveys conducted by the former State Electricity Commission (SEC). At the time of printing details of the Stanwell project, including turbine type and size, were yet to be determined.

This wind generator nacelle was on display at the Portland Renewable Energy Expo held in Portland VIC in March 2001. More than 2000 people visited the displays and attended workshops on renewable energy. This AN Bonus nacelle was on display at the Expo and is one of 14 installed at the new Codrington wind farm near Port Fairy.

Lake Bonney SA

Babcock and Brown Windpower will be constructing a 60MW wind farm at Lake Bonney, near Millicent in south-east South Australia. Stage one of the project will comprise 41 turbines and is expected to be operational in late 2001. Stage two will be completed by late 2002 and will add another 60MW capacity. The project is still tendering with details of turbines unknown at the time of printing.

More wind news

There is much activity on the wind prospecting front, with reports coming from all over Australia, but mainly in southern coastal regions, of land owners being approached by companies wishing to construct large-scale wind farms.

As we reported in the last issue of *ReNew,* Pacific Hydro is planning the 150MW Portland Wind Energy Project. The proposal is to build a 100-turbine wind farm over four sites, Cape Sir William Grant, Cape Bridgewater, Cape Nelson and Yambuk near Portland in south-western Victoria. This development is currently undertaking an environmental effects statement (EES) process.

Western Power is investigating new sites, as is Eraring Energy (owner operator of Blayney and Crookwell wind farms in New South Wales). Stanwell Corporation is planning construction of its 13MW phase two of the Windy Hill site in Ravenshoe, North Queensland.

Primergy Limited, a New South Wales renewable energy company, has joined forces with Melbourne-based investment company Bennelong Group to allow 'fast tracking' of its renewable energy portfolio in the UK, Europe and Australia. Primergy has also signed an agreement with Wind Prospect to 'co-develop up to 100MW of new project opportunities in Victoria and South Australia'.

Wind Prospect is proposing to build a 25-turbine, 40MW wind farm at Green Point, near Port MacDonnell in SA. They are also looking at sites in south-western Victoria and Gippsland.

We'll keep you posted in future issues of *ReNew*.

Wasteful lighting

I note with interest that the proposed Megawatt Class Solar Installation due to be built by Solar Systems and Australian Inland Energy and Water near Broken Hill later this year is slated to save 71,000 tonnes of carbon dioxide emissions over its projected 30 year operation. This is almost the same amount as the 72,000 tonnes of carbon dioxide that is emitted as a result of light pollution in a small city like Adelaide in just one year!

Martin Lewicki, Queenstown SA

Of fluoros and inverters

On reading Q&A in *ReNew* issue 75 regarding the suggested remedy for trying to cure radio frequency interference from fluoros, may I suggest that as some RFI can also be radiated from the tube itself, sometimes reversing or replacing the tube may cure some of the problem.

Also, in the article starting on page 62 you advise that the SEA Piccolo inverter was used. I believe that this model is the only inverter supplied by SEA that is not manufactured in Australia, and that its AC output is rated at 225VAC, not 240VAC.

Don Taylor, Kilsyth VIC

Don, I had not heard of that particular cure for RFI from fluoros, and while not overly sure why it would work, with this problem anything is worth a try.

As for the SEA Piccolo mistake, we were not aware of that fact until you pointed it out and it was confirmed by SEA.

Lance Turner

Defining technology

Our kids are interested in technology (the older seriously interested in electronics and computers and the younger mainly interested in all things that look and sound impressive).

I see technology as being merely techniques—how things are done—ranging from pencil and paper to computers, or from wheelbarrows to semi-trailers.

However, in western society at present, technology has associations with big, flashy, noisy, expensive, complicated consumer items and with environmental destruction. So I would like to offer my kids an alternative approach: that technology can be environmentally benign or a help to society. I hope joining ATA can help us.

Margaret Panter, Castlemaine VIC

More on washing

I am after advice on how to measure power and energy consumption in 240 volt appliances. I currently use a rough moving iron ammeter and a clumsy domestic kWH meter, but yearn for something better.

The EMU1 described in 'Products' in *Soft Technology* issue 49 looks like a fine tool for this sort of job. Could you help with a current supplier, or is there another suitable tool?

I also have some input into the ongoing issue of washing machines. We use a Fisher and Paykel top loader. Despite its energy star label, we measure it to use about 75 watt-hours for a full cycle. Its peak power when spinning is just under 300 watts. It worked very well for years on a 550 watt Latronics square wave inverter, and now works just as well on a Selectronic sinewave. They are fairly thirsty, using about 140 litres per wash, and this accounts for the somewhat misleading energy star label.

The energy star label accounts for energy in heating hot water, and seems to assume that you've used peak mains power (who'd be so silly?).

As for the various non-consumable washing thingos, I borrowed a pair of 'washing solution' balls from a neighbour a few years ago. It's easy to make the mistake of comparing them to detergent to see if they work. I suggest it makes more sense to compare them to plain water. I suspect that many or all of these products take advantage of the fact that much of the time we don't need any more than warm water to clean our clothes, and add detergent out of habit and the reassurance of the residual smell. Over the years I have forgotten a few times to add detergent to a wash and been a bit confused by the clean washing that came out.

I did a careful test in the old twin tub. Using two batches of artificially stained and soiled nappies I found that both hot water (60 degrees C) and hot water with magic balls washed the nappies very clean. No difference between the two batches was distinguishable by an audience who didn't know which was which. The balls, which looked very much like polyethylene balls with blue water inside, came out rather oily from the oil content of some of the soiling materials, strengthening my feeling that they had no actual surfactant value.

Perhaps these things have a very important job to do; showing us that we may be using detergent routinely when it's not always any use to us. The main value of detergent is to emulsify oils and fats when there are more of them than plain water can deal with. When most of us are getting our clothes and bedding just a little sweaty and dusty, maybe plain solar heated water is quite powerful enough, perhaps with a little detergent. Save the manufacturer's recommended dose for when you've been chainsawing or fixing the car.

Thanks for all the work you do to keep this excellent magazine going. I've been really enjoying the stack of back issues I recently bought.

Bruce Teakle, Mt Glorious QLD

The EMU1 meter is no longer available in Australia, as far as we know. A reader recently contacted us about these meters and suggested he may be willing to become a distributor. If anything happens on this front we will let readers know.

There are industrial type power meters available, they are used in the electrical industry to measure consumption for various reasons, but they can be very expensive. A quick check of our catalogues showed the cheapest to be over $1000, although this unit had a measurement range from 7 watts to 150kW! If anyone knows of a suitable meter for measuring appliance power and energy consumed, we would love to hear about it.

We keep hearing about the very low energy use of the Fisher and Paykel Smartdrive range. These machines do indeed seem to be very suited for use on even small independent power systems, though the greater use of water compared to a front loader may be a problem if you have to rely on tank water. Reusing the wash water for watering the garden should certainly make the equation look better.

As for washing balls, it seems there are several types of these. The fluid filled ones are, put simply, a con, they would have no affect at all on the washing as far as we can tell. We tested some a few years back that contained ceramic beads that were designed to slowly dissolve over many washes. While they did seem to work, we did not do exhaustive testing of them. I use detergent for washing, but always use far less than the recommended dose and never have problems getting clothes clean.

Lance Turner

Competing for the planet

ReNew 75 had an interesting article, 'Negotiating Regulation', (page 42) suggesting strategies for consumers to participate in the so-called contestable energy market. I do not want to be 'contestable', and I would also urge all *ReNew* readers to turn the tables on this pathetic sham of a competitive market.

The electricity grid is a giant melting pot, and no matter what spin the retailers may put on the 'product' that they are marketing, the physical reality is that all the generation sources are mixed together in the wires, and distributed to your suburb by a single monopoly distribution business, at a voltage and power quality of their choosing. At night it is nearly all coming from baseload coal.

ReNew readers must not fall into the trap of playing a passive role when in fact we are perhaps the best placed group to provide some real competition, and guidance for all other consumers.

Our best way to compete is by consuming less: by boycotting baseload power, by boycotting cheap off-peak tariffs, by installing solar water heating, by declaring war on phantom loads in our appliances, and by turning off our refrigerators from midnight to 6am every night. Then we should go out and 'sell' our cost-effective, economically efficient strategy to our work colleagues, relatives, friends, acquaintances, neighbours, and talk-back radio presenters.

For consumers to adopt such a strategy is pure market forces being wielded by empowered market participants. Concerted action by enough of us can help keep prices down, but more importantly achieve real reductions in greenhouse gas emissions: because fundamentally the contest is about saving the planet for future generations from those that would destroy it.

Michael Gunter, Kensington VIC

Loves solar

I farm approx 800 acres of grain and 500 sheep. We live in ever changing times and I feel alternative technology will have an increasing influence on farming. Why we use some some chemicals is extremely complex and so I won't even try to explain. The point is, I feel we won't be bound to using chemicals

forever as new technology with bacteria and beneficial organisms increases.

At present, the use of chemicals is the most efficient cost wise, like the power grid being the cheapest, most cost efficient method of electricity generation at present. But as we use up the oil, gas and coal and discover more efficient means of producing electricity, forward looking alternatives will certainly come to the fore.

Six years ago I invested in a solar water pump. This device pumps water from a big dam (we have an annual water run and that has to do us for 12 months other than the rain water in the tanks) near the channel, 800 metres up and over a hill to the house dam. The solar pump puts out up to 12,000 litres a day to top up the dam. The power for this device is free—the only thing against it was the initial outlay. But as electricity and fuel prices rise, solar and wind power will come into their own. We have so much sun in north-western Victoria (but not so much wind) we should be using it.

Connie Heintze, Minyip VIC

230 VAC is wrong

I read the article 'Are you buying more power than you think?' in issue 68 of *ReNew*.

I did not think it was a conspiracy, I just thought countries like Australia were stupid or possibly trying to protect local manufacturers by causing equipment made for world markets to blow up on our higher voltage.

Power consumed is not just a simple square law for electronic or magnetic equipment. Just about all electronic equipment is made for a world market and will only operate properly at either AC 110 V or AC 220 V. Countries such as Australia, New Zealand, the Netherlands and the UK can not be accommodated when electronic equipment is designed. Manufacturers will sell equipment in these small markets claiming it will operate from 213.6V to 254.4VAC and accept the inevitable failures.

Power supply units (or PSUs) for electronic equipment are often custom designed for the two standard mains voltages and the load of the rest of the equipment itself. Resonant converters used for PSUs in modern equipment convert power at almost 100 per cent efficiency at rated load and supply voltage. If they are operated at other than the rated supply voltage then the efficiency of conversion can be much less.

I have repaired many charred PSUs and seen PSUs in identical equipment operated at 220VAC that look as good as new.

Other equipment contains 50Hz magnetic equipment such as transformers and motors. With this kind of equipment, over voltage has a disproportionate effect on magnetisation losses. This equipment too is often designed for 110V and 220VAC, with windings placed in parallel or series to set the voltage.

We should have 220VAC as this is standard and easier to transmit than the other standard of 110V.

Though my background is in electronics I work in material processing. It is in IT where I see the cost of charred routers, access servers, switches, terminals and terminal servers. Computer room equipment can be given the right voltage of 220VAC via a UPS. It is here that I see equipment that looks as good as new and lacks 'that smell'.

Andrew Buckeridge,
BGC (Australia) Pty Ltd

Problems with greenpower

Early last February I began to seek information from my electricity supplier, United Energy, now Pulse, about contributing under the Green Power scheme. It was difficult to obtain even basic advice as the enclosed copies of letters demonstrate. I particularly wanted advice about whether my contribution would be part of the company's compulsory two per cent mandatory quota.

Sometime in early March a representative of your organisation was interviewed on the night-time program on ABC radio 774. As I had not received an answer to my telephone enquiries or to a letter I sent to Pulse on 2 March 2001, I rang the program and told my story, I was assured by your representative that my contribution would be additional to the mandatory two per cent.

From a very uncertain call centre supervisor I was later verbally informed that that was the situation. However my letters to the environmental manager continue to go unanswered. Naturally I have not signed up—one cannot have confidence in companies which are not prepared to answer letters requesting simple policy information.

I note that the National Green Power Accreditation Steering Group was preparing a full statement concerning this issue. Have you received their advice and are others finding it difficult as I have done to receive the information we need to make informed decisions?

Merle Mitchell, Springvale VIC

The National Green Power Accreditation Steering Group acts a bit like a quality control body and monitors the customer service performance of companies offering Green Power. The steering group comprises most state energy agencies. Each agency has a Green Power manager who discusses any problems they are aware of with electricity companies directly. I have passed your letter onto the Sustainable Energy Authority of Victoria where I expect it will be dealt with further.

You are not the first ReNew *reader to contact us about problems with gaining information about Green Power product. It is sad fact that while most retailers offer a Green Power product, not all can adequately deal with resulting customer enquiries. It is embarrasing for the electricity retailer involved that members of the community are more informed about their products than the staff at their own call centres.*

Kulja Coulston

Successful greywater systems in Arnhem Land

Glenn Marshall spent five years designing greywater treatment systems for use on Aboriginal communities in Arnhem Land. Here he describes the process he used for developing appropriate technology

It is essential systems are easily maintained by residents and local maintenance staff, in this case desludging a trap with a bucket and shovel.

For five years I have worked with Aboriginal people and others in Arnhem Land to design appropriate sewage systems for their homes and lifestyles. I wish to share my story of how an 'appropriate technology' was developed for people who until recently had no need for such systems. Instead they led fulfilling, nomadic lives in the bountiful north of Australia. The gulf between that traditional lifestyle and their current difficult circumstances is huge, and so I offer the caveat that the sewage systems we have developed allow these people to focus on more important life issues, without the additional worry of inadequate sanitation.

Maningrida is a community of 1100 people on the spectacular Arnhem Land coast of the Northern Territory, flanking the Liverpool River estuary. The town was created by the Commonwealth government in the early 1960s, supposedly to repatriate the 'rowdy Liverpool River mob' who were drifting into the fringes of Darwin. In the wet season, all roads are impassable and access is possible only via aircraft or a weekly barge from Darwin. A remarkable facet of Arnhem Land is the diversity of language groups in the region. Maningrida boasts six distinct local languages, as different from each other as English and Russian.

Sadly, the spectacular location of Maningrida has not buffered its people from the tragic social and health problems shared by Aboriginal communities across remote Australia. Television images of squalid scenes are not exaggerated. In Maningrida, illness rates are high and meaningful job opportunities are rare. Education standards are low, leaving young people ill-equipped to be proactive in a non-Aboriginal world. Culturally, people have not adapted well to a sedentary lifestyle.

Outstation life

My work was not in Maningrida, it was on the outstations dotting the surrounding country. In the late 1960s, older people began to move their families back to traditional clan areas, away from the problems of Maningrida. People camped around favoured surface waters, as they had done for generations. They continued teaching their children the ceremonies and lore of their country, and returned predominantly to a hunter-gatherer lifestyle (currently 70 per cent of people's food is collected in this way, the rest coming from the 'tucker run' store in Maningrida). Today around 700 people live on 33 outstations dotted over 10,000 square kms of pristine woodland, rainforest, wetlands, floodplains, river corridors and coastal habitats around Maningrida. They are collec-

tively known as the Bawinanga outstations and remain simple, small places with one to 10 houses, a water supply, sanitation systems, a few photovoltaic power systems, a fridge, satellite telephone and a track leading to the outside world.

The outstations are an eclectic mix of old and new. One night I lay in my swag on the fringe of an outstation listening to the sound of didgeridoos, clapsticks and singing. This competed with the nearby sound of *Baywatch* coming from a television sitting under a mango tree, with a dozen engrossed people huddled around it. On another occasion I was speaking via satellite phone to my brother in inner-city Melbourne. An old man wandered past me with a metre long barramundi hanging from a three-prong spear, having just speared it in the river nearby. As you can imagine, my memories of times in Bawinanga outstations are rich.

Rejecting 'code' approved systems

How did I end up there? In 1996, Bawinanga outstations received funding to construct 28 houses to help relieve overcrowding. A compulsory funding condition was the installation of code-approved sewage systems at each new house. Bawinanga personnel wanted to install smaller non-approved greywater systems, and so contracted me (a wastewater consultant) to design and trial appropriate systems, and gain approval from the NT Health Department to do this. It was a large project, eventually resulting in the installation of 77 systems and 1600 metres of absorption trenches.

The success of our greywater systems relates mainly to the process we followed. Before designing the systems we undertook a detailed examination of the cultural context, the lifestyles of users, the lessons learnt from previous systems and sought to capture the on-ground experience of Bawinanga personnel. This led to a design which was installed at three sites and rigorously monitored over three years. The system was continually modified based on the information obtained, and the current design is close to an ideal system for current outstation life.

History of water services

After people moved back to their land in the late 1960s, bores were sunk in the early 1970s. These now boast solar-powered pumps and work only when the sun shines (they have no batteries, meaning less can go wrong with them).

Planting and harvesting of bananas over greywater trenches is designed to reflect traditional food collecting techniques. In the background is a Bawinanga house with solar system on the roof, a kitchen sink on the verandah, and a stand-alone shower/ laundry to the right.

They have proved robust and successful, and nowadays deliver reliable, clean water to outstations via header tanks. Until the late 1980s yard taps were the only water points for people's needs. There were no formal toilets, showers, sinks or tubs on any outstations, although rudimentary pit toilets existed in some places. People were still mainly living in basic tin humpies, which has changed in recent years with the advent of a mudbrick factory in Maningrida and the subsequent construction of more robust outstation houses.

Failure of 'code' systems

In 1988, five communal ablution blocks were constructed on four of the largest Bawinanga outstations, following an increased national focus on Aboriginal health. They contained flush toilets, showers and laundry tubs draining to code-approved septic systems and absorption trenches. All units quickly became dysfunctional. Toilets were often without water for flushing, and a lack of toilet paper led to the use of rags, rocks, cardboard and other materials which clogged the system. Maintenance of the blocks was infrequent due to a lack of resources and Wet season access. The facilities had become health hazards, rather than health enhancers as intended, and Bawinanga staff had learnt valuable lessons in inappropriate systems.

Learning from the past

In 1995, Bawinanga began installing ventilated improved pit (VIP) toilets on outstations. These are dry pit toilets with a darkened interior to discourage flies and a vent pipe to remove odours. They have proved robust with low maintenance requirements (Bawinanga has limited maintenance capabilities due to a lack of resources) and are generally accepted by residents. Toilet enclosures are now manufactured at Maningrida by local residents, providing employment in the community. BAC staff indicate that the VIP toilets could still be improved to better suit the lifestyles of residents. In particular, toilets do not currently have any nighttime lighting and people are scared to enter them due to cultural beliefs. BAC has costed the installation of stand-alone solar lighting for the toilets, but has not yet installed any.

Also in 1995, Bawinanga began installing showers and laundry tubs on outstations. These are located separately from houses to limit health problems if systems fail. Bawinanga's poor experience with septic systems meant they constructed surface spoon drains to remove water from the showers, relying on soakage, evaporation and uptake by bananas to remove greywater. In many ways this was successful—it was low maintenance, simple and provided food for residents. Indeed it was no different than the way yard tap water had been disposed for many years, which contained significant food scraps, deter-

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Photo by Jan Rodda

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gents and other materials. However the drains were often clogged by chooks, dogs and pigs scratching in them, and accumulated water, mosquitoes and odours. The prevalence of hookworm and other water-liking pathogens in the Top End meant a health risk had been created. In addition, funding for new houses was conditional on code-approved sewage systems being installed, and spoon drains were outside the code. An irony is that even now many outstation residents still prefer yard taps to showers, despite long-term exposure to showers in Maningrida. I suspect this choice is a *response* to the exposure at Maningrida, where facilities and plumbing are often dysfunctional and unpleasant.

Designing systems for specific community needs

I had gleaned the above information mostly from long-term non-Aboriginal staff at Bawinanga, for a few reasons. During the pre-design period, Aboriginal outstation residents did not know me, and were reluctant to talk with me about sanitation. In addition it was not perceived as a high priority in their lives, and for many people English is only their third or fourth language, making it difficult to communicate complicated ideas on sanitation systems.

I relied immensely on the accumulated knowledge of three non-Aboriginal people called Ian Munro, Wayne Tupper and David Bond who had been Bawinanga employees for 10, four and 25 years respectively. They have forged close relationships with outstation residents and had closely observed the daily lifestyles of people. Ian and David have been largely responsible for the appropriate technology which has developed on Bawinanga outstations, having been present through all of the good and bad developments in previous decades.

Ian and Wayne felt that few greases were washed down kitchen sinks (important information when sizing the systems), and that showers would produce very little solids in the greywater, expect perhaps for mud washed from bodies after hunting trips in the mangroves. Both observations proved to be absolutely correct. The systems had to be robust, because although people look after their belongings, hardware is not treated with kid-gloves. The systems needed to have few moving parts to minimise failure, and could not have any electrical components (such as pumps) because many houses had no electricity supply and those that had small photovoltaic systems were not 100 per cent reliable. We also wanted to achieve good reuse of the greywater for food production.

Only after obtaining the above information did I design the systems. I cannot overemphasis the importance of designing to the lifestyle of residents, the lessons of the past and the maintenance capabilities of the users. The importance of these factors cannot be underestimated, and is often the reason for failures in 'aid projects' around the world.

Successful system design

In the original designs, greywater flowed to small (300 litre) concrete silt traps then to shallow sub-surface absorption drains planted with bananas and pawpaws. Separate systems were installed for shower/laundry blocks (which stood separately from the houses) and kitchen sinks (which were located on the verandah of each house). The traps were constructed to withstand accidental vehicle traffic, such as tractors with slashers cutting long grass after the wet season, and cars which often did not stick to formed tracks around outstations. The traps had heavy concrete lids which kids could not remove. An adult could remove them if maintenance was required, and the baffles in the trap were removable to allow cleaning out with a bucket and shovel if necessary (these are readily available on outstations, unlike septic pump-out equipment). Graphical signs were erected on shower walls showing how to clean out the traps if required (it has not been necessary after four years).

For the absorption trenches, we originally used Reln tunnels and gravel but then switched to strong Atlantis plastic tunnels. These were marketed as 'trafficable' so we installed a few and repeatedly drove a five tonne truck over them to test the claim. They stood up to the test and are now used across all Bawinanga systems, with four corner posts to mark their location. Another significant advantage of Atlantis is that gravel is not required around the trench before backfilling with soil, unlike Reln. The closest source of gravel for us was Jabiru, over 200 kilometres away, and at $200 per tonne was cost-prohibitive when we had 1600 metres of trenches to install.

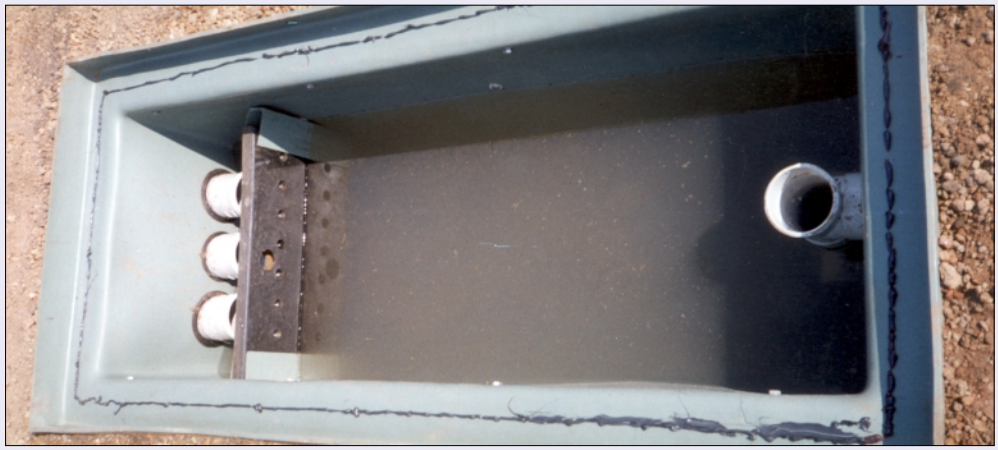
Bananas and paw paw essential to design

Greywater reuse was a major aim of the systems. Numerous discussions, particularly with outstation residents and with Wayne Tupper (who was the horticulture adviser), resulted in a system matched to the traditional hunter-gatherer habits of people. We did not aim to support vegetable gardens, as these have been tried on outstations with little success. There are strong cultural reasons for this, namely because Aboriginal people did not traditionally tend crops for later consumption. Instead people traditionally entered an area, intensively collected resources (such as lighting a fire to drive animals to waiting hunters), then left the area to regenerate its food supplies. We sought to emulate this with our greywater systems. We planted banana suckers and pawpaw seeds on top of the greywater trenches at the beginning of the wet season, allowing them to establish via rainfall. When the dry season arrived, roots were tapped into the shallow underground greywater and plants continued to grow with no extra irrigation. Towards the end of the Dry, people were harvesting pawpaws and bananas, and were as happy as Larry with the produce (pathogens in wastewater are not transferred through vegetation to fruit). The system has proved robust, with banana suckers resprouting after fire or damage by feral pigs or pet buffaloes, and people are happy to chop out old banana suckers to allow new growth in the coming Wet.

Gaining Health Department approval

Designing the systems was the easy bit. Gaining Health Department approval took over 12 months of protracted ne-

How Bawinanga greywater systems operate



On Bawinanga outstations, kitchen systems are generally separate from shower/laundry systems due to distance. In kitchen systems, greywater flows via standard fittings to a rectangular 300 litre concrete trap. The trap has one baffle designed to retain floating scum and grease. Trials showed that heavier food scraps sink to form a sludge layer, which then remobilises to the disposal trenches after partial digestion (monitoring indicated no impact on trench performance).

Three identical pipes exit the trap, leading to three parallel Atlantis trenches each 4.3 metres long (in sandy loam soils) and 250mm under the ground. One of the three trenches is passively rested by use of a threaded end cap over that outlet within the trap. The cap has a half-circle cut from it, and is turned so the uncut half is at the base. Therefore greywater only overflows to that trench if the two active trenches become overloaded (maintenance personnel will move the cap to the next outlet annually, meaning each trench is rested for one year in three).

In shower/laundry systems, there is no silt trap due to trials showing an almost complete lack of solids. Instead, all greywater flows to a standard distribution box, then is split to three parallel trenches of 11.3 metres each, with passive resting of one trench as with the kitchen systems. Bananas and paw paws are planted over all trenches, as described in the main text.

gotiation, because they were sceptical of the design's merits, and they had just released a new code stipulating a minimum size which was 10 times that of our systems (the NT code remains a prescriptive one, unlike other states and the national code which have moved towards site-specific designs, as ours was). Approval was eventually granted for three trial systems, which were closely monitored by myself every three months for three years. The trials proved very successful and have now been approved by the Health Department for use in all Bawinanga outstations.

The importance of regular monitoring and recording of data cannot be overstated. We regularly recorded populations in outstations, use of wet areas (by asking people and recording numbers of detergent and soap packets), water meter readings at kitchen taps, showers and laundry tubs to record flow volumes, measured sludge and scum build-up in traps at every visit, the physical resilience of systems as well as the ongoing performance of trenches and fruit trees, and the feeling of residents towards the systems over time. By monitoring over three years, we gained valuable insights into the appropriateness of systems. This was particularly clear after 18 months when one of the 300 litre trial systems seemed to be showing signs of slow failure. We subsequently installed larger 1,000 litre systems on other outstations, but ongoing monitoring showed the 300 litre systems were fine and we have reverted to them, since they are smaller, cheaper and more robust.

Everyone seems satisfied with the end-product greywater systems now installed on Bawinanga outstations. I stress again that this is the result of the process we followed, by considering the cultural context of the systems, the lifestyles and maintenance capabilities of the users, and the lessons learnt from previous systems before we designed and installed them. I trust that the wonderful Bawinanga Aboriginal people in the pristine beauty of Arnhem Land will rarely have to think of their greywater again, as they tackle more important issues and maintain their unique way of life.

Glenn Marshall operates Waterways Asia-Pacific from Alice Springs. He works with numerous remote communities to improve sanitation systems and water use. Further details of the Bawinanga greywater systems are available on request. He is the coordinator of the Arid Lands Environment Centre in Alice Springs. Contacts PO Box 294 Alice Springs NT 0871, ph: (08)8952 2497, email: aridlec@ozemail.com.au

Clever retrofitting provides more energy, light, comfort

Derek Wrigley tells us about the improvements he made to his Canberra townhouse: a solar reflector and roof ventilation system, sunshades and a 2.3kW solar array, which act together to offset his power use

In January 2000 our ACT Minister for Urban Services, Brendan Smythe, MLA, gave an impassioned speech on the announcement of the Photovoltaic Rebate Program (PVRP) organised by the Federal Government through the Australian Greenhouse Office. This proved to be a premature announcement as I subsequently found the bureaucracy was not ready to process any enquiries.

Having worked out that the roof of my house was suitable for such a PV array (area, aspect, angle, no shading et cetera) and that I really should be doing my bit to reduce the CO_2 levels in the atmosphere, I plunged into a rat race of five approvals. My Body Corporate approval went through without any problems. Design approval proved to be another matter. Hot water absorbers do not need approval in the ACT, so why should PVs? Enquiries about this at our Planning and Land Management authority met with the response of 'What are photovoltaic panels?' I knew I was in for trouble.

I learned later that the Minister was considering waiving approvals for PV arrays, but this had not been put into effect by the bureaucracy so I ended up having to pay over $400 in fees, some of which the Minister says will be refunded, but this has not yet happened. There was also a $250 fee to obtain approval from a privatised system of building design certification, which will not be refunded.

I applied to the local office for the rebate, but could not find a qualified installer, which is a requirment, as there were none in the ACT at that time. I was told that 'SEIA is running a training course in a few months'. We found a quasi-legal way around that one.

This photograph of Derek's house shows the adjustable sunshades he built and installed, and his 2.3kWH solar array which has already earned $87 in electricity credits in its first few months of power generation!

All this was a race against the impending GST which would have added something like $2000 to my bill, so I was more than anxious to get moving. (I just managed it.)

To test the field, I called for three quotes which were somewhat difficult to evaluate. One was from the NSW south coast and two from Canberra/Queanbeyan. The quotes varied from $14,500 per kilowatt installed to $12,480 per kW with no details given as to how the panels were to be fixed to the 10 degrees corrugated iron roof. It was not clear what I would be getting for my money (which could have ended up as a contractual headache) so I ended up organising and fixing the array myself—with considerable help from my (now) accredited installer at a nominal net cost to me of $5670 per kW for a 2.3kW array (no GST).

After assessing the characteristics of available panels I settled on Canon US64 amorphous silicon panels, tilted at six degrees above the 10 degree roof on a galvanised Dexion framework which I installed myself. There are two banks of 18 panels each with 500mm walkways around both banks (absolutely essential for convenient fixing and wiring up).

Accurate layout is essential, particularly in relation to the fixings to the roof trusses underneath. Allowing for thermal expansion, alignment adjustability and creep during fixing of the panels are also traps for the unwary.

I am very conscious that my array is not angled at an optimally efficient way for winter months. My reasoning being that as a low pitch means that cooling ventilation is slower to operate. Amorphous panels would be an advantage as they operate more efficiently in summer heat than do crystalline and, as a retired architect, I am very sensitive about the aesthetics of technology being 'stuck on' to existing roofs. I could not accept the appearance of an efficient angle of approximately 40 degrees on a 10 degree roof. And as part of my reasoning is to persuade others to install a PV system, I felt that it would be counter-productive to install something that would look ugly. Consequently, to compensate, I put on more panels than absolutely necessary, which made the array of two rows seem more integrated with the architecture. They are almost the full length of the roof and nobody has complained of their being ugly—quite the reverse in fact.

One side benefit of fixing the panels above the roof surface is that they provide a ventilated shaded area over most of the northern roof and over hot days in late December our house was around eight to 10 degrees Celsius cooler than ambient.

My inverter is a 4kW grid-interactive SEA model which will allow for a small extension of the array, should I ever need it.

ACTEW (our ACT electricity supplier) has been very helpful and has installed an electronic meter with a modem in the meter box which can be interrogated once a month to download the data from the system. ACTEW has kindly offered to provide me with graphs of my data.

This 2.3kWH array cost $13,000 plus Derek's labour, and more than offsets his household's power needs

The solar reflector system ensures that the south-facing living space receives double the exposure to sunlight.

I am also keeping detailed records of input and output data, weather and temperature in the hope of producing graphed records at the end of the first year of operation. After the first 100 days of operation I found I had exported an average excess of 1kWH to the grid every day and the figures improve considerably in summer with the sun more perpendicular to the panels, feeding up to 7kWH on a sunny day into the grid after satisfying my own domestic needs of around seven to nine kWH per day. My first electricity account since installation of the array indicates an $87 credit which is very gratifying. ACTEW is buying my output at the same rate up to net metering with excess export to the grid at one cent less than their selling rate.

One thing for others to bear in mind is that the figures I obtained from my inverter read-out were consistently up to 10 per cent lower than those I obtained from the electronic meter installed in my meter box. A query to SEA indicated that I should trust the supplier's meter as inverters usually read on the low side.

All in all, the system cost me around $13,000, having bought and fixed the array support system myself, but having a licensed PV installer to wire it up.

My overall feeling is that (apart from Siemens) panel manufacturers do not seem to have given enough thought as to how their panels should be fixed to roofs and they give very little or no help to self-installers. And the approval authorities need to understand the urgent need for cleaning up our environment and get their act together to simplify the red tape. It should not be so difficult to find one's way through the system. (See the article in *ReNew* issue 75 page 38 which will help you negotiate a grid-connect agreement with your power company.)

It would be really interesting to have other's views on the most efficient PV angle relative to latitude, as I have a suspicion that an efficient angle for flat plate solar hot water absorbers is not necessarily the same as for PVs which is usually latitude plus 10 degrees.

Would I encourage others to do as I have? Most certainly, from every point of view—if you have the money. My original calculation showed that I could anticipate a payback period of 16 years, but I suspect it might even be shorter than that. I can't really tell until I have a full year's figures on which to base my calculations.

I am now saving up to buy my electric bicycle which can be charged up 'free' from my system.

Solar reflector system

Aim: to improve the thermal characteristics of large south facing windows. Our existing townhouse has two large (2.3m^2) south facing windows, one in the dining area and the other in the main bedroom. Aspect is 15 degrees east of south and the only sun they receive is in the very early morning in midsummer.

The house already had a pergola with battens on top, but no solar rationale could be found for its existence, other than to grow vines on for some degree of privacy. The battens were reducing the amount of daylight entering the two rooms and were a painter's nightmare, so I pulled them off with an immediate improvement in the light quantity.

The corrugated iron roof has a 10 degree pitch enabling the sun to shine over the roof in the cooler months from around May to September, when sun penetration into the house is welcome for its heat and psychological benefit.

A carefully measured drawing of the window/pergola relationship convinced me that benefit could be gained by having large reflectors fixed to the pergola which could reflect the sun into the two windows.

Reflective film stretched on to wooden frames would have been a lightweight answer, but would have moved with the wind, giving a disturbing visual effect. The film was not given any reasonable life by the suppliers and its cost was not much less than polished stainless steel which would have an indefinite lifetime.

I then built a trial reflector panel consisting of a wooden frame to which I screwed a double sided, highly polished 0.7mm thick sheet of stainless steel about

1m^2 which cost around $70. I designed and made strong adjustable hinges so that the angle of the panel could be adjusted, but in practice I have never adjusted the panel, so a rigid, vertical fixing seems to be fine—and much cheaper.

The one panel worked so well that I made five others—three to each window, their lateral positioning being determined by the pergola beams—somewhat ad hoc but it works well. It is important to make sure the panels are securely screwed to resist wind gusts.

Around 9.30am the sun is reflected onto the internal west wall and slowly moves around the room to the east wall, finishing around 4pm, imparting a most pleasant warmth when sitting at the dining table for lunch—and of course the warm glow is very welcome. The panels have a total nominal power of 6kW, sufficient to nearly cause a small fire in the woolen upholstery of one of our dining chairs due to one of the panels becoming slightly concave and concentrating the sun. It was quickly corrected by making the panels slightly convex (10mm in 1m) and there has been no more trouble.

The really rewarding aspect of the panels is that they are self correcting for winter and summer sun angles. From late autumn to early spring the lower altitude sun reflects into the rooms and in summer the higher altitude keeps the reflection outside the windows. Since erecting the panels I have not had to adjust or clean them.

On an overcast day there has been an increase in the quantity of light in the rooms and there has been no problem with glare at all. Small areas of floor in the middle of the house receive double exposure to sunshine!

The panels are parallel to the road with a bank of tall eucalyptus between and their 'back ' surfaces reflect the tracery of the branches and leaves, almost camouflaging them from a passer's-by viewpoint.

Derek installed three highly-polished sheets of stainless steel outside of two south facing windows to reflect more light into his home.

It is truly a very simple, 'set and forget' type of installation, but it is important that anyone wishing to put up a set for themselves should do their homework. The geometry of sun angles and reflective angles—not only vertically, but horizontally as well—should be thoroughly explored relative to the house's latitude.

Sunshades

Aim : to enable more winter sun to penetrate the north windows and to completely exclude unwanted hot sun. The house had an existing wooden pergola on the north side with fixed battens on top which, while providing reasonable shade in summer, excluded at least 30 per cent of the available winter sun.

I looked around for a material which would exclude the heat yet be transparent to daylight and be ultra-violet resistant for as long as possible. It also needed to be fairly cheap and easy to fix and replace. The system should not require adjustment more than twice per year and be easy for a person with limited arm strength to manage.

I settled for adjustable wood framed panels fitting between the pergola beams, pin hinged near the wall and held in a winter and a spring/autumn position with stainless steel rods which provide a firm wind-proof fixing without the need for tools. When lowered between the pergola beams they are easily secured with stainless pins.

Finding the right shade cloth was a bit harder. No plastic material other than an off-white, knitted HDPE, 90 per cent shadecloth (Coolaroo) met all the criteria.

It has a good translucent colour and the knitted construction of the fabric has a reflective quality for daylight without transmitting the direct rays of the sun and so far it seems an ideal material. It is lightweight and easy to staple onto the frames. It had the added advantages of letting rain through the fabric onto the garden beneath and its knitted construction lets the wind through, limiting flapping to an absolute minimum.

The winter position is approximately 31 degrees above horizontal, but a higher position permits the warming sun in early spring and late autumn to penetrate as much as possible. By the time the sun is unwelcome inside it is time to lower the shades to the summer position. Five panels can be ad-

justed from a stepladder without tools in less than ten minutes.

Material cost per panel was under $15 plus my own labour.

Ventilation system

Aim : to cool the house without the need for an air-conditioning system.
The townhouse was built in 1984 and is traditional brick veneer with 75mm fibreglass insulation batts in the roof cavity. The unventilated roof space was unbearably hot and there was only token insulation over the ceiling.

A few years ago I installed R4 glassfibre batts over the whole ceiling and installed five ceiling skylight panels which brighten various dark areas of the house. With the aid of cords and screweyes the panels of prismatic acrylic can be lifted about 45 degrees to allow hot air to escape into the roof space. There are no hinges, which simplifies the construction. Sections of the corrugated iron roof were cut out in appropriate positions and replaced simply by translucent corrugated polycarbonate panels sealed down over the hole.

The main vent to the atmosphere is a ridge vent made of folded galvanised iron to match the roof slopes of 10 degrees, mounted about 150mm above the roof surface. Wind-blown rain is prevented from entering the opening by glued on expansion foam which neatly seals the corrugations. The actual ridge opening is about $2m^2$ in area, which matches the total area of the ceiling vents, and it is inconspicuously surrounded by bird wire.

Each ceiling vent is surrounded (in the roof space) by a stiff cardboard enclosure (reused from the photovoltaic cartons) stapled to the roof framing and painted gloss white inside. This increased the light quantity and eliminated the glass fibre smell. Some warm downdraft has been experienced on windy, hot days, but this is a minor inconvenience. It could have been resolved by a closing flap in the ridge vent, but that was an awkward and rather expensive solution which ranked low on a cost/benefit scale.

A similar house in our townhouse group was recently equipped with ducted air-conditioning at a cost of several thousand dollars, continuing running costs, noise from the heat pump system and an ongoing CO_2 contribution to global warming.

My costs for the ceiling vents, roof lights and the ridge vent were approximately $400 plus my labour—and no running costs, noise or CO_2 emissions. On very hot days our internal temperature has never gone above 26 degrees so I regard the measures taken as quite cost effective. ✲

Sustainable homes—buying not building

You don't have to start from scratch to have a comfortable, energy efficient home that protects the environment. Catie Dale and Ralf Pfleiderer suggest a number of features you can look for when buying or renting a house to reduce the effort and expense of making it sustainable

Finding a place with the potential to retrofit without costing the Earth can be done, but in all likelihood you will have to trade off between various energy efficiency features. Prioritise those features that can't be changed easily or without great expense over those which can be retrofitted. The orientation and design of the building 'envelope'—that is the floor, walls and roof—are fixed features and will have the greatest impact on how comfortable the house is and how economic it is to heat or cool, and therefore the overall energy consumption. 'The average household in Victoria spends over $2500 on energy annually and contributes some 15 tonnes of greenhouse gas emissions into the atmosphere each year'.

What you look for in a house will depend on the climate of the area. Concentrate on finding a house with features that will offset the season you find least comfortable, and therefore the season in which most energy is used on heating or cooling. When summer and winter temperatures vary significantly, there will always be a trade-off between summer cooling and winter passive heating or vice versa, but with some simple design features, your home may become up to 5°C warmer in winter, and 10°C cooler in summer.

Orientation

The main living spaces and day use (including outdoor) areas should face between 30 degrees East and 15 degrees West of North. The largest proportion of windows should face north to access the winter sun, but minimise high summer sun. The higher the heat storage capacity in the room, the larger the windows should be.

Ideal solar access is measured by the number of hours that the sun can shine into north-facing windows between the hours of 9am and 3pm on the shortest day of the year—22 June. In areas where winters are relatively warm, solar access should be a few hours. In temperate zones, solar access should be the entire six hours. It is important to separate solar access zones from areas that don't receive sun, (separating warm from cool rooms in winter and vice versa in summer) as well as heated or air-conditioned rooms from those which are not.

Structure

The cooler the climate, the more important is a well-sealed structure with no leaks or cracks. Cobwebs (because spiders like to build webs where there is air), and dusty fibreglass insulation are a good indication of air leakage. Access to winter, and to a lesser extent, autumn and spring sunshine, is a top priority. Look for large north-facing windows, preferably with double-glazing as the opportunity to retrofit such windows is rare, and internal heat-storing materials such as concrete slab floor and internal masonry walls that are exposed to sunlight to warm them. Internal fireplaces can be effective in absorbing heat from direct sun and releasing it into the house when the sun is gone. Conversely in summer they can act as a cooling device by absorbing excess heat from air in the room, so long as they are not exposed to direct summer sunlight.

Avoid houses that are overshadowed by obstructions to the north. In year-round cold climates, avoid shading the east or west unless shelter from cold winter winds is also a consideration. In such climates, outer doors should open on to a small entry hall, which can act as an air-lock between inside and outside. External brick or concrete should be avoided if possible as it will draw heat out in winter, and absorb heat in summer.

In warmer climates where night and day, or seasonal temperatures do not vary greatly, a lighter house construction (timber, fibro or brick veneer) will cool more quickly at night. This will also allow the house to warm up faster if heating is required. This is particularly important for bedrooms. Metal roofs also cool faster at night than tiles, and can be painted with a reflective white coating to reflect the sun's heat during the day. Look for good cross-flow ventilation with large, fully openable windows, positioned opposite each other and door openings, in order to take advantage of prevailing summer breezes. Open-plan living areas with high ceil-

An older style home with extension, viewed from the North-East corner. Homes like this have a lot of potential with the right modifications.

ings that maximise air movement and reduce radiant heat to occupants are also an advantage. Look for shade from verandahs and existing vegetation or overshadowing from nearby buildings.

In climates with variable night-to-day and seasonal temperatures, internal materials with good heat storage capacity, such as brick, concrete, or stone, will soak up heat from the room in hot weather. This works only if they do not receive direct summer sunlight. The hotter the summer, the smaller the windows (they should be primarily north facing), the wider the eaves and the higher the windows should be set under the eaves. The fewer windows facing east and west the better

In all cases look for eaves that provide protection on east and west windows and from higher summer sun shining in north windows as extending eaves requires major structural work.

Insulation

If possible, it is worth obtaining details on the level of insulation in the roof, walls, and floor. Insulation is easy to lay retrospectively in roofs with ceiling cavities, but difficult or impossible in flat roofs, floors and walls. New houses should have minimum R2.5 in the roof, as should renovations or extensions. In cold climates look for edge insulation on concrete slabs, insulation for timber floors and external walls, very thick ceiling insulation, and insulation of metal framing, if used. In hot climates, reflective foil insulation in the roof and walls is essential to reflect incoming sunshine, but bulk insulation prevents the house cooling down at night, so is not desirable unless air conditioning will definitely be used.

Retrofitting

If you've found a house with the above features you're off to a good start. You then need to consider what energy efficiency measures you will want to implement. Following are some features to look for, and hints on changes that can be made to the building to make it more energy efficient.

Appliances

Hot water heaters, air heating, and air conditioning are the biggest energy users. Solar water heaters are best, and gas appliances are preferable to electric appliances, in terms of running cost and emissions. If you are considering retrofitting a house with a solar water heater or photovoltaic panels, you need to consider solar access to the roof, including the orientation (north) and tilt of the roof, and its distance from and height of, adjacent buildings and trees that might cause shading, as well as obstructions, such as skylights, on the roof. It will be worthwhile investigating local council regulations on the installation of photovoltaics in particular. In the meantime look at improving the level of insulation on the pipes and tank of the existing water heater.

Outdoor sun control

If existing eaves do not provide enough sun protection, external fixed or adjustable louvres or blinds or slatted pergolas can be fitted on east or west windows. Vegetation can provide a similar affect (see the article on page 40 of this issue for further details). If you don't want to eliminate a view to the east or west, an extremely wide verandah can be used. It will provide shading for windows facing the view, as well as a large outdoor living area.

Floor covering

Cork and carpet are good thermal insulators so these floor coverings will prevent heat flowing into and out of a concrete slab floor. This is fine for heated rooms in cool climates without solar access, but slate or tiles (ceramic or stone) are better choices in rooms where the sun comes in. Wooden floors should be well sealed to prevent draughts.

Weather proofing

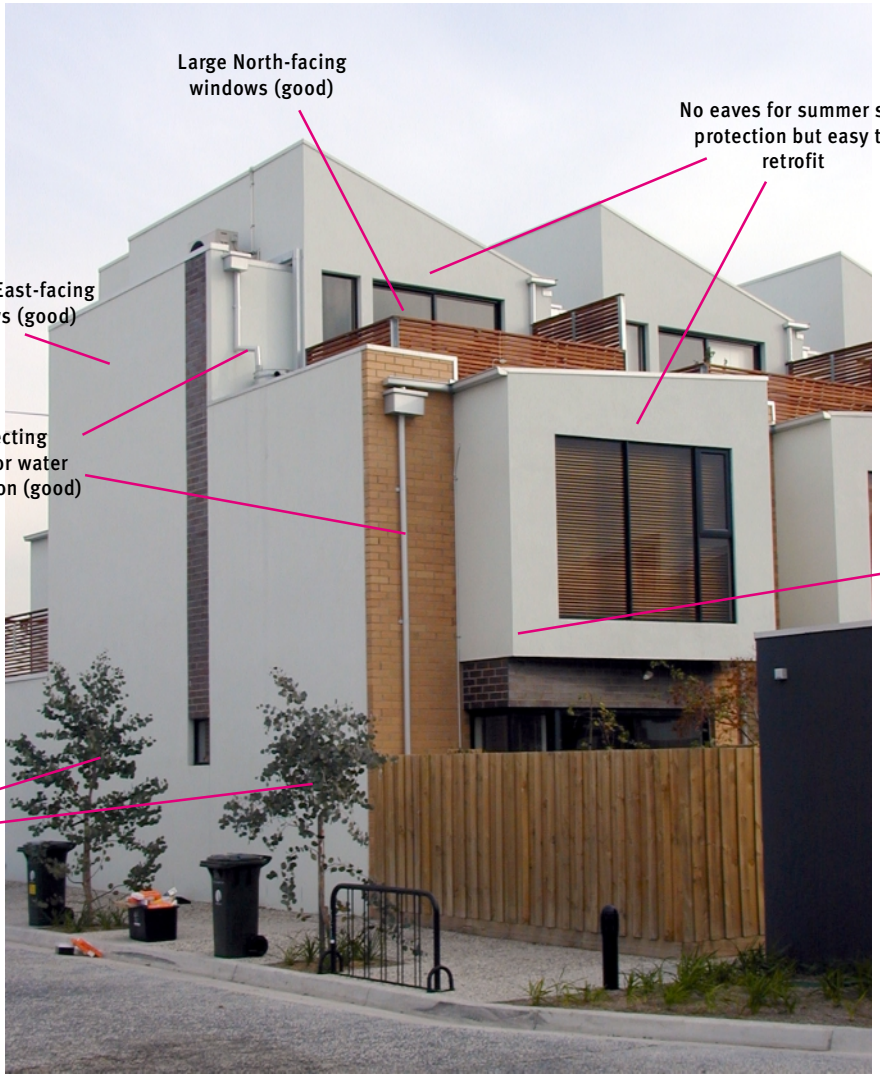
Weather seal all door openings, leaks, or cracks. Older houses especially may need holes filled. Look carefully at floor to wall and window and door frame joins. Avoid draughts by closing chimney dampers in open fireplaces if fitted and by draft proofing around doors and windows. Double glazing on south and north windows will reduce unwanted transfer of heat between inside and outside. Heat reflecting glass can be used but this also reduces natural light levels.

Water

Check that you can access waste water pipes easily for grey water diversion to the garden, and incoming water pipes for installation of a rainwater tank. Look at space requirements for such a tank and whether guttering will require repair or replacement.

Renting not buying

Some of the features discussed above are more difficult to find in rental houses. For rental properties, there is an incentive for house owners to use cheap components and appliances over more expensive energy efficient ones that have long-term financial benefits which the tenant, rather than the landlord, will reap. When looking at rental houses, factor the running costs of major appliances into the rent. Pay particular attention to components such as heating and cooling, water heating, cooking, refrigeration and laundry facilities.



Here we have a new two-storey townhouse viewed looking south-west.

Rental tenants are obviously limited by what is worthwhile in effort or expense for the period of the lease, and by the changes they are permitted to make. However, there are a number of simple and inexpensive things that can be done to make a rental house more energy efficient and sustainable. (The following things are just as worthwhile to undertake in a house you own.)

Use door snakes. This will stop cold breezes in winter and help trap cool air in summer, so you need less energy to keep your house temperate. Covering timber floors in winter will also provide some insulation.

Hang some curtains and keep them closed. By closing curtains during the day in the summer months you will keep the excess heat out of your house and help keep it cool. By closing curtains after dark in winter you will keep the warmth in and help reduce your heating costs. To prevent winter heat loss, close-weave curtains or blinds that extend beyond the bottom and sides of window are best. Boxed pelmets stop the continuous cycle of warm air flowing in the top of the curtain, being cooled by the window, and flowing out the bottom as it becomes more dense and drops.

Replace fittings. Compact fluorescent bulbs can be substituted for standard lightbulbs. Toilet cistern water savers are very cheap and easy to install yourself. Water saver shower heads and taps will help you save on water bills as well as on energy for water heating. Ensure tap washers are not leaky—the real estate agent or landlord should maintain this.

Check for a low maintenance garden that is not water intensive. Compost food and green waste to reduce the amount going to landfill. Worm farms can even be used on verandahs if you live in a flat. Use vegetation to provide shelter, but make sure you select fast growing plant varieties so that you can reap the benefits in the term of your lease!

It is worthwhile investigating what the landlord will pay for—for example, if no blinds or curtains are fitted you can often negotiate to have them installed before you sign the lease. It is also important to determine what changes you are allowed to make, such as putting up your own blinds or changing the garden.

For more information on how to modify the house to be more energy efficient, see the article 'Energy efficiency—how easy is it?' on page 42 of this issue. Also check out the What's on section on page 67 for details on the ATA's new Low Energy Homes course.

Investing in Australian renewable energy companies

Robert Rosen, lead columist for *ethical investor* magazine, believes renewable energy investments are continuing to strengthen. He points out current market issues, and identifies some managed funds and companies worth considering if you would like to put your money in 'responsible' hands

Despite the recent Bush Administration decision to back away from the Kyoto protocol, globally the outlook for renewable energy industry is still very buoyant. Global warming unfortunately is just not going to go away and what we are now witnessing is the early phase in a major transition away from fossil fuel dependence into a new solar age. Oil giants Shell and BP Amoco are both developing major renewable energy capabilities. BP Amoco has even gone as far as marketing itself as BP–'beyond petroleum'.

While Mr Bush's decision to withdraw from the Kyoto protocol has lessened the likelihood of tough action on emissions in the US—to the relief of many executives, the Pew Center, a group of 32 companies, including Boeing, International Business Machines, Du Pont, Shell and BP Amoco, that favour action on global warming, described Mr Bush's decision as 'a profound disappointment and, potentially, a serious setback to international efforts to address the very real threat of global climate change'.

Renewable energy targets

In Australia the Federal Government introduced Mandatory Renewable Energy Targets (MRET) on 1 April 2001. Under MRET large energy users and energy companies are required to source an extra two per cent of their electricity from renewable sources by 2010. The Government's renewable energy target seeks to increase the contribution of renewable energy sources in Australia's electricity mix by 9500 GWH per year by 2010.

The Federal Government's renewable energy targets are however rather low compared to European targets. The European Union intends to pass a Renewable Energy Directive later this year boosting the proportion of renewable energies in total power production to around 22 per cent by 2010. Even George W Bush, when Governor of Texas, set Texan renewable energy targets for 2009 which will do more for reducing greenhouse emissions than the Australian Federal Government's initiative.

In 1997-8 Australia's renewable energy use was about six per cent of total energy use. Of that six per cent, wood from home heating contributed 39 per cent, bagasse (sugar cane waste) used to generate electricity and steam, also contributed 39 per cent. Hydro contributed 21 per cent and only one per cent was generated by other renewables including wind and solar. In the electricity sector current use of renewables contributes approximately 10.7 per cent of electricity, much of which is generated from the Snowy Mountain and Tasmanian hydro electricity schemes.

Renewables expansion

The renewable energy sector is expected to expand significantly in Australia over the next 10 years partly in response to inevitable pressures on government to redress some of the massive imbalance of renewable energy subsidies compared to fossil fuel subsidies. Australia currently subsidises renewable energy by about $200 million per year, while direct and indirect subsidies to the fossil fuel sector amount to about $6 billion a year. Technological advances are also expected to make renewable energy sources more competitive. Many predict

that advances photovoltaic cell technology will make solar power a highly competitive alternative to coal fired power stations within 10 years.

The key areas of growth in Australia are likely to be in the increased take up of solar hot water systems and electricity generation from landfill,waste-to-energy conversion, solar, wind and mini-hydro.

Making sure your RE investment is ethical

It should not be automatically assumed that all renewable energy sources are necessarily socially and environmentally responsible alternatives.

Large-scale hydro-power projects in Asia have been responsible for the destruction of major ecosystems and the displacement of thousands of villagers. US energy legislation does not consider large hydro schemes a renewable source because the rivers being dammed aren't seen as being renewable.

In Australia the Federal Government's definition of renewable energy includes the burning or gasification of green and wood wastes, including forest residues. The Greens and Democrats opposed the Federal Government's MRET partly because of concerns about the targets including energy derived from green waste and so called forest residues. A number of environmental groups are also concerned that these targets may encourage more rapid clearing of native forests for the development of less biodiverse mono-culture plantations grown specifically for carbon credits benefits and biomass energy conversion. Recent US Department of Energy research suggests that the more diverse an ecosystem, the better it can serve to absorb carbon dioxide thus reducing greenhouse gas emissions.

Managed funds

In the US the US$54m New Alternatives mutual fund has focused on investments in renewable energy and energy efficiency for over 20 years. In Australia, given the limited range of suitable listed investment opportunities, it would be difficult to set up a green managed fund with such a narrow focus. The increasing number of listed Australian companies involved in renewable energy and energy efficiency is however providing a far better range of environmentally positive alternatives for green fund managers and individual ethical investors to choose from.

Local investment fund manager Australian Ethical Investments has always been a strong supporter of both listed

Some Australian-listed renewable energy companies

Solar Energy Systems

The company's goal is 'to take water and electricity to people and the planet using the primary power source (the sun) in the most efficient, environmentally responsible manner possible.' Its products are ideal for use in third world countries and are able to take advantage of subsidies available for the development of appropriate technology in small-scale communities. Solar Energy Systems has developed solar applications suitable for remote area power systems (RAPS), including a light sensitive, programmable electronic tracker – the Sun Tracer. The company has also developed the Poly Piston Pump, which is a simple and practical solar pump also well suited for installation in remote areas. Solar Energy Systems are also involved in the development of a small scale 400 litre per day solar water plant for purifying polluted or brackish water.

Renewable Energy Corporation

The company is involved in the conversion of waste to energy using its patented Waterwide combustion process. This gasification process enables emissions to be controlled during the combustion phase rather than afterwards, resulting in low emissions levels. The final burnout of the process is at very high temperature which ensures that all smoke and volatile matter is eliminated. Suitable waste materials range from high moisture sludge, pre-sorted municipal solid garbage, green waste and industrial wastes. The company claims that installations fuelled by 'clean' fuels such as wood or other biomass generally will require no further emissions control, except where local conditions or regulations are particularly demanding. Fuels containing sulphur, chlorides or other noxious materials would however generally require the addition of an emissions control unit. There are currently over 600 Waterwide plants operating in 31 countries.

It should not be assumed that in all instances these processes would create the best environmental outcome. Waste reduction and recycling would in many situations be a preferred primary strategy to gasification. The benefits of power generation from green waste by Renewable Energy Corporation and other companies in Australia including Envirostar Energy need to be carefully assessed on a case by case basis.

Pacific Hydro

Pacific Hydro has interests in hydro, wind, geothermal and cogeneration energy systems. The company operate a hydro electrical project on the Ord River in the Kimberley region, supplying up to 220GWH of electricity per annum. They also have three hydro projects in Victoria with a total annual generation of 34GWH.

Pacific Hydro has a 50 per cent interest in the 70MW Bakun A/C hydroelectric scheme in the Philippines. The plant was commissioned in September 2000. The Company also has a 42 per cent interest in a second 68MW proposed hydro scheme at Tagoloan in the southern Philippines.

In 1999 Pacific Hydro, together with Todd Energy, acquired geothermal, hydro and co-generation facilities in the NZ Bay of Plenty area. These facilities supply power to 22,400 customers. The company is building the 18.2MW Codrington wind farm near Port Fairy in Victoria to be complete in mid-2001 and is also planning a 150MW wind farm at four locations near Portland, Victoria, with a potential for 100 wind turbines. This is expected to provide 450GWH per annum of power or enough to supply 100,000 homes.

Advanced Energy Systems

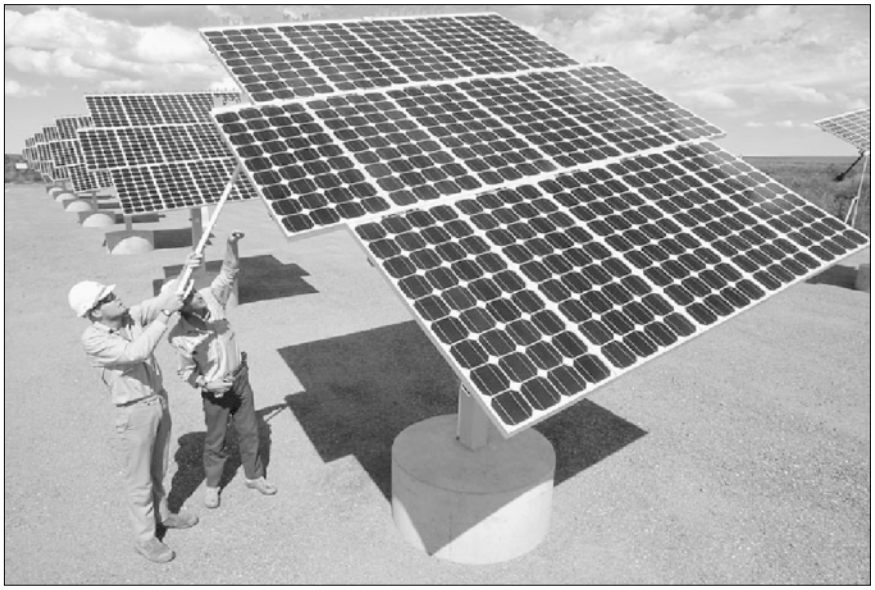
Advanced Energy Systems is a Perth based company that listed on the Australian Stock Exchange in 2000. The company supplies solar and wind energy technology products, diesel power systems and hybrid diesel and wind power systems. Advanced Energy also provides power-conditioning systems that convert direct current from batteries to alternating current as well as battery backup facilities. Products are available for both grid connected systems and stand alone remote area power systems (RAPS). The company has been involved in projects around the world, including a diesel/solar hybrid power station for a tourist resort in Belize, Central America, a community solar system on Sagar Island, India and hybrid power systems for both the US Army and the US Airforce.

Energy Developments

Energy Developments is primarily involved in the extraction of landfill gas from old tip sites. The extraction prevents greenhouse gases escaping into the atmosphere. About 50 per cent of the gas is methane which is 20 times more damaging a greenhouse gas than carbon dioxide. The gases are converted into electricity and sold to local electricity authorities. This process has the combined benefit of creating a new source of energy while also reducing greenhouse gas emissions. However even this very positive process is ultimately dependent on an ongoing supply of major new landfill sites, which is not a sustainable waste management option. The company has about thirteen such sites in Australia and is involved in developing sites in the UK with the British Government and in France with the utilities giant Suez Lyonnais des Eaux. Energy Developments have also been awarded a contract to supply power to Pasminco's Century Zinc Mine in Queensland.

The company's other major direction is the development of its SWERF process which separates organic from inorganic waste at tip sites and then gasifies the organic waste to fuel power plants. A test plant is operating near Brisbane and the company has commenced the construction of its first commercial plant for the Wollongong City Council.

Company profiles compiled and selected by Robert Rosen



and unlisted companies promoting renewable energy or energy efficiency. Their positive ethical criteria include seeking out 'investments that provide and support … the development of appropriate technological systems'. Australian Ethical's investments in renewable energy and energy efficiency include:

Advanced Energy Systems (solar and wind power), Energy Developments (landfill gas conversion to energy), Environmental Solutions International (oil from sludge), New Generations Technologies Pty Ltd (alternative energy products retailer), Orbital Engine Co (energy efficient engines), Pacific Hydro (hydro and wind power), Rainbow Power Company (small scale solar and micro-hydro), Sky Solutions (daylighting components for low energy buildings), Sustainable Technologies (energy efficient window technologies).

AMP's recently launched Sustainable Futures Funds screening criteria include energy conservation and renewable energy as 'areas of support'. To date in Australia they have invested in Energy Developments, Renewable Energy Corporation (waste to energy systems) and Solar Energy Systems (grid and remote solar power systems and solar pumps). Their Sustainable Future International Share Fund investments in renewable energy include, Ballard Power Renewable Energy in Canada and Vestas Wind Systems Renewable Energy in Denmark.

Challenger's Socially Responsive Investment Fund has only a broad positive environmental investment criterion but has investments in Advanced Energy Systems and Energy Developments.

Companies with some RE interests

A number of larger Australian-listed companies have some involvement in renewables and energy efficiency. Australian Gas Light (AGL) is developing a $5m plant to extract methane gas from Melbourne Water's Werribee waste treatment plant and has completed installation of a 3MW methane gas powered co-generation plant for Sydney Water at their Malabar sewage treatment plant. Brambles in Taiwan provides waste-to-energy recovery from landfill gas and Lend Lease was the developer for the Sydney Olympic Athletes' village which is part of the Newington residential development at Homebush, the largest solar powered suburb in the world. Wine producer Southcorp is also a major manufacturer of solar hot water systems both in Australia and USA, and Telstra plays an important role in the development of remote area solar systems in Australia.

See the table opposite (page 32) for companies identified by Rosen as being Australian-listed ethical renewable energy companies. ⋆

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Solar power your home entertainment system

A solar system doesn't always have to break the bank. Andrew Moore chose to run his television, stereo and Sony Playstation from a small solar system and learned a lot in the process

My partner, Beth, and I decided to make the Perth house that we were renting more environmentally friendly. The house is a standard two bedroom, one bathroom home built in the 1930s.

To begin with we purchased compact fluorescent light bulbs to reduce our power consumption and a worm farm to recycle our organic waste and constructed our furniture using recycled timber. We ride bicycles instead of using a car and grow a vegetable garden in large pots. To reduce water use we purchased a water efficient shower head which reduced shower water consumption by 40 per cent. We decreased the flush volume in the toilet by putting a large brick in the cistern (simple but it works). So what comes next? A renewable energy system!

I have been reading about renewable energy for several years, but have not applied any of the knowledge that I had gained until now. I kept making excuses to myself like, 'I will wait until we get a home of our own...'. We were not ready to settle down and buy our own house yet, so we decided to get on with it while we were still renting. We designed a basic solar electric system to run some appliances in the lounge room, as that is usually where you will find us. The system is small but does the job. It can run a 51cm television, video, stereo and some lighting for several hours a night. It has one solar panel, battery bank, regulator and an inverter. It has been running like a dream for more than a year.

The first thing people ask when I tell them that I have a solar system on my rental house is 'What does the landlord think about that?' Well for us it was not a problem as Cassy is a good friend of ours, is studying environmental science at university and shares the house with us.

Andrews's first step towards a full home system

System specifications:

- Canon 64W amorphous silicon solar panel $500
- Plasmatronics PL20 regulator $270
- Jaycar 300W modified square wave inverter $199
- five 12V 36AH Sonnenschein batteries & leads (Free)
- Wiring, shelving & misc $45

Total cost $1000

That said, we have not made any permanent modifications to the house. Everything is installed on a temporary basis so that we can take it with us when we do get a place of our own. All components of the system were chosen so that we can expand its capacity in the future.

Where do you start?

To start with I had to find out just how much power each appliance consumed. The power ratings that are on the back of appliances are the first thing to check. They give you an idea of how much power the appliance consumes. Often the power ratings are the maximum consumption and under normal use they draw much less. I had a sparky mate make a junction box so that I could measure using a multimeter what each appliance actually consumed. Our television is rated at 110 watts but only consumed 55 watts when tested. This was a good start. The video recorder is rated at 21 watts and was tested at seven watts (maximum consumption), likewise the stereo is rated at 120 watts and

Solar-powered Playstation—this system can provide hours of fun.

tested at 20 watts (ranged between 15 and 45 watts depending on the volume). This made things look a lot better than the appliance labels wanted us to believe. The total load based on the appliance labels should have been 240 watts but actually it was only 82 watts.

After looking up annual solar radiation figures for Perth, estimating how much TV we watch, and doing a few quick calculations I decided that we could get away with one solar panel in the 60-plus watt range. If the appliance load was actually 240 watts, and not 82 watts, we would have had to buy three solar panels which would have made the system twice as expensive.

Selecting a solar panel

For our system the solar panel was the most expensive component so I spent some time finding one that would be best suited to our needs. The solar panel that I chose was a Canon 64 watt amorphous silicon triple junction panel. There are several reasons for this choice. First, the panel has no glass to worry about—the silicon is laminated onto stainless steel, making it extremely robust. Cost per watt (*ReNew* issue 70) shows the panel to be very cost effective. Many solar panels lose efficiency when they heat up to operating temperature but the Canon panel retains its rated current output (*Home Power* magazine). Factoring this into the cost per watt calculations made the Canon panel very competitively priced.

The roof of the house that we are renting faces due north at an angle of 24 degrees, so orientation to the sun was not a problem. The panel is tied down to the corrugated iron mounting bolts using fencing wire. Several pieces of timber stop the panel coming into direct contact with the roof to minimise corrosion. To get the most out of your solar panel it should be mounted on a frame that is adjustable to the corresponding angle to match the season. In Perth, that means 15 degrees off horizontal in summer and 60 degrees in winter. These figures vary depending on where you live (*The Earth Garden Book of Alternative Energy* has more information on this). If I mounted the panel at 60 degrees in winter I could expect 20 per cent more power than I would get with the panel at 24 degrees. Being 15 degrees out makes negligible difference but any greater than that and you should adjust the angle of your panel. The trigonometry that I did at high school has finally been useful for something!

As the house is a rental every component of the system is mounted on a temporary basis without any permanent modifications being made. This method of mounting the panel is by no means ideal but for a small, temporary system it works just fine. Ideally when setting up your own solar power system in a rental house you would mount the panels on a frame in the back yard at ground level, thus making it easier to get to and potentially causing less problems with your landlord.

Wiring it together

Twin core, double insulated, six millimetre square wire is used to wire up the panel to the regulator, which is about 10 metres away in the bike shed. You have to be careful about the wiring that you choose as you can lose a lot of your power before it even gets to the battery bank. Your friendly renewable energy retailer should be able to help you with this. It is not easy to find other retailers that sell suitable high current wire, so save yourself the time and get the wiring when you buy your solar panels. Try to keep the runs of wire as short as possible to save money and reduce the power lost in transmission. I used three circuit breakers in the system to protect components from any short circuits.

The regulator

A regulator is a device that is wired in-between your power generator (solar panel, wind turbine, or whatever) and battery bank to make sure that the batteries are not overcharged.

Choosing a regulator was quite easy. I wanted to expand my system when my finances allowed and did not want to purchase things twice. I could have saved money and bought a simpler regulator but instead I chose to get a Plasmatronics PL20. It does so much more than just regulate input power. It is the brains of my system that regulates, monitors and records statistics on the whole system. It records battery voltage maximum and minimum, amp-hours received, amp-hours consumed, state of charge and a whole lot more.

Each day I ride home from work, put my bike away in the bike/battery shed and check how much power the solar panel has generated courtesy of the PL20. I then know how much we can use that night without wringing out the battery bank too much.

Energy storage

I managed to get hold of some second hand batteries that were headed for the

recycling heap. They are all 12 volt, 36 amp-hour Sonnenschein deep cycle Gel cells. They are not the most suitable batteries as they have only a relatively small capacity but they are all in good condition, require no maintenance and were free of charge. I have five of these wired up in parallel. Often batteries are removed from equipment, such as wheelchairs and forklifts when they are serviced, and are disposed of even though they still have several years of life left in them.

I have been told that having batteries wired up in parallel will cause them to degrade or 'fight' with each other until the capacity of the battery bank is greatly reduced. As I did not have to pay for them I can afford to experiment with this. So far we have had no problems. We have a couple of spares if one does fail. Eventually I will purchase a battery bank that is better suited to the system requirements but for now it works fine.

The batteries, inverter and regulator are mounted in a shelf made from recycled timber that is all stored in the bicycle shed adjacent to the house. The shed is well ventilated so any explosive gases should not accumulate.

The inverter

The inverter enables us to run 240 volt AC appliances from a 12 volt battery bank. It converts the 12 volt direct current (DC) to 240 volt alternating current (AC).

There are a lot of things to consider when purchasing an inverter. Should I get a modified square wave or sinewave? What capacity should it have for constant and surge loading? How efficient should it be? Do I need extra features? I knew that I wanted it to be able to power a 51cm TV, stereo and video which had a total potential load of 240 watts, according to the ratings on the appliances.

TVs generally require quite a large surge of power to start up so it needed a good surge rating. Often when you run audio and video equipment on square wave inverters there can be an annoying buzz sound coming from the appliances. Sinewave inverters alleviate this problem by having a smoother AC wave form but they are much more expensive. Efficiencies of inverters vary but generally they are around 90 per cent efficient.

The inverter that I chose was a 300 watt Jaycar modified square wave inverter that cost $200 on sale. It has a surge load rating of 1000 watts that is enough to start our 51cm TV and is rated at 85 per cent efficiency. It runs the TV, video, stereo and Sony Playstation all at the same time with no problems at all. It is still a good idea to turn the TV on first and then turn on any other appliances otherwise they struggle while the TV starts up. There is a slight buzz in both the TV and stereo transformers but it is very quiet and you can only hear it if you know what to listen for. I even ran a 68cm TV on this inverter with no problems at all. The build quality of the 68cm TV was far better than our 51cm and it ran without any buzz or hum whatsoever. The 'soft start' ability of the larger TV meant that the inverter was put under hardly any surge load so started much better, not affecting other appliances that were already running.

One other function that would be handy to have in an inverter is an automatic start. This basically means that the inverter turns itself on only when you start using power. The inverter we chose does not have this functionality and has to be turned on manually. We could be lazy and leave it turned on all the time but it consumes about three watts when idle. This adds up to three watts x 24hrs = 72 watt hours. I would prefer to use this power on running the lights or TV. Initially we had to run out to the bike shed every time we wanted to turn the inverter on or off. The novelty of doing this wore off pretty quickly. A simple solution was to install a 'remote switch' to turn it on and off. A 50 amp relay installed between the batteries and the inverter did the job well.

Spanning the gap

To get the 240 volt AC power from the inverter in the bike shed to the lounge room we ran a standard heavy duty power cord under the eaves of the house

and in through the lounge room window. This window is now permanently locked open just enough to let the power cords in. The wiring for the inverter remote switch and a 12 volt DC power cable (6mm twin core wire) also follows this path. The 12 volt DC power cable supplies power to the 12 volt fluorescent lighting in the lounge room.

Control centre

A four socket power board with a switch on each socket is used to control which appliances are on and to remove any phantom load when the appliances are not being used. The television and stereo consume eight watts each when they are not even in use. If we are not using an appliance it is turned off at the wall so it does not waste any of our precious energy.

In-house volt meter

With a small solar system such as this it pays to be mindful of the system voltage so that you do not discharge the batteries too much. Ideally you do not want to discharge them more than 50 per cent of their capacity. To help keep an eye on the battery voltage I plugged a cheap multimeter into the wires that power the 12 volt lights. Turning the lights on does affect the reading (as they are on the same wires) but you can still get an idea of the system voltage. We have had to be a bit careful of how much power we use during the winter months.

The system was designed to run the TV for about three hours per night and a bit extra during the day on the weekends. If the system voltage is very low or we are going to watch heaps of TV during the day we just unplug the power board from the extension cord and plug into the mains power. Once every few weeks in winter we needed to use mains power and let the solar system fully recharge itself. In summer there is more than enough to go around.

Does it work?

Yes! The system works very well in summer, in winter we have to be a bit more careful with how much power we use. This means thinking about how much rubbish we watch on TV!

In the future I would like to expand the system with the addition of a larger capacity battery bank, more solar panels, and a small wind turbine. For now I still have to build a variable angle mounting frame for the solar panel to increase input in winter.

Overall it has been a very rewarding exercise. I have learnt so much more about renewable energy and I can now tinker with the system and do my own experiments. I highly recommend it to anyone who is thinking of having their own system.

Veggie oil van reaches desert horizons

Zoe Bishop chased down the owners of this van to find out their recipe for cleaner transport

Detectives were sent deep into the Australian desert recently to defect a van allegedly running on veggie oil. A victimless crime you may argue, more a commendable act of eco-friendly travelling. What's illegal about unburdening fish and chip shop owners of greasy waste? Or avoiding revving diminishing fossil fuels into the bright blue desert sky?

When police finally did catch up with the Labrats' camouflage painted van pulling its silver caravan, they also reluctantly found nothing to actually charge its owners, Izzy and Marc, with. The motor was unchanged, and therefore legal. They had to settle for grumbling about dirty license plates.

So why were these coppers so interested in the Labrats? Perhaps they'd heard reports that these campers harbour not just one but three sources of sustainable energy, and they are not just innocently travelling Australia, they are also educating and inspiring it.

'The message is that there is an alternative, we are living it and you don't have to be a millionaire or a scientist to work it out,' says Izzy about their wind powered cinema and solar-powered sound system pulled by a veggie oil van. The set up was designed, acquired and 'mutated' by Izzy and Marc using materials found, donated or invented.

After seeing a documentary about the Bougainville Revolution Army who ran their vehicles on coconut oil, they converted their own vehicle using trial and error, with old car bits found discarded in the desert.

The vehicle starts on diesel or biodiesel for 10 minutes until the oil is hot enough and can be switched straight to pure veggie oil.

To build a heated fuel tank they welded a copper coil into an old Mazda fuel tank. Then they put together new fuel lines for the veggie oil, and got a strong diesel fuel pump to pump the oil to the motor. For heating the tank they ran some heater hose from the radiator to the copper coil and then back out to the radiator. To catch gunk they installed a fine mesh screen near the motor. For switching from diesel to veggie oil they added a tap into each fuel line.

The vehicle starts on diesel or biodiesel for 10 minutes until the oil is hot enough and can then be switched straight to pure veggie oil. This method also avoids the processing and additives used to make biodesiel, which would be dangerous and time consuming for a mobile system, and difficult to acquire in remote areas. On departure, the exhaust emits the delicious smells of fish and chips, or donuts, depending on the past life of the fuel.

On the roof of the van sits three 80 watt solar panels and inside ride four 12 volt batteries. The caravan stores six 6 volt batteries and carries another 80 watt solar panel. Attached is a light-weight 12 volt 400 watt Air303 wind turbine, which works perfectly in desert winds. The tower for this is a seven metre high extendable pole which was constructed from fence posts found at the Alice Springs tip. This turbine runs

a video projector, video players and a small music studio.

Continued frustration with the mainstream media was one inspiration for making the wind-powered movies. The Labrats show mainly political, environmental and activist films.

'A lot of the footage we show is sent to us from SKA community TV in Melbourne which produces grassroots docos about local and overseas issues. Our main aim is to show people what they won't see on TV,' said Izzy.

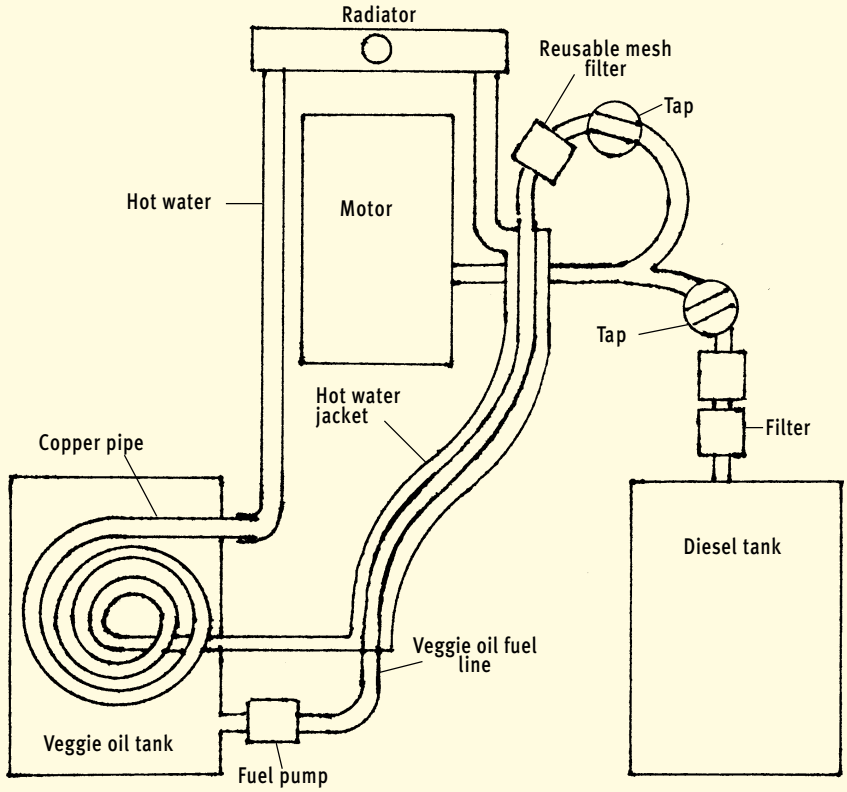
One Labrats movie night was outside the gates of Western Mining Corporation's Roxby Downs Uranium mine in South Australia. As the mine lights blinked nearby like an angry volcano, activists and miners shared sausages and watched a Chernobyl documentary. Police in riot gear hovered in the background expecting the BBQ to turn into a war zone, but no one was hurt—just better informed.

The Labrats' setup is a real head turner—because if you don't check it out it'll be gone. Although turbines and solar panels are becoming a common roadside sight, and Australians are warming to solar and wind power becoming part of their homes, a completely mobile sustainable cinema, home and sound system gets a lot of attention.

'The chip shop people love us because we take away all the old oil. The working class, like farmers, think we're great because they're always looking for cheaper ways to run their tractors, and we practice what we preach. The Aboriginal mob love it because they're natural bush mechanics and can relate to it. People also like the fact that the message of their struggles is getting out to a wider audience through the cinema and the music.'

And the police? Well maybe they're trying to work out how to get that delicious donut smell coming out of their own exhaust pipes.

How to run your vehicle on straight veggie oil



- You must have a diesel vehicle
- Collect used oil from fish and chip shops, pubs, service stations.
- Filter all the crumbs, chips, batter by pouring out the oil through fine mesh and material
- Get another fuel tank and install a heating system into it, you can use the hot water from the radiator by putting a copper pipe inside the tank for the water to circulate. This is very important because cold oil will not work
- Depending on the position of the tank you will probably need a fuel pump to get the oil to the motor
- You will need to install a reusable mesh filter on the fuel line that you can easily remove to clean
- This veggie oil fuel line must be heated
- Cut the diesel line just before the motor and install a tap and a T-junction
- Install a tap on the veggie oil fuel line and attach to the T-junction
- Bleed the diesel oil into the fuel lines
- Run the motor on diesel for 10 minutes until the oil in the tank is warm, then turn the veggie oil tap on and rev the engine.
- Turn the diesel tap off and away you go!

Important! Before switching the engine off, turn diesel back on and veggie oil off so as to rinse engine of oil. Run for five to 10 minutes, then it is safe to turn the engine off.

Deciduous planting for passive solar design

Jillian Sorrell from the CERES permaculture and bush foods nursery highlights the benefits of using fruit trees as part of your home's design

A great way to incorporate some ideas in passive solar design around the house is to plant deciduous trees. Some of the incredible benefits of doing this are by creating protection from harsh weather and providing animal and bird habitat. Deciduous fruit trees have the added benefit of supplying the occupants of the home with fresh produce.

Consider planting a row of plum trees along the western side of the house. The dense foliage in summer acts as a shade screen and protects the house from extreme heat. This helps to keep the walls cool and therefore the house interior is comfortably habitable. This is a welcome relief for anybody who has a bedroom on the western side of the house. The trees also act as insulation and will trap cool air against the house when the sun goes down. Opening a window at dusk allows the cool air to breeze in, laden with the fragrance of fresh fruit!

The other factor to consider is that the trees will buffet strong westerly winds away from the house. The area immediately inside the garden will often be very calm on windy days.

This design is also very important in the winter and cooler months. As the trees begin to lose their leaves, providing a wonderful mulch for the garden, they allow more sunlight in to reach the house. The winter sun is much lower in the sky than at other times of the year. It also tends to remain on the side of the house for longer periods. The leafless fruit trees are generally pruned at this time of the year eliminating unwanted excess branches. The maximum amount of sun helps to heat up the walls and shine through windows, thus creating a warm, cosy interior. The heat absorbed by the walls will also radiate into the house long after the sun has gone down in the evening.

When this deciduous grape vine drops its leaves it will provide much-needed light in winter. In summer and early Autumn when the sun is strong the windows remain shaded.

If you live in a house that has only a small garden and doesn't allow the planting of many fruit trees, then consider espaliering the trees along a fence. This is the method of training trees in a formal fashion and has been in use in Europe for centuries. There are some very good books available that offer detailed information on the methods and different designs of espalier. Ask the horticulturist at your nursery about their thoughts on methods and tree selection for the process.

Some other points to consider are the spectacular display of leaf colour in Autumn and the beautiful blossom in Spring.

Deciduous vines are another alternative to consider when incorporating passive solar design into your home. There are many fruiting vines such as Kiwifruit *(Actinidia deliciosa)*, Passionfruit *(Passiflora edulis)* or Grapes *(Vitis vinifera)* that can be grown successfully even in the cooler climates. Vines can be grown over fences all around the house or up over the veranda awning to act as an insulation. Like fruit trees, deciduous vines will allow sunlight to heat up the house in winter and keep it cool in summer.

The possibilities for tree selection are boundless, consider almonds, apricots, nectarines, apples, peaches, quinces and more. The beauty in all this design is the functionality of it and the joy of

plucking fresh, sun ripened fruit straight from your own tree.

Using native plants

Native trees and shrubs can also be used for the purpose of passive solar design. As Australia does not boast many deciduous trees of its own, it is more likely that a well-managed native garden with a combination of smaller bushes and trees would provide the best design results.

Raise the canopy level with larger trees for shading from high summer sun and use semi-shading trees and shrubs as an understorey. Many tree species, such as Wattles (*Acacia sp.*), respond well to strategic pruning, enabling you to increase the amount of light access through the understorey in cooler months. Other spectacular native trees to consider for flower and fragrance are Native Frangipani *(Hymenosporum flavum)*, Blueberry Ash *(Elaeocarpus reticulatus)* and Lemon Myrtle *(Backhousia citriodora)*.

This espaliered apple provides a good fence boundary while protecting the wall from the sun and weather. Picture taken in Autumn after many leaves had dropped.

While a native garden may be preferable or more appropriate for some sites, many people are understandably reluctant to plant eucalypts close to their homes for fear of them dropping limbs. But before discarding the idea of using natives, consider the area you wish to shade—you may not require large trees for the job and your local nursery may have a number of options for you. Native plants that are indigenous to your area are often much more hardy and adaptable to your climatic conditions. Ask at your nursery for appropriate species selection and layout. ✲

Energy efficiency—how easy is it?

The energy crisis in the US could have been avoided by implementing energy efficiency measures, rather than trying to meet demand. We take a look at some simple ways that anyone, anywhere, can use to save energy

By Lance Turner

We have been hearing a lot about the energy crisis in the Unites States lately, and here in Australia we have also had severe power restrictions on occasion in some states.

While building more power generation plants to meet peak demand may seem to be the only answer touted by the energy industries and governments, in fact it is a bandaid measure.

The fact is, a vast quantity of power used in this and most other western countries is simply wasted due to inefficient homes, buildings, appliances and industrial processes. So, why generate additional power to supply inefficient machines when simply changing over to more efficient devices and systems would solve the problem and reduce power consumption and greenhouse gas emissions?

It seems that this question is being asked all over the world, but unfortunately there seem to be very few actions forthcoming. However, while most people may think that there is little they can do personally, there are in fact many ways the average citizen can greatly reduce their energy use and thus greenhouse gas emissions.

Refrigeration

There are many items in the average household that waste a lot of energy, but the largest potential waster is the humble fridge. This appliance is often responsible for 25 per cent or more of the total electricity consumption of the home, yet most fridges use this energy with abandon, wasting it in many ways due to poor design in many aspects of their construction.

One common problem is the use of small heating elements in the fridge door and cabinet to reduce the buildup of frost in the insulation or interior cabinet of the fridge. While putting heating elements inside a device designed to keep food cold may seem like a strange, even stupid idea, it is all too common. The consumer preference for frost free and cyclic defrost refrigerators over manual defrost models has seen the proliferation of fridges that not only waste power, but make themselves work harder while doing so.

The heating elements have a detrimental effect in two ways. The first is to use power to produce heat. This obviously increases energy bills. The second effect is to make the fridge's compressor run for longer trying to remove that extra heat, which again uses more power and arguably reduces the life of the compressor unit. And all this just so that the owner won't have to defrost the fridge once or twice a year.

The obvious solution to this is to buy a fridge that does not have these elements. This can be a difficult proposition nowadays, but when looking for a new fridge, try to find one with a push-button defrost system.

Another problem with the average fridge is a lack of insulation. Open your fridge and have a look at the thickness of the cabinet wall. I bet it is nowhere near 50mm thick, yet this is the only thing that stops heat pouring back into the cabinet as it is removed. So the rule generally is, the thicker the cabinet's walls, the better the fridge is likely to perform.

So, how much power should a true energy efficient fridge use? Well, there are AC fridges on the market, such as the Vestfrost range (see Products in *ReNew* issue 75) that will use less than one kilowatt-hour (kWH) of electricity per day for a family-sized model, so if your fridge uses more than this, and odds are it uses lots more, then all that extra en-

If the conventional straight fluoro does not excite you, then look for fittings designed especially for compact fluoros. The dome light on the right uses a 2D tube and costs around $50 complete. Alternatively, there are many shapes of compact fluoros available now, including incandescent bulb-like units such as the one shown here.

ergy used is just being wasted through poor design—it's as simple as that.

There are some units, such as the Sunfrost from the US, that use less energy again. For instance, their 19 cubic foot (513 litre) fridge-freezer uses less than 800WH (0.8kWH) per day, or 292kWH per year. Compare that to your current fridge.

Lighting

We have talked about lighting efficiency many times in the past, but it is well worth covering here. It is estimated that lighting counts for up to 10 per cent or more of the electricity use of a suburban home, so savings here can also be considerable.

Unfortunately, in recent times the trend in lighting has been towards 'low voltage' lighting, especially halogen downlights. The problems with these lights are twofold. Firstly, halogen lights, while more efficient than a conventional incandescent, are simply incandescent lamps themselves, and thus cannot be very efficient at turning electricity into light.

Secondly, most of these 'low voltage' fittings are of the spotlight or downlight variety, which means they light up only a small area, so in fact, you need many lights to provide adequate lighting levels in a room. Indeed, it is not uncommon to find six or more 50 watt halogens in a single room of, say, six by four metres. This adds up to well over 300 watts of continuous power consumption, as these lights are used with 240 volt to 12 volt transformers which are themselves not 100 per cent efficient.

However, if these lights were replaced with two 20 watt compact fluorescent lamps on hanging leads (a total of 40 watts of power consumption), the room would not only be better lit, but would be receiving at least 250 watts less heat from its lights—a big bonus in summer.

This is a reduction in energy consumption of over 85 per cent, yet most home builders and architects still persist with the use of halogen downlights for general room lighting. You can use downlights for 'task lighting' over specific areas, such as the kitchen bench, but they should not be used for general illumination.

So, what of the argument that fluoros give off a harsh light? This is often put forward by proponents of halogen lamps, and we have heard it dozens of times here in the office. The fact is that you can now buy both compact and conventional strip fluoro tubes in many colours or 'temperatures', some of which are very close to the warm light from incandescent lamps, and others with a close rendition of daylight, so there really is no reason not to use them.

As for flicker, this may be a problem for the older style straight fluoros (which can be cured by fitting electronic ballasts to the light fittings) but most compact fluoros run at very high frequencies so flickering is not a problem.

Another fallacy, and one which I have heard even from electricians, is that fluoros use more power if switched on and off than if left running. A few seconds thinking about this should tell you otherwise, but this myth still persists. The fact is, unless you are going to be out of the room for only a few seconds, you will be saving energy by turning off the lights when you leave. Constant switching on and off of fluoro lamps can shorten their lifetime, but this is rarely a problem except for rooms such as the toilet.

Skylights are a great alternative form of lighting, and can do away with the need for lights completely under many conditions. There are many types of skylights available, starting at under $150, so they are a great cost-effective option.

Water heating

This is one area where large savings are to be had. Water heating can typically use up to half of a household's energy consumption, and there are several ways of reducing this.

Efficient fridges are few and far between in Australia, but the Vestfrost range is one option if you want to stop wasting money keeping food cold.

The most effective and dramatic way is to install a solar water heater. In warm climates, this can reduce energy use by up to 95 per cent, but even in colder climates like Victoria, savings can be around 60 per cent.

Another option, if a solar water heater is not a possibility due to house orientation or location, is the fitting of a more energy-efficient water heater. Some heaters are simply terribly designed, with minimal insulation, and thus use more energy than they should, as heat leaks away from the water stored in the tank at too high a rate.

Instantaneous gas water heaters are a good alternative, they heat only the water you are using, so there are no standing losses other than the hot water left in the pipes when the tap is turned off.

Another problem with storage-type water heaters is they are often installed with their thermostats set to quite a high temperature. While it may seem that you would simply use less water if it was hotter, the fact is that the higher the water temperature in the tank, the greater the standing losses due to the higher temperature difference between the tank and the surrounding air. The solution here is simple—just turn down the thermostat setting. A temperature of around 60°C is adequate for most uses, and is enough to prevent any nasties from growing inside the tank. If you don't know how to do this safely, call a plumber or electrician.

Some older electric water heaters don't have an adjustable thermostat. For these you will need to contact a plumber or the manufacturer to see if lower temperature thermostats are available.

Space heating and cooling

While water heating and refrigeration are large users of energy, for many homes the greatest proportion of energy use during extremes of weather can be from just trying to keep the house within a comfortable temperature range. While there are minimum insulation requirements for all new homes, there are no requirements for proper house design and orientation on the block. This means that most modern homes are energy-wasting brick-veneer box nightmares, costing many hundreds or even thousands of dollars to heat and cool throughout the year.

If this sounds like your home, there are a few things you can do to improve the thermal performance.

First, take a look at the insulation in the walls (if possible), roof and floor (for wooden and suspended floors). Odds are that it is just up to the minimum standard requirements, and could be a lot better. Upgrading the insulation can reduce energy bills significantly, but it should be combined with other upgrades, such as double insulation or heavy curtains and pelmets on windows and draft excluders on windows and doors.

Be aware though, that adding to the insulation of a home without protecting the windows can result in high temperatures inside the home in summer, as heat can enter easily but can't escape. Outside eaves, blinds or large deciduous trees covering windows can greatly reduce a home's energy intake in summer, making it far less costly to keep cool. For more information on using appropriate shade plants, see our article on page 40 of this issue.

Insulation can be added by you or you can hire someone to do it for you. There are many types available, for more information see the Insulation Buyer's Guide in issue 71 of *ReNew*.

Excluding drafts can greatly improve the performance of heating systems in winter, especially in older homes that tend to suffer more from draft problems. Draft excluders are readily available from most hardware stores, and can be as simple as a stick-on foam strip or beanbag 'snake'.

For summer, ventilation of the roof cavity can greatly reduce cooling bills. A properly ventilated roof can be up to 30 degrees Celcius cooler than an unventilated one, which means your insulation will be much more able to reduce heat flow into the house. There are many different types of wind-powered ventilators available starting from around $50 plus installation. Solar-powered fans are also available, and have the advantage that they work hardest when they are needed most.

Ceiling fans are very effective for both summer and winter. In summer they create a cooling effect on the skin that reduces the need for airconditioning, and in winter they will recirculate the warm air trapped up at ceiling level, thus reducing heater running times.

Low flow shower heads not only save a lot of water, but the energy used to heat it as well. This unit is an Interbath Rainmaker.

Lastly, if you have a gas heater, shut the unit down at the end of the cooler months, there is no point using gas to keep the pilot light burning during summer, you are just wasting gas and producing unnecessary heat—in effect, your heater becomes a phantom gas load for six months or more of the year.

Getting clean

With hot water using such a large proportion of the average home's energy, it makes sense to use as little hot water as possible. There are many ways to use less hot water, including having shorter showers or fitting a low-flow shower rose. We have heard numerous complaints over the years about low-flow heads, usually that they just don't provide enough flow or pressure to have a decent shower. This is true of some brands, or specific models at least. I have used three different models of Interbath brand heads, two which looked very similar but performed completely differently, and my latest one, the Rainmaker, which has a flow of 9.5 litres per minute. I would say that this unit is the best low-flow unit I have used, I have no com-

plaints at all about its performance.

Clothes washing is another big user of hot water. The fact is that there is really no need to do a warm or hot wash unless the clothes are particularly greasy. However, I have known so many people over the years who set the machine controls to warm simply out of habit or the false belief that clothes are just not clean unless they are washed in warm water. Given that the average top loader can use up to 100 litres to fill the wash bowl, this represents a huge amount of energy simply being sent down the drain.

Cooking

This is an area not often considered for energy efficiency, but there are many ways to reduce consumption here also. One of the simplest is to use lids on pots—while this seems obvious, many people cook without lids to make it easier to stir the food.

I did some testing on my own cooking habits to see just how much energy I was wasting. For example, a pot of pasta needed the large gas burner on my stove turned up full to keep it boiling, yet by simply placing a vented lid on the pot I could turn the burner to its lowest setting and the pasta would cook in the same amount of time. Judging by the flame size I am saving two-thirds to three-quarters of the energy used to cook the food simply by using a lid.

Microwave ovens are another huge energy saver. Food cooks in a fraction of the time used by a conventional oven, yet the average microwave uses far less electricity than the average electric oven. However, when comparing a microwave to a gas oven, the savings become less—gas is a more efficient fuel in the overall fuel cycle than electricity, so using a microwave in place of a good gas oven may not greatly reduce greenhouse gas emissions or save you much money.

Another option is a toaster oven. These use less power and preheat much faster than a full sized oven, so energy consumption is reduced. In fact, there are a great many appliances designed to cook specific foods quickly and effectively, such as breadmakers, coffee makers and electric frying pans.

Another wasteful habit many people have is boiling enough water for several cups of coffee when they only need enough for one. If you do this, stop it, that extra energy used to heat the water just dissipates into the room and is completely wasted, in most cases.

While it is a good idea to use the most efficient cooking appliance and methods, why not eliminate the costs altogether simply by using a renewable heating source—the sun. We have looked at solar cookers several times in

past issues of *ReNew*. While not ideal all year round, a solar cooker can do a great job on clear sunny days, allowing you to cook all manner of foods using nothing but the sun's rays.

Solar cookers are difficult to buy commercially, but this is slowly changing, and there are many models you can purchase on the internet using just a credit card. Check out the Products section of this issue for an unusual inflatable model from the US.

Computers—home or office

Computers can also be big users of power, but it is not the computer itself that uses most of it, the monitor is the usual culprit. If you are leaving the computer for even a few minutes, turn the monitor off. Don't rely on the computer's energy saving features, which may or may not be effective. Screen savers do nothing to reduce power consumption, they are a relic from the past when monitor burn-in was a problem. They are simply used as toys nowadays.

Turn off any unused peripherals, such as printers or scanners. Even though they may be energy efficient models, they are still using power for no reason at all when not being used.

Phantom loads

We have covered this problem some time ago in *ReNew*, when we explained what phantoms were and how to deal with them. Briefly, phantom loads are all those electrical loads that are there for the sake of convenience or have no real use. For instance, the energy used by the digital clock in your microwave oven or the TV or VCR in standby mode are phantom loads. Some devices, such as washing machines and dishwashers, may even draw significant amounts of power when they are switched off at the machine.

You may not think that these loads amount to much, but you should remember that these loads are present all of the time, whether the appliance is being used or not, and can add up to considerable energy use. In fact, the Australian Greenhouse Office has found that phantom loads account for 11.9 per cent of electrical use in the average home—not an insignificant amount.

So, what's the solution? Just turn the appliances off at the power point. This may not be possible for all appliances, such as built-in dishwashers, but for TVs, VCRs and many other appliances this is the best solution. If you have a lot of appliances plugged into a single power board, just use a power board with switches for each appliance so you need only turn on the ones you are using at the time.

Transport

There are many savings to be had here also. Before you hop in your car to go to the local shops, think about an alternative, such as taking your bike, or even walking. You will not only save fuel and money, but you will be better off for it and you will be doing the planet a favour. For longer trips, try public transport, it may not be as bad as you think!

Many people have made the decision to get rid of their car altogether. Not only do they save thousands of dollars every year in maintenance, registration and insurance costs, but they also save several tonnes of greenhouse gases each year from being spewed into the atmosphere.

If you must have a car, don't fall for the 'great aussie icon' trap and get a big six cylinder or V8 fuel guzzler when a more fuel-efficient four cylinder will serve just as well. You are driving on public roads, not a race track, and just don't need zero to 100 in six seconds performance. If you want to drive like that, get yourself a Playstation, it is a lot safer and cheaper! Another factor in fuel usage is average speed—drive a bit slower, especially on freeways, and you will see real fuel savings. Running around with underinflated tyres will also increase fuel consumption by up to five per cent, as will not getting the care tuned when it needs it.

In the next few years we will start to see the introduction of new vehicles with greatly reduced fuel consumption. To see the first of this next generation of vehicles to be available in Australia, see the Honda Insight hybrid vehicle in the Products section of this issue.

Star ratings

While energy ratings on appliances are a great idea in theory, there is still a lot of confusion as to what it all means. There are two main parts to the energy ratings label, the stars themselves, and the comparative energy consumption figure or figures.

The stars, while a reasonable indication of energy use, are only relative to other similar appliances, so do not look at them alone when purchasing a new appliance. The more important figure is the actual energy use figure. This is given in kilowatt-hours, or megajoules for gas appliances. Basically, the smaller the number the better an appliance performs, but even here there can be problems, and these have to do with how appliances are tested.

A typical example is the Fisher and Paykel Smartdrive range of washing machines. The energy star rating for these are not as good as most front loading machines, yet these machines use tiny amounts of power in their drive systems. This comes about because the energy used to heat the water in a warm wash is factored into the rating. To be fair, the new ratings label has comparative energy consumption figures for both warm and cold washes, the later being the number in the blue box on the label, so take notice of this number rather than the one in the red box.

A recent introduction in Australia is that of fuel consumption labels for new cars. These labels give consumption figures for city and highway driving, and allow you to compare one car directly with another to find the most fuel efficient. This is certainly a step in the right direction.

Independent power supply battery buyer's guide

This guide is an update of the one in issue 59 of *ReNew*, written by Alan Davies. We have taken a new look at the marketplace, what to buy and how to care for them. Tables by Emily Fisher

This is a range of small-format lead-acid batteries from Ryde Batteries. The range includes deep cycle batteries of both flooded cell and gel types.

The battery is the heart of any independent or remote power system, but it is the one component usually overlooked, simply because it is totally uninteresting!

Experience shows that batteries are way down the list of considerations by most independent power supply (IPS) system buyers. This is sad, because these people invariably have problems with their systems. Many people believe that all batteries are the same—they are not.

Batteries are designed for specific applications. For example, today's car battery is designed to provide high cranking amps (it has lots of thin plates, with a large total surface area) for starting the engine. Because the alternator powers the car once it is started, the battery is not designed for providing continuous power and will quickly fail if deeply cycled more than a few times.

Over time, and with changes in technology, the energy storage requirements for domestic independent power systems have changed quite considerably. Twelve volt DC systems are mainly found in caravan and camping situations, though smaller IPS systems may still run at this voltage.

Modern IPS homes usually have 24 or 48 volt DC systems with sinewave inverters for converting the power to 240 volts AC, and use efficient and economical appliances. These homes have large capacity battery storage facilities to cope with the high surges required to start motors and ensure long battery life through shallow cycling of the batteries (deep cycling of batteries will shorten their life expectancy).

Battery requirements

In most systems, the battery bank is made from a number of cells or batteries connected together, either in series or parallel. By connecting cells in series the voltage increases, while the amp-hour rating stays the same as for one cell. Connecting the cells in parallel increases the amp-hour capacity, but the voltage remains the same. However, paralleling strings of cells can result in unequal charging of cells which can damage the system, so battery manufacturers generally specify the maximum number of parallel strings allowable.

IPS batteries should have the following characteristics:

- low self discharge
- long life under the continual charge/discharge regime
- ability to withstand deep discharges
- low maintenance
- high charging efficiency
- high performance-cost ratio
- ability to perform over a wide temperature range.

There are significant differences between batteries designed to suit different applications. Similarly, battery manufacturers have different specifications on the batteries they produce. For this reason, different types and sizes of batteries must never be mixed. Combining batteries of different specifications can lead only to disaster.

The other big battery no-no is upgrading an existing battery bank to increase its voltage. If your power requirements mean that you will need a 48 volt system in, say, two years time, but a 24 volt system will suffice at the moment, it is better to install the 48 volt system now. New batteries added to an existing bank are soon pulled down to the performance level of the older units, effectively wasting your investment.

Battery types

The most common type of battery found in independent power supply systems is the flooded-cell, lead-acid battery. Others available include the sealed-lead-acid and nickel-cadmium (nicad) batteries, although these are rarely found in systems in Australia.

The flooded lead-acid cells are usually in the form of 2-volt cells which can range in capacity from less than 100 amp-hours up to several thousand. While there are numerous brands of this type of cell, most of them are similar in what they can offer the IPS house owner. In a well designed system, these cells can provide up to 20 years of power storage, and are the preferred option for larger systems.

While most flooded cells have flat plates, some are now sporting tubular positive plates, where the positive plate material is compressed inside woven polyester tubes. This is said to increase the life of the battery by eliminating 'shedding' from the positive plate, where material breaks away from the plate and falls into the bottom of the battery, thus reducing the usable material.

Small format batteries

Looking like large car batteries, these come in two basic types, the flooded cell and the sealed lead-acid. The flooded-cell small-format battery is usually a six or 12 volt battery, ranging in capacities up to 300 amp-hours or so. They contain several cells connected together to provide the nominal voltage.

Sealed-lead-acid batteries are similar in size and shape to the flooded-cell variety, but their electrolyte is either a sulphuric acid gell or a fibreglass separator soaked in liquid sulphuric acid. Both forms of electrolyte are effectively immobilised, making them the safest choice for mobile installations such as caravans. Sealed batteries also do not require equalise charging, making them virtually maintenance free.

Nickel cadmium, or nicad batteries, use a totally different cell chemistry than lead-acid batteries. While they are said to have many advantages, such as being smaller for the same energy storage, they are very expensive initially and are rarely seen in IPS systems.

Capacity ratings

The unit of battery capacity is the ampere-hour, or amp-hour (ah). Battery capacity is a measure of how much energy a specific battery has available for use over time. In IPS systems, the system designer needs to know how much energy will be required each day as, unlike a normal grid-connected house, there is only a finite amount of energy available.

The actual capacity of the battery varies depending on the rate at which it is discharged. This is expressed as the 'C' rating, for example C_{100}. In this instance, the battery is discharged over a period of 100 hours. If you were to discharge the battery in say, 10 hours, the capacity would be reduced. In the IPS industry, batteries are usually specified at the C_{100} rate, as this most closely represents the discharge rate experienced in these systems.

Battery life

Battery life is measured in cycles rather than in years. A cycle, in simple terms, is when the battery is discharged to a certain level and then recharged fully. The more deeply the battery is discharged, the lower the number of cycles it will last for. The depth of discharge (DOD) of a battery is expressed as a percentage. A 30 per cent DOD means that 30 per cent of the usable power is taken from the battery before it is recharged.

Lead acid batteries should never be completely flattened, as this will severely reduce their life expectancy. For IPS systems, the usual DOD is around 20 percent per day. At this rate, most large-format batteries will give around 10 years of service.

Sizing the bank

The battery bank should be discharged only by about 20 per cent per day, and so needs to be sized accordingly. If the house is expected to use 150 amp-hours every day, then the battery bank would need to be at least 750 amp-hours.

A further consideration in battery sizing is the number of days of autonomy—the number of days the battery can sustain the system without being charged. Four or five days is usual, but this depends on each system's particular requirements.

Battery efficiency

Nothing is perfect, so they say, and this is also true of batteries. Charging efficiencies of 90 to 95 per cent can be expected from new cells, however, efficiency will decrease with age with sulphation and stratification. The less-than-perfect efficiency means that you have to put back more charge into the battery than you took out, to get back to the same level.

Sulphation occurs when the battery is discharged. During the battery's discharge phase the active materials on both plates are converted to lead sulphate ($PbSO_4$). The sulphate deposit on the positive plate is normally dissolved during recharge. However, if the battery is left for a period without being fully recharged, the lead sulphate can crystallise and become insoluble, resulting in reduced battery capacity.

Stratification occurs where the cells get little or no cycling. The electrolyte tends to settle into layers of different densities (with higher specific gravity at the bottom) which can reduce the life of the battery by accelerating plate corrosion. This potential problem is solved by regular boost charging (gassing) of the cells. This also helps to equalise the state of charge of the individual cells as non-uniform charging can occur due to inevitable differences in characteristics of individual cells.

Temperature has a direct bearing on the battery's state of charge. The lower the ambient temperature the more charge needed to replace that taken out. The reverse applies for higher temperatures. Battery specifications assume an ambient temperature of 25 degrees Celcius and battery manufacturers provide correction tables and graphs so you can determine precise specific gravity.

Maintenance

Most manufacturers supply ancillaries kits along with their battery sets. These kits include such items as hydrometers, thermometers, stainless steel or brass nuts and bolts, terminal covers, terminal spray, log books, installation manuals, safety signs and more.

A home for your batteries

Batteries should be housed in a secure enclosure ventilated to the outside, which meets SEIA (Sustainable Energy Industry Association)/ASA standards. They should not be left on concrete floors, as the cold can lead to temperature differences inside the cells, causing stratification—this will definitely void any warranty claims. Ideally, the batteries should be placed on wooden or plastic bearers to insulate them from the floor. The batteries should not be kept inside the house, and should be fully protected from any sparks or flames that may accidentally occur nearby.

Safety

While battery banks are extra-low-voltage, in most cases they have the potential to cause serious, sometimes fatal accidents for the unsuspecting. Safety signs are a requirement and care should be taken at all times. The short circuit current delivered by a large battery bank (all battery banks must be fused appropriately) will be several thousand amps, more than enough to melt a metal tool, such as a spanner, dropped across the terminals.

The electrolyte of lead-acid batteries is sulphuric acid, which is very corrosive to metals and will burn through skin and clothing. When batteries are being charged they release hydrogen gas which can lead to explosion and fire if ignited. Utmost care should be taken in working with batteries. Safety equipment such as rubber gloves, aprons, and safety goggles should be worn. Wall charts detailing procedures and first aid are available and should be displayed in all battery rooms. Always consult an SEIA accredited installer if you need assistance.

Second-hand batteries

There is no way you can know the past history of a secondhand battery—only what the previous owner tells you.

The batteries are the heart of an independent power supply system, and determine system performance. They are a major investment, often costing several thousand dollars. Remember that, with an anticipated life expectancy of 10 to 15 years or more, good quality batteries are an investment. If you can't stretch your budget to cover the entire system cost, cut back on the number of solar panels or other devices installed, they can be added at any time. Always go for the best in a battery, because everything else depends on it! ✶

Large Format Flooded Cell Lead-Acid Batteries

Supplier	Model	Voltage	Amp hour rating		Cycle Life @ % DOD				Weight (kg)	Warranty years	Retail $	$/Ah @ 12 Volts
			C20	C100	10	25	50	80				
Energystore II GNB Battery Technologies ph:(02)9722 5701 fax:(02)9774 2150	12RP340	12	213	340	4000	-	2500	1500	84	1	956.00	2.81
	6RP570	6	366	570					67		706.00	2.48
	12RP570	12	356	570					134		1239.00	2.17
	6RP670	6	423	670					80		751.00	2.24
	12RP670	12	423	670					160		1302.00	1.94
	6RP750	6	493	750					92		824.00	2.20
	12RP830	12	565	830					210		1770.00	2.13
	24RP830	24	565	830					420		2974.00	1.79
	6RP830	6	630	910					119		980.00	2.15
	24RP910	24	630	910					470		3560.00	1.96
	6RP1080	6	772	1080					143		1063.00	1.96
	8RP1080	8	772	1080					190		1341.00	1.86
	6RP1350	6	973	1350					181		1297.00	1.92
Enersun SSR Century Yuasa ph:13 2287 fax:(03)9384 1606	SSR450-6	6	363	450	4000	2900	2050	1400	81	3	706.20	3.14
	SSR535-6	6	435	535					88		804.10	3.01
	SSR700-6	6	575	700					109		952.60	2.72
	SSR875-6	6	717	875					133		1082.40	2.47
	SSR1025-4	4	840	1025					103		899.80	2.63
PV Stor BP Solar ph:(02)8762 5777 fax:(02)8762 5888	6P210	6	147	210	7500	-	2500	1200	27	5	451.00	4.29
	2P430	2	300	430					17		247.50	3.45
	2P570	2	400	570					23		313.50	3.30
	2P785	2	550	785					29		467.50	3.57
	2P1110	2	780	1110					48		583.00	3.15
Suncycle Battery Energy South Pacific ph:(02)9681 3633 fax:(02)9632 4622	3AS190	6	-	195	12-14	9-12	6-8	4-5	30	8	Price on request	
	2AS450	2		450					21			
	2AS620	2		650					32			
	2AS770	2		840					51			
	2AS920	2		1000					55			
	2AS1100	2		1100					61			
Raylyte Choice Electric ph:(07)3252 4808 fax:(07)8354 1038	R700	6	-	700	7250	2900	1450	950	114	5	952.60	2.72
	R1000	4	-	1000					102		899.80	2.70

Small format flooded cell lead-acid batteries												
Supplier	Model	Voltage	Amp hour rating		Cycle Life @ % DOD				Weight (kg)	Warranty years	Retail $	$/Ah @ 12 Volts
			C20	C100	10	25	50	80				
Enersun SSDC Century Yuasa ph:13 2287 fax:(03)9384 1606	SSDC 100-6	6	85	110	1600	1100	800	500	15	-	-	-
	SSDC200-6	6	190	220					29			
Trojan GNB ph:(02)9774 0500	T105	6	250	250	-	1825	-	-	28	1	193.60	1.55
	24TMS	12	85	80					19		172.00	2.15
	27TMX	12	105	94					22		194.00	2.06
	27TMS	12	115	117					25		231.00	1.97
Ryde Batteries ph:(02)9807 3933 fax:(02)9807 3700	US 2200	6	220	242	5000	2000	1000	500	28.9	1	274.00	2.26
	US 125	6	235	258					29.5		290.00	2.25
	US 145	6	244	269					32		320.00	2.38
	9C11	6	250	275					32.8		367.00	2.67
	US 305	6	305	335					42		450.00	2.68
	8C6U	6	330	366					44.2		462.00	2.53
	8L16	6	370	420					51.4		525.00	2.5
	STU1	12	32.5	36	3000	1200	400	200	9.2		136.50	3.79
	US22NF	12	55	60					14		170.00	2.83
	US22F	12	65	72					15		190.00	2.64
	DC24	12	75	83					20.4		205.00	2.47
	DP27	12	80	88					20.7		225.00	2.55
	DC27	12	90	99					25		250.00	2.52
	27TM	12	105	115					25		250.00	2.17
	DC310T	12	105	115					27.2		294.00	2.56
	31TMX	12	130	143					28.5		294.00	2.06
	8KFS	12	135	150	5000	2000	1000	300	36		462.00	3.08
	EV145	12	145	160					38		462.00	2.89
	8C12	12	195	215					52		560.00	2.60
	9C12	12	228	253					57.6		630.00	2.49
	8DHC	12	240	264					61		630.00	2.38

Large Format Vented Flooded Cell Nicads												
Supplier	Model	Voltage	Amp hour rating		Cycle Life @ DOD				Weight (kg)	Warranty years	Retail $	$/Ah @ 12 Volts
			C20	C100	10	25	50	80				
Saft Nife Saft Australia P/L ph:(03)9465 5734 fax:(03)9465 6213 www.saftbatteries.com	SUN 3-2	2.4	-	35	9000	6500	3000	1000	5	1	180.00	25.71
	SUN 3-3	3.6	-	35					8		270.00	
	SUN 3-5	6	-	35					13		450.00	
	SUN 7-2	2.4	-	70					8		305.00	
	SUN 7-3	3.6	-	70					12		458.00	21.80
	SUN 7-5	6	-	70					21		763.00	
	SUN 10-2	2.4	-	105					11		427.00	20.32
	SUN 10-3	3.6	-	105					17		640.00	
	SUN 10-5	3.6	-	105					28		1067.00	
	SUN 14-2	6	-	143					14		561.00	19.59
	SUN 14-3	2.4	-	143					21		842.00	
	SUN 14-5	3.6	-	143					37.5		1401.00	
	SUN 17-2	6	-	178					17		678.00	
	SUN 17-3	2.4	-	178					25.5		1016.00	19.02
	SUN 17-5	6	-	178					42.5		1693.00	
	SUN 21-2	2.4	-	214					19		798.00	18.64
	SUN 21-3	3.6	-	214					29		1198.00	
	SUN 24-2	2.4	-	251					24		924.00	18.40
	SUN 24-3	3.6	-	251					36		1386.00	
	SUN 28-2	2.4	-	286					27		1041.00	18.19
	SUN 28-3	3.6	-	286					40.5		1562.00	
	SUN 31-2	2.4	-	322					31		1167.00	18.12
	SUN 31-3	3.6	-	322					46.5		1750.00	
	SUN 35-2	3.6	-	358					32		1288.00	17.98
	SUN 35-3	1.2	-	358					48		1932.00	
	SUN 38-1	1.2	-	393					18		705.00	17.93
	SUN 42-1	1.2	-	429					19		767.00	17.87
	SUN 52-1	1.2	-	537					25.5		953.00	17.74
	SUN 63-1	1.2	-	645					29		1135.00	17.59
	SUN 70-1	1.2	-	717					34		1258.00	17.54
	SUN 84-1	1.2	-	860					38.5		1503.00	17.47
	SUN 87-1	1.2	-	890					42.5		1564.00	17.45
	SUN 104-1	1.2	-	1070					48		1863.00	17.41

Sealed lead-acid batteries												
Supplier	Model	Voltage	Amp hour rating		Cycle Life @ % DOD				Weight (kg)	Warranty years	Retail	$/Ah @ 12 Volts
			C20	C100	10	25	50	80				
Energel Battery Energy South Pacific ph:(03)9874 1011 fax:(03)9874 1044 besp@battery energy.com.au	6EG100	6	-	100	-	-	-	1500	28	8	Price on request	
	6EG125	6		125					32.5			
	6EG150	6		150					37.5			
	2EG190	2		190					14.5			
	2EG210	2		210					19.5			
	2EG270	2		270					23			
	2EG330	2		330					26			
	2EG390	2		390					33			
	2EG450	2		450					36.5			
	2EG510	2		510					39.5			
	2EG570	2		570					40			
	2EG650	2		650					52			
	2EG750	2		750					58			
	2EG1000	2		1000					76			
	2EG1200	2		1200					89			
	2EG1500	2		1500					107			
Sungel Battery Energy South Pacific ph:(03)9874 1011 fax:(03)9874 1044 besp@battery energy.com.au	6SG200	6	-	195	5000	4000	2500	1500	32.5	8		
	2SG250	2		245					13			
	2SG450	2		440					23			
	2SG650	2		635					54			
	2SG875	2		850					49			
	2SG1000	2		1030					54			
	2SG1400	2		1350					71			
	2SG1750	2		1705					71			
	2SG2000	2		2050					71			
Concorde Sun XTender BP Solar ph:(02)8762 5777 fax:(02)8762 5888	1234	12	33	38	5100	1850	1000	540	10.88	1	100.76	4.63
	6220	6	220	263					30		445.50	3.39
	12210	12	210	253					61.2		820.60	3.24
	1265	12	60	70					44.04		323.40	4.09
	1285	12	85	102					27.66		376.20	3.69
	12100	12	100	120					31.29		405.90	3.38
Sonnenschein Dryfit M+H Power Systems ph:(03)9763 0555 fax:(03)9763 0577 www.mhpower.com.au	SB12/60	12	56	60	6000	5000	2000	1300	20	1	291.50	4.86
	SB12/75	12	70	75					30		451.00	6.01
	SB12/100	12	90	100					39		594.00	5.94
	SB12/130	12	116	130					48		693.00	5.33
	SB12/185	12	165	185					64		880.00	4.76
	SB6/200	6	180	210					31		517.00	5.17
	SB2/ 600	6	280	330					48		861.30	5.22
	A600 Solar 2V	2	490	600	5000+		3500	1800	42		642.40	6.42
	A600 Solar 2V	2	800	960					68		TBA	
	A600 Solar 2V	2	1000	1200					82			
Johnson Controls Australia P/L ph:1300 362 836	U1-31B	12	31		5000	2500	900	600	-	1	Price on request	
	U1-33	12	33	-					-			
	GC12V45B	12	45	-					-			
	GC12V65B	12	65	-					-			
	BBG165RT	12	82	-					-			
	GC12V100B	12	87	-					-			
	GC6V200B	6	170	-					-			
Geltech Ryde Batteries ph:(02)9807 3933 fax:(02)9807 3700	8GU1	12	31.6	36.4	3800	1500	650	-	11	1	217.00	5.96
	8G22NF	12	50.6	56.5					17.1	1	325.00	5.75
	8G24	12	73.6	80					24.3	1	407.00	5.08
	8G27	12	86.4	98					28.7	1	485.00	4.95
	8G3107	12	97.6	108					32.5	1	534.00	4.94
	8G4D	12	183	210					59.9	1	1002.00	4.77
	8G8D	12	225	265					73	1	1118.00	4.41
	8GGC2	6	180	198					32.5	1	522.00	5.27

Welcome to the ATA's solar-powered office

Here at the ATA, our power system has been something of a work in progress for around two years. We last looked at it in issue 71 of ReNew, but since then there have been a few changes and we have added to both the independant battery-based system and the grid interactive system.

We originally had six 64 watt Solarex panels mounted above the battery shed feeding into the grid interactive system, along with seven Canon Econoflat panels mounted on the face of the workshop. The Solarex panels have since been replace with six 83 watt Solarex units which have been wired into 24 volt strings and are now feeding power into the 24 volt battery bank. The original two 83 watt panels that fed the 24 volt battery bank now feed into the smaller 12 volt bank, also in the main battery shed.

The six 64 watt panels, along with another six 80 watt units, have been fitted to the roof of the Solar Workshop on purpose-made frames that allow for the 30 degree southward slope of the roof. These panels have been wired in 72 volt strings and are connected, via blocking diodes, in parallel with the Econoflat array to provide a nominal 1260 watts total to our grid interactive inverter.

So far, the best output to date for the new array has been 6.8kWH, though at the time of writing the array had only been connected for a few weeks.

The 24 volt system has since had a Trace 3024 sinewave inverter fitted, and is capable of running the entire office for several days if the need arises. At the moment we have a regime of allowing the batteries to charge fully, then we flip a large changeover switch and the whole office is running on the battery system. The grid interactive system continues to dump power into the grid, and winds our power meter backwards at a great rate of knots when we are on the battery system. After a day or two we switch back to mains power to give the batteries time to recharge.

While this may seem a hard way of doing things, it gives as the chance to trial both technologies and types of systems, and to evaluate the performance of the system. The battery system has performed very well, and the Trace doesn't flinch, even when we have six computers and a laser printer running and someone turns on the 2000 watt kettle. Occasionally we notice that the fluoro lights flicker in time to the heater in the laser printer switching on and

Volunteers Beni Cuter and Catie Dale are seen here assembling the solar panel frames and preparing the panels for installation on the roof of the Solar Workshop. A lot of the work at the ATA is done by volunteers who are looking to gain experience in renewable energy systems.

off, but this is barely noticable and causes no problems with the computers or other equipment. This is most likely due to the Trace being connected with thinner-than-recommended cable—very few installations have the recommended 100mm^2 cable between the inverter and battery bank!

System monitoring

The 24 volt system has had new LED voltmeter and ammeter added to them so that the general public can read the meters through the window of the battery shed. For more details on some of the problems using LED meters for current monitoring, see the current measuring datalogging article in this issue.

The SEA grid interactive inverter was upgraded to a newer unit with an RS232 datalogging output courtesy of Solar Energy Australia. The data output from the inverter is connected directly to a second-hand laptop computer we bought specifically for the task. This

The control centre of the 24 volt battery system. The big box on the left is the Trace sinewave inverter, which is capable of running the entire office. It can also be grid connected, though we have not installed this optiuon as yet. The box on the right is the Trace PC250 Power Centre. Since our last look at the system, it has had two new LED meters installed so that visitors to the site can see what is happening with the system.

The power systems

Here at the ATA's head office we have numerous power systems. Below is a brief component description of each one, and what they are used for.

Grid interactive system: offsets office energy use

Seven Canon Econoflat amorphous panels
Six Solarex 64 watt polycrystalline panels
Six Solarex 80 watt polycrystalline panels
SEA 2500 watt grid interactive inverter

24 volt independent system: office backup power system

Six Solarex 83 watt polycrystalline panels
Air303 24 volt, 300 watt wind turbine
Trace PC250 Power Centre regulator with added LED meters
Trace 3024 sinewave inverter
Chloride Fauré-X 650AH (C_{10}) 24 volt battery bank
Davy Industries solar tracker

12 volt independent system: battery shed ventilation and security lighting

Two Solarex 83 watt polycrystalline panels
Chloride Fauré-X 650AH (C_{10}) 12 volt battery bank
BP Solar GCR3000 30 amp regulator
Jaycar Electronics 140 watt modified squarewave inverter

12 volt independent lighting system: outdoor security lighting near office

Three BP Solar 50 watt monocrystalline panels
One Canon Econoflat amorphous panel
Concorde 12 volt, 100AH sealed lead acid battery
SEA Piccolo 140 watt sinewave inverter
12 volt Maitland Enterprises Super Solar Regulator
Gardener's Choice lighting controller

computer is shut down at night to conserve energy.

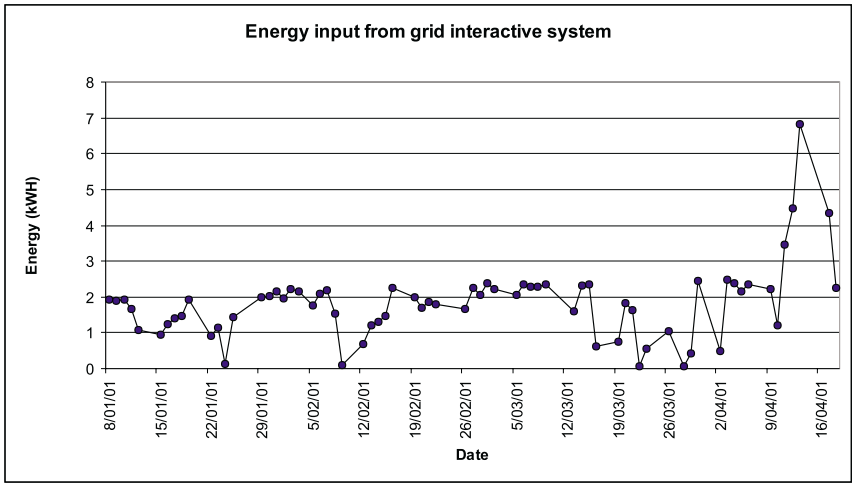
The datalogging software was written by me in plain old GWBASIC, and displays the various parameters of the inverter, such as power output, array voltage and current, AC grid voltage and accumulated energy on the screen in both numerical and bargraph format. By pressing a couple of keys, visitors to the office can view the power curve for the day, as well as the accumulated power curve (more of a straight line) and the power generated each day since we have been logging.

This last graph is quite interesting, as the poor weather and cool changes are clearly reflected by sudden dips in the graph. Examples of these graphs can be seen elsewhere in this article.

Volunteers

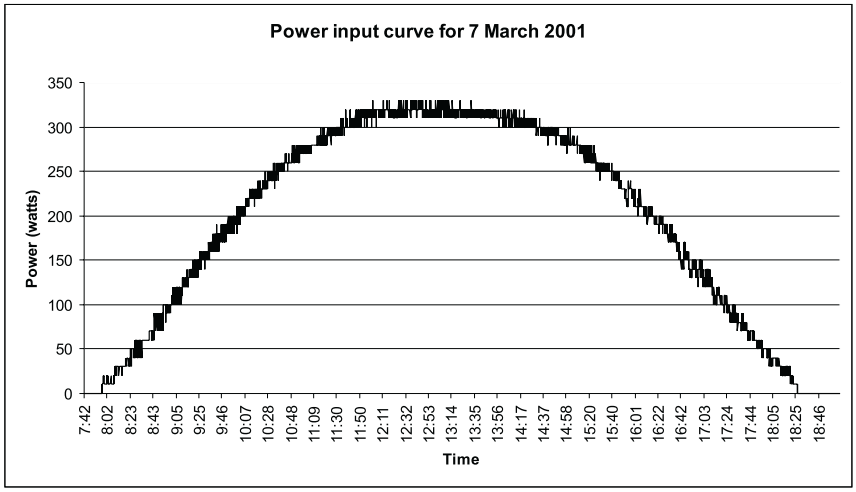
A lot of the ATA's power system installation has been assisted by various volunteers. Theses include the fearless mountaineer Emily Fischer, Beni Cuter and Catie Dale, who were all instrumental in getting the second stage of the array mounted on the Solar Workshop. Thanks, guys!

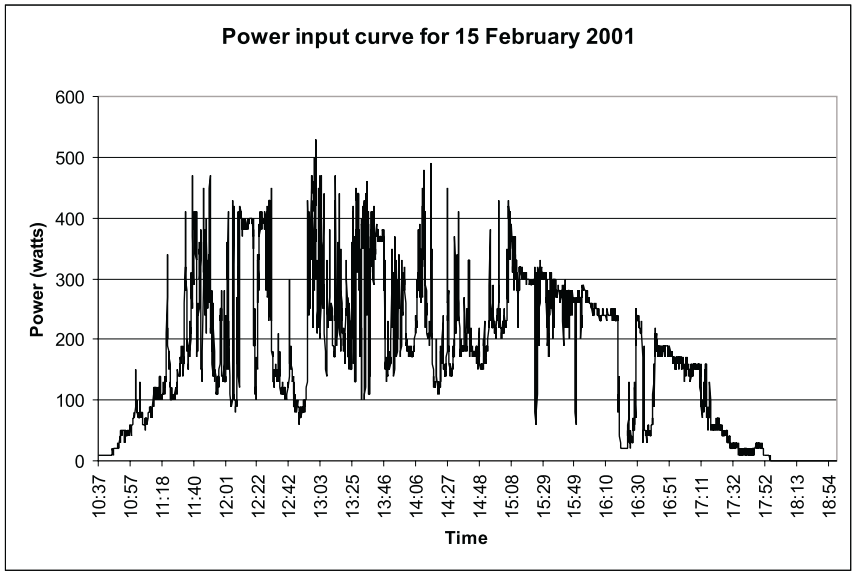
Catie Dale, left, and Beni Cuter at right work at fixing some of the solar panels to the office roof. The volunteer in the middle, Paul McKay, was an ATA member who just happened to be at the office to use the library at the time!



The daily energy totals since we began logging in early January. Note the sudden increase in energy with the trippling of the solar array in mid April. The straight line represents the average daily input, around 2kWH at this stage.

Here you can see a perfect power graph. Note the bell curve shape. Also note that the peak power is somewhat less than the array's rated power, which was 420 watts at this time. This is mainly due to the Canon array's steep mounting angle of 60 degrees. While this curve represents a perfect day for generation, they are not as common as we would like in Melbourne, even in the summer months.





Here you can see the graph of a cloudy day in mid February. Note that the peak power generated here was 530 watts—110 watts higher than the rated array output. This is caused by light reflecting from the Earth's surface bouncing off clouds and returning to Earth, thus increasing the solar intensity. While this effect is usually brief, this particular day it was quite extended and the power system generated 1.5kWH for the day.

Measuring BIG currents in a RAPS system

We look at one way of measuring large currents for metering, datalogging or other purposes

Many independent power systems provide some form of current monitoring, usually using a large, low-value resistor called a shunt. By measuring the voltage across the shunt, the current can be calculated. However, there can be problems here, depending on the type of meter that you want to use to display the current value.

In the 24 volt power system at the ATA national office, we needed to be able to display the voltage and current on two separate meters on the front of the Trace Power Centre. The Power Centre comes with a simple battery bar graph, but we wanted something a bit more informative, so we selected a pair of large digit LED displays so that anyone peering into the battery shed through the window would be able to read the meters easily.

The problem with many meters is that they must be powered from a power supply separate from the voltage being measured. However, we located some meters that could share a common power supply ground—in other words, they could be powered from the voltage source they were measuring.

Now while this is not a problem for the average LCD meter, LED meters are a different story. The problem arises from the fact that the shunt in most systems has only a very low voltage across it, even with large currents flowing through it, to keep to a minimum the power losses and heating effect of the current. A common value is a 50mV/500 amp shunt, which means that with 500 amps flowing through it, there is a mere 50mV across it.

So, what is the problem with that? Well, an LCD meter, which has almost no current consumption itself, can measure and display the value across the shunt quite accurately. But with an LED meter, things change quite a bit. This is due to the fact that the LED meter draws significant currents—up to 100mA or more. This current causes a voltage drop of about 1.4mV to appear along the common negative wire, thus giving a false reading.

It should be explained here that even though we are saying that we were setting up a voltmeter and an ammeter, ammeters are effectively voltmeters, measuring very small voltages. While the small voltage drop in the negative lead had negligible effect on the voltmeter (1.4mV is tiny compared to 24 volts), the effect is much greater on the ammeter.

When we hooked our meters up we found that the meter would read about 14 amps when no current was flowing through the shunt—not exactly accurate!

So, how to fix this problem? There are two ways. The first was to use a different type of meter to display the current. We could have used a moving iron meter, the type that has a needle that swings across a dial. There were several problems with this, though. First, they are hard to read from a distance, and this is how most people would be reading the meters. Second, any meter that was capable of reading up to 500 amps would be useless for reading the much lower levels of current flow more often found in the system. A 10 amp flow is a mere two per cent swing of the needle which would not even be perceptible to anyone looking at the meter.

Some LED and LCD meters don't interfere with the voltage they are measuring, but these units require a separate power supply isolated from the voltage they are measuring, which means that we would need another battery and charging system isolated from the 24 volt system to feed the meter.

The second way to fix this problem was to find a way to amplify the voltage

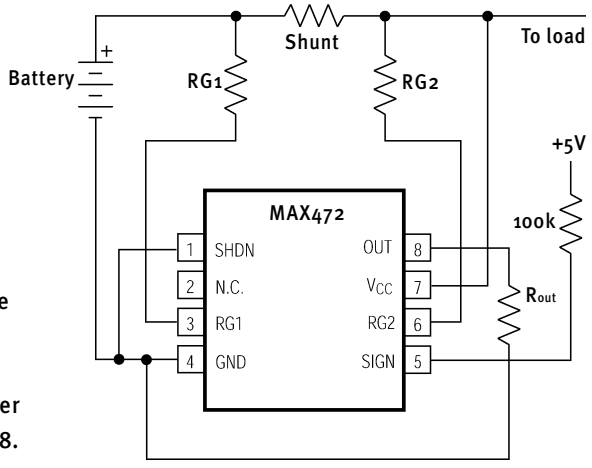
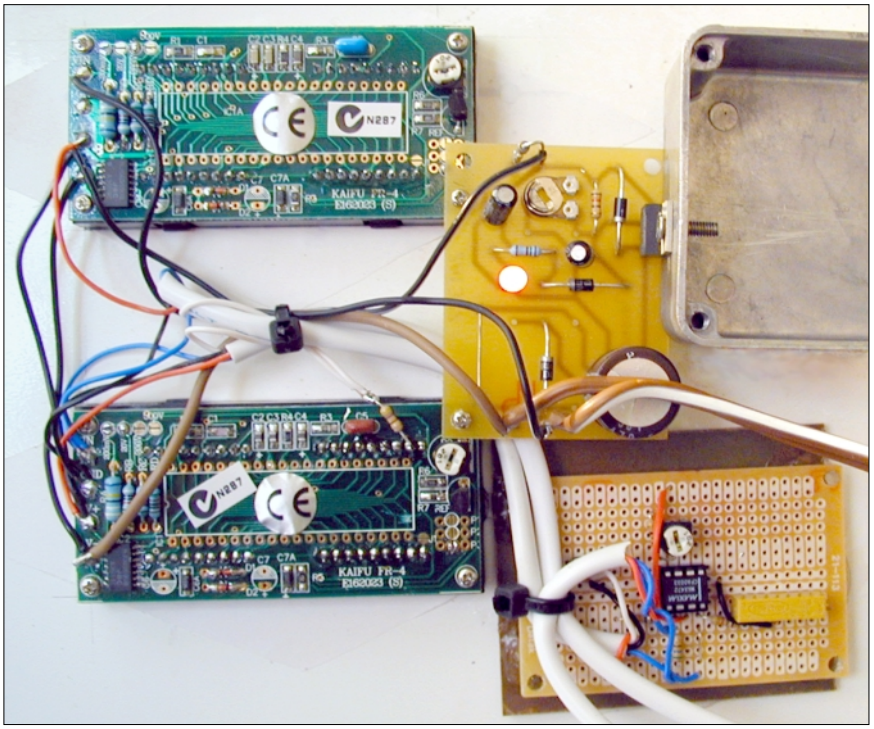


Figure 1. The circuit uses the MAX472 to measure the voltage across the shunt, converting it to a much larger proportional voltage at pin 8.

across the shunt so that the voltage drop in the leads was miniscule in comparison. After a bit of searching, we came across a range of natty little integrated circuits called 'high side current amplifiers' from Maxim. These essentially allow the shunt to be placed in the positive lead from the battery instead of the common negative, thus eliminating the effect of voltage drop in that lead.

The chip reads the tiny voltage drop across the shunt and amplifies and converts it to a proportional current output. By feeding this current through a resistor, a voltage proportional to, but much greater than, the shunt voltage can be obtained. This can then be fed into meters, dataloggers or whatever you wish. Another advantage of this is the ability to measure the current from a distance. Electrical noise will have much less effect on a zero to 5 volt signal than on a zero to 50mV one.

The IC we used is called the MAX472. This chip uses only a few components to measure the current. The circuit diagram for the measuring part of the circuit can be seen in Figure 1. Another similar chip, the Max471, has an inbuilt shunt, allowing it to measure currents up to 3 amps directly with only one other component. These chips also supply a sign output, which is either high (5 volts) or low (0 volts) depending on which way the current is flowing. We used this output to simply activate the minus sign on our voltmeter.



The circuit was built on a simple breadboard and was attached to the back of the Power Centre front panel, along with the 5 volt power supply for the panel meters. You can see this conglomeration of boards and wires in the photo at right. In our circuit, we made RG1 variable so that we could adjust out any zero error. The output resistor, R_{out} was a 1.5k resistor and a 5k variable resistor in series so that we could adjust the output to the desired voltage range.

The voltage and sign outputs from the MAX472 were also taken outside the Power Centre via a length of shielded cable for connection to our datalogger at a later stage.

Obtaining the chips

We got our ICs directly from Maxim via their website at www.maxim-ic.com. We simply ordered them as samples, and Maxim were kind enough to supply two of each of those that we specified. However, we cannot guarantee that they will send samples to everyone who asks, but it is worth contacting them. These ICs are also available from RS Components, but you will pay over $10 each for them. Their part numbers are 810352 and 810368 for the 471 and 472 respectively.

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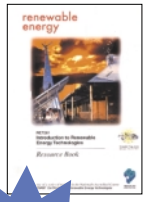

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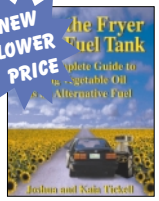

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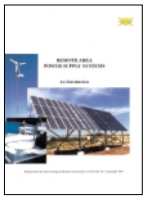

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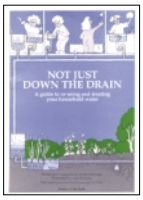

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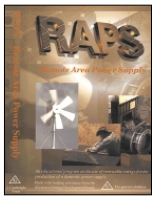

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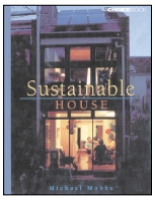

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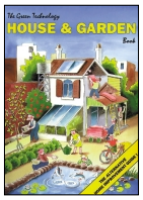

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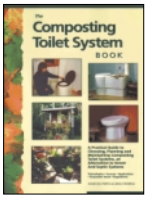

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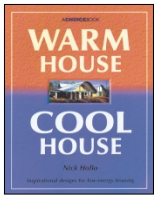

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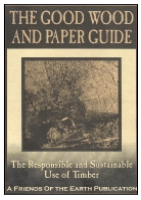

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ReNew Issue 70
Solahart PV solar concentrator; Earth covered house in the suburbs; Studying renewable energy; Environmental education for kids; SHW at the zoo; Renovating for hot weather; Going bush with renewables; Solar panel buyer's guide; Sustainable Energy Foundation; Pulsing LEDs; DIY: Composting toilet, small Savonius wind turbine.

ReNew Issue 71
Sustainable house ideas; YHA eco-hostel; Solar-powered school; Bushfoods; Independent power in suburbs; BYO electric bike; Make biodiesel in a dishwasher; Wood-fired power stations; Insulation buyer's guide; Going Solar fair; Solar TAC billboards; TEAP; Converting old computers to data loggers.

ReNew Issue 72
Sustainable inner city living; Electricity industry deregulation; Indonesian environment centre; DIY micro-hydro; Micro-hydro buyer's guide; Community gardens; Products index; Articles index; Oatley regulator modifications; ATA's power system; Home-made solar bread.

ReNew Issue 73
Servicing remote power needs; Renewables for renters;Renewables in Germany; On the road with renewables; Avoiding RAPS mistakes; Diverting rubbish from landfill; ATA turns 20; Solar hot water buyer's guide; Solar turbine; DIY: datalogger.

ReNew Issue 74
Biodiesel for sale; Corporate green revolution; Save 100,00 litres of water; Driving LEDs from any voltage; A 3-phase workshop on renewables; Car-free days; Giving old bikes their second wind; Birds and wind turbines; Australia's largest wind farm; Sinewave inverter buyer's guide; How much is a solar system; DIY: solar light dimmer, freezer to fridge conversion, solar air conditioner.

ReNew Issue 75
1MW solar power station; ReNew inspires new house; Fuel cells; Hybrid vehicles; A dialysis centre's solar backup power supply; YHA solart hot water; Solar heated spa; Light pollution; Getting into a SCRAP; Grid connect hassles; Deregulation and contestability; Green Power buyer's guide; Wind powered water pump; Automatic solar lighting system; Solar scarecrow.

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76/01

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Global warming getting you down?

Want to make the world more sustainable, but feel like no-one's listening?

The Renewable Energy Development Trust was established in 1994 to allow people to make tax deductible donations to support the activities of the Alternative Technology Association (ATA). Besides publishing *ReNew*, the ATA also runs educational activities across Australia, sets up demonstration projects of environmental technology and encourages its members to put sustainable living into practice

Make a donation today and make a difference.

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phone (03) 9388 9311 fax:(03)9388 9322.

76/01

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We are looking for great build-your-own articles and ideas. You don't have to be a tech-head, just have an idea, simple or complex, electrical or mechanical, that has appeal to do-it-yourselfers and involves renewable energy or appropriate technology in some form. It may be a regulator, pedal-powered generator, a solar cooker or anything useful, really.

Just send your ideas to: ReNew, PO Box 2001 Lygon St North, East Brunswick VIC 3057, email: ata@ata.org.au
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Within Australia: $24 for one year (4 issues), $48 for 2 years (8 issues).
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Elsewhere: AUD$36, AUD$72 (2 years). All payments must be in Australian dollars.

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Alternative Technology Association, PO Box 2001 Lygon St North, Brunswick East VIC 3057, Australia, Fax: (03) 9388 9322.

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Take out a new subscription or membership, or renew your current one, before 27 July 2001 and you could win a Sola-Kleen/Smalls Solar 240 litre solar hot water system valued at $2500. See page 5 for full details.

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ATA members receive:

- Free back issue of *Soft Technology* or *ReNew*
- Subscription to *ReNew*
- *The Sun*, a bi-monthly members newsletter, detailing events, meetings and branch contact details. You can receive it by post or email
- Discounts on ATA Adult Education courses such as Solar Electricity, Batteries, Greywater, Windpower and Solar Hot Water. (Courses held in VIC only)
- The chance to participate in member activities such as field trips and seminars
- Access to the ATA's renewable technology library
- Members card
- The chance to network with over 1300 other members throughout Australia

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- Solahart: 10% off all solar water heaters (except the Black Chrome XII range)
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Call (03) 9388 9311 or visit our web site at www.ata.org.au for more information about the ATA.

Alternative Technology Association, PO Box 2001 Lygon St North, Brunswick East VIC 3057, Australia

Building energy efficiency codes for Australia

A step in the right direction, but Alan Pears is not game to hold his breath waiting for it to deliver significant savings

In July 2000, the Australian Building Codes Board (ABCB) reached agreement with the Australian Greenhouse Office to develop and incorporate energy provisions in the Building Code of Australia. The ABCB has just released a *Directions Paper* in which it outlines progress to date and maps the timetable for future work. Although some minor changes may be introduced early next year, it will take several years to include all the relevant regulations. But don't hold your breath, there are no guarantees that the provisions will be set at levels that deliver significant savings.

To be fair, the bureaucrats, consultants and volunteers working on this process seem to be generally well-intentioned and hard-working. The problems are deep-seated: cutbacks in research into building energy since the mid-1980s mean that many issues simply can't be resolved using non-existent solid data and research findings. Instead, vested interest groups representing different products (such as foil versus bulk insulation, and timber versus heavy materials) debate and delay action. And major building industry associations have made it clear that regulations will only be supported if they merely remove worst practice, rather than requiring good practice.

The building industry associations are way out of touch with community expectations and those of many within the building and sustainable energy industries. Recent consultation on the proposed Victorian *ResCode* provision to mandate a minimum four-star energy rating for all new homes uncovered enormous public support for regulation of high standards of energy performance. The ACT has had mandatory four-star minimum rating requirements for five years, without the world ending.

What's needed is strong public input calling for levels of performance that will allow new homes to be part of a sustainable future, instead of yet another liability as we move into a low greenhouse emission world. You can read the *Directions Paper* at www.abcb.gov.au. And please make a submission, even if it's short.

At this point, I should declare my conflict of interest. I am on the steering committee of this process, with the title *community advocate*. But I have no budget for liaison or publicity. So send me copies of your submissions on apears@c031.aone.net.au

A particular issue of concern to me is the debate between the advocates of using energy/greenhouse emissions as an indicator of building performance, and those who argue for recognition of overnight ventilation and design features to avoid air-conditioning. On one hand, I would like to believe that we could avoid air-conditioning in most of Australia, but I am not convinced that opening up houses to provide comfort is a practicable option for many in our suburbs, where noise and fears about personal security limit such behaviour. I'm still not convinced that we can't encourage use of natural cooling but design the houses so that, if they are air-conditioned, they will use minimal energy. What do you think?

Appliance energy efficiency in Australia

One moderately bright spot on the sustainable energy horizon is the progress on appliance energy efficiency. A recent workshop in Melbourne reviewed progress to date and mapped out future directions in this field. Reports presented showed that the energy efficiency of most energy-labelled products has been improving and, with revised, tougher energy labels now introduced, and the long-awaited MEPS (Minimum Energy Performance Standards) program coming into play, further substantial improvements look certain. The cost of appliance energy efficiency in greenhouse terms is estimated at: $31 per tonne of CO_2 avoided (yes, a negative cost!) and a far cry from the $40 per tonne predicted by economic modellers for greenhouse response. This negative cost is actually an argument for much more aggressive action, as it shows we're missing out on cost-effective savings!

A disturbing study also released at the workshop showed that 11.6 per cent of Australian household electricity is used by appliances and equipment on stand-by, when it's doing little or no useful activity—so-called 'phantom loads' or 'energy leaks'. And it's growing at eight per cent each year! Governments outlined the actions they are taking to respond to this. But their effectiveness is severely constrained by government acceptance of industry arguments that we must follow international processes, rather than lead on this issue.

A speaker from the appliance importers' association also pointed out that proposed changes to Australia's electricity voltage to 230 Volts (+10%/-6%) would not allow them to optimise the energy efficiency of their products. Michael Gunter of ATA has worked hard to raise this issue with limited success. Maybe this industry backing will lead to some reconsideration of a proposal that is designed to suit the electricity supply industry at the expense of consumers and the environment. Interesting that government is reluctant to act on standby energy if it is out of step with international practice, but it will accept the electricity industry's internationally inconsistent proposals.

The Government has also announced a public consultation process on the future direction of its appliance efficiency program. A discussion paper is available on the Australian Greenhouse Office website www.greenhouse.gov.au or email: energy.efficiency@greenhouse.gov.au

The more submissions there are advocating strong action to make Australia's appliances world-best, the better.

Can't see the Bush for the trees?

I've left until last discussion of President Bush's efforts to put the short term interests of some sectors of the US ahead of those of the people of the world, the environment, and his own descendants. In some ways, this statement may do some good. According to US greenhouse commentator Stephen Schneider, a subsequent survey showed three-quarters of Americans support action on greenhouse. And there is serious support for action at senior levels in his own administration. After all, the President didn't argue about greenhouse science—he's just concerned that the companies who support him may be hurt.

A disturbing outcome of the Bush statement has been the media barrage by Australia's anti-greenhouse forces using Bush's position to undermine the very limited action Australia is taking. Media analysis generally ignored the fact that the Kyoto Protocol is a process taking a first step towards a global response to a serious global problem, not a conspiracy to cripple Australia's 'old world' economy. And Australia's government will actually be able to determine the extent to which business sectors benefit or suffer as a result of our response to Kyoto.

The government-preferred approach to greenhouse response is an emissions trading scheme. This means all emitters would have to buy emission permits on a market, so the effective cost of fossil fuels would increase, supposedly damaging the competitiveness of Australian business. In reality, the Australian Government will receive the money from the initial sale of permits, so it will have many billions of dollars available to do things like rebate increases in energy costs to those businesses vulnerable to competition from countries without Kyoto targets, finance energy efficiency and other emission reduction actions, reduce taxes on labour, and so on.

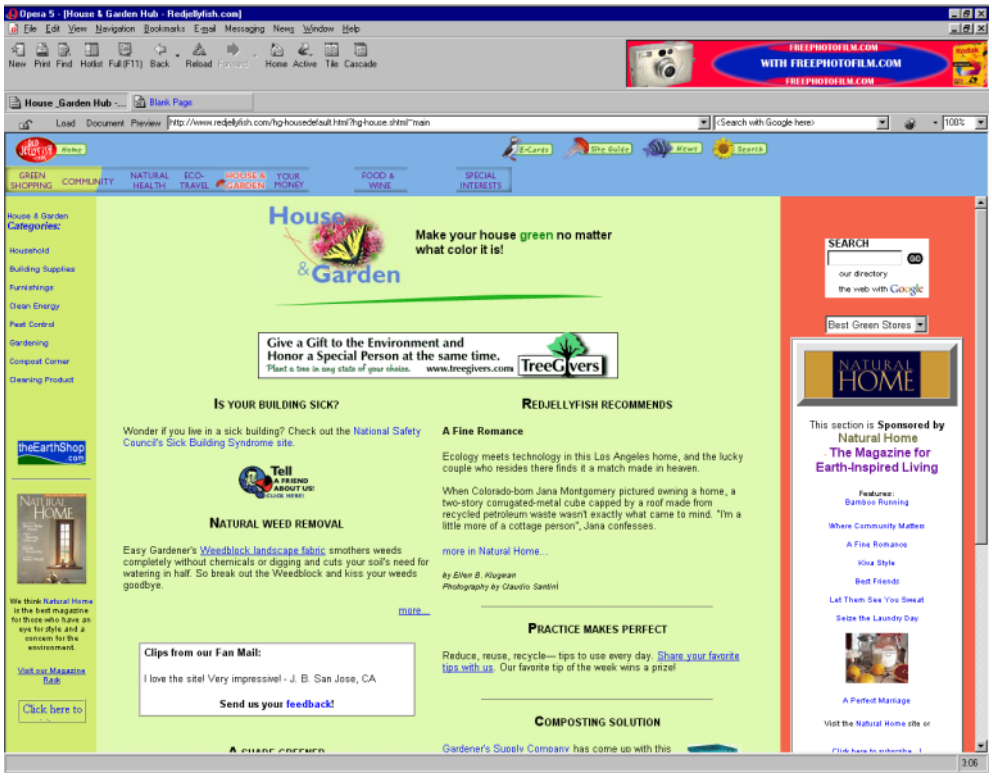
This potential to offset distortions and impacts is rarely mentioned by Kyoto critics and is generally not well-modelled in economic studies used to support their position. And, of course, the businesses that reduce their dependence on fossil fuels through smart strategies could come out way ahead. But that would involve seeking opportunity instead of complaining about the injustices of the world. ✲

Browser

www.redjellyfish.com

It may have a bizarre name, but this site is a great place to start if you are looking for general information on sustainable living and what you can do to have less impact on the planet.

This site contains information that the average person can apply to their lifestyle, and includes pages on food and wine, home and garden, animals, travel, natural health, books and music, green shopping and money and investment. A special interest page has a little bit of everything.



You can search the site for relevent information, check out the latest environmental news and information, or even send someone an electronic postcard with an environmental theme.

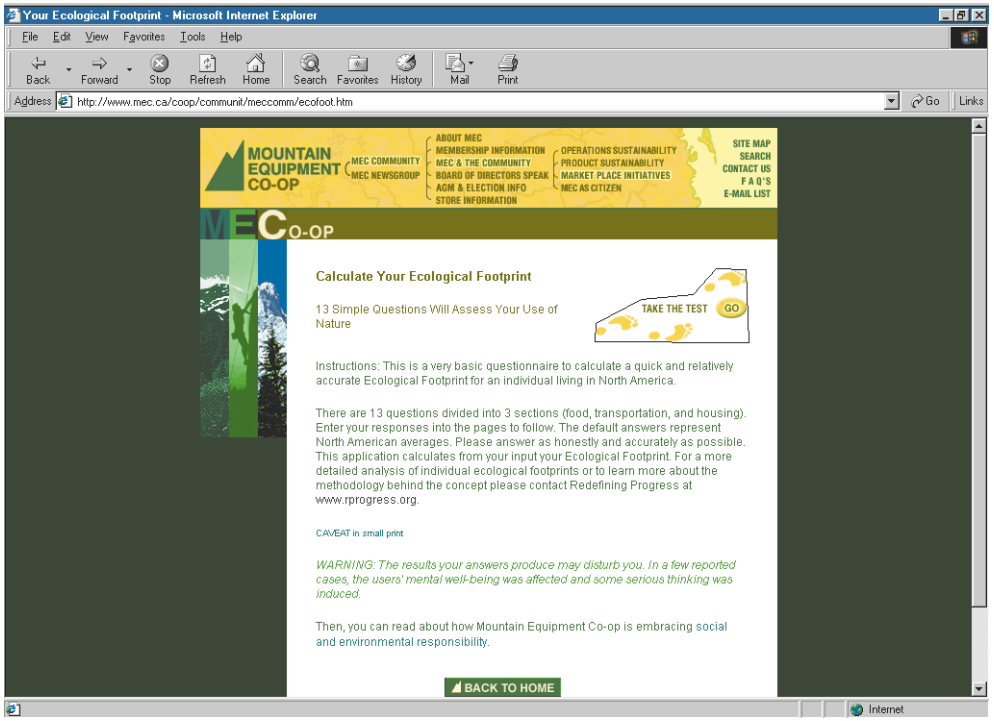
There is also a full site guide that makes it easy to find what you are looking for without wasting time searching for it.

You can also find out how many people existed on earth when you were born, or take part in the current site survey.

www.mec.ca/coop/communit/meccomm/ecofoot.htm

This page is a metric version of the Redefining Progress (www.rprogress.org) page which is designed to allow you to measure your ecological footprint by answering 13 simple questions. There is also an imperial unit version of this page at: www.lead.org/leadnet/footprint/intro.htm

By answering the multiple choice questions, you can find out just how many hectares or acres of land is required to support you and your lifestyle. One staff member did the test quickly and was amazed to find that they needed around 3.6 hectares to exist with their current standard of living—about a third of the average North American's requirements.

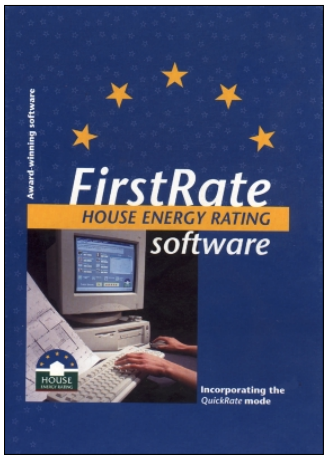


FirstRate House Energy Rating software

Software by: Sustainable Energy Authority of Victoria
List price: $300
Web: www.seav.vic.gov.au Email: firstrate@seav.vic.gov.au

If you want a quick and easy tool to rate your building designs for energy efficiency using a star rating, then *FirstRate* provides you with this tool and the flexibility of choosing between 20 different climatic zones.

The latest update of *FirstRate* House Energy Rating software from the Sustainable Energy Authority of Victoria (SEAV) is a condensed version of the NatHERS (National House Energy Rating) program. It provides a quick and user-friendly interface for the designer to make assessments on the star rating (energy efficiency) of a proposed housing project at the sketch design stage.



As a design tool, it evaluates the energy performance of each part of a house and tests the effects on energy efficiency of changes to the building design as soon as they are made.

A new feature is that there are two rating modes—a comprehensive *FirstRate* mode and a *QuickRate* mode. The *FirstRate* mode allows for a detailed assessment of the energy efficiency of a proposed housing project. The *QuickRate* application, as it name implies, allows for a quick assessment of a scheme at any stage, with a number of assumptions built into the program.

The major difference between the FirstRate software and previous versions is that the program assumes that utility rooms are not mechanically heated or cooled. *FirstRate* maintains backward compatibility with files using the HERS (House Energy Rating) software, however the HERS rating will not be valid until you have manually deleted the utility areas.

Improvements in the *FirstRate* home energy rating software include: window orientations increased from eight to 16 in *FirstRate* mode; upgrading of the 'optimise' section with additional options available to improve energy rating; automatic allocation of numbers to each section of floor, wall, ceiling, window and skylight making amendments easier; inclusion of custom windows rated according to the window energy rating scheme.

***FirstRate* manual and *QuickRate* data sheet and instructions is supplied on the CD in Adobe Acrobat (pdf) format.**
Training: one day ($195 plus GST)
Accreditation: $440 for first year, $275 subsequent years

FirstRate has a number of key features, such as the standalone shading calculator, which assists users to determine the proportion of a window affected by overshadowing buildings or courtyards and a hints list that is automatically generated.

The program provides point scores for design features, providing an overall rating on a scale zero to five stars in half-star increments.

An energy efficient home design can include climatic design elements, such as attached garden conservatories, solar chimneys, and earth bermed wall or wind catches. These elements cannot be evaluated in the *FirstRate* rating system at this stage.

As with all performance-based modelling software there are a number of assumptions made which may or may not apply to the way you operate your home's building system. The basis of the energy rating is energy use per square metre of conditioned floor area. The predicted energy use in the program overestimates the energy use compared to average bills, with extensive periods of heating and cooling.

The details screen, in a series of spreadsheets, allow you to enter data about the climate building materials and design of the house with point scores for the building fabric and design elements. The optimiser tests the effect of the design changes on the star rating and points score of the design being rated. A list of on-screen hints is available for improving the energy efficiency of the design being rated which is a useful tool if you are new to energy efficient building. The star rating is automatically updated as data is entered or changed.

Reviewed by Bridget Puszka of BP Architects

Send details of events to *ReNew*, PO Box 2001, Lygon St North, Brunswick East VIC 3057, Fax:(03) 9388 9322, email: ata@ata.org.au. For event updates, see our web site at www.ata.org.au

ATA workshops 2001

CERES site, Lee St, East Brunswick, VIC

- Greywater: 3 June, 1 July, 5 Aug, 2 Sep, 4 Nov, 2 Dec
- Solar electricity: 10 June, 12 Aug, 14 Oct
- Wind power: 17 June, 19 Aug, 21 Oct
- Solar Hot Water: 24 June, 26 Aug, 28 Oct
- RAPS Batteries: 29 July, 23 Sep, 25 Nov
- Low Energy Homes: 22 July, 16 Sep, 25 Nov

Fee: $77 for ATA members, $88 for non-members, inc GST. Contact: ATA, ph:(03) 9388 9311, email: ata@ata.org.au

Renewable Energy Generators Australia Ltd 2001 Forum

6-8 June, 2001
Launceston, TAS

The theme of this conference will be 'Renewable Energy: A World-Wide Business Opportunity'.
Contact: Lee Slaidins, Conference Design Pty Ltd, PO Box 342, Sandy Bay, TAS 7006, ph:(03) 6224 3773, fax:(03) 6224 3774, email: lee@cdesign.com.au

Non-conventional Homes Eco Tour

10-11 June, 2001
Manning Valley NSW

A tour of 38 houses and places to visit.
Contact: Ph:(02) 6551 3403 or (02) 4997 6055 for a guide book.

Community Technology 2001

5-6 July, 2001,
Murdoch University, Perth, WA

International conference on governance and sustainable technology in indigenous and developing communities.
Contact: Andrea Lee, Concept Connections, PO Box 235, Mount Hawthorn WA 6915, ph:(08) 9242 2232, fax:(08) 9242 2238, email: andrea@concon.com.au

Sustainable Energy Day 2001

11 July, 2001
Monash University, Clayton Campus

Contact: Dr. A. Zahedi, Solar Energy Applications Research Group (SEARG), Monash University, Department of Electrical and Computer Systems Engineering, Clayton Campus, Wellington Road, Clayton VIC 3800, ph: (03) 9905 5957, fax:(03) 9905 3454, email: zahedi@eng.monash.edu.au, http://www.ecse.monash.edu.au/prof/sustenergyday/index1.html

Energy Efficiency in Industry

24-27 July, 2001
Tarrytown, New York, USA

Participants will discuss issues relating to energy efficiency in industry, and the theme of the conference will be 'Increasing productivity through energy efficiency'.
Contact: Rebecca Lunetta, Conference Manager, 2001 ACEEE Summer Study Office, PO Box 7588, Newark, DE 19714-7588, ph:+1 302 292 3966, fax:+1 302 292 3965, email: rlunetta@erols.com

Red Dust Run

Late July, 2001
Darwin to Adelaide via Uluru

A four month trek by electric wheelchair to raise awareness for people with disabilities. Support vehicles are expected to be renewably powered.
Contact: Fred Kohl, mobile: 0414 304 732, email: fkohl@bigpond.com, www.reddustrun.com

Environmental Home Expo

11-12 August, 2001
City Hall, Hobart TAS

Ideas for a healthy, environmentally friendly, energy efficient home and community.
Contact: Tasmanian Environment Centre, 102 Bathurst St, Hobart TAS 7000, ph:(03)6234 5566, fax:(03)6234 5543, email: restec@southcom.com.au

Wild Spaces National Environmental Film Festival

21–23 September 2001
Simultaneous screening in all Australian States and Territories, as well as many regional centres.

Wild Spaces is Australia's only environmental film festival. In its sixth year, the festival's success has seen it expand to reach towns and cities in all Australian States and Territories. The festival is the only one of its type and runs simultaneously over three days in all participating cities.

Expect a selection of inspiring and educational films, shorts and documentaries which will challenge and inform you about environmental and social justice issues affecting Australia and communities around the world. Most of the films selected have never been screened in a public forum before. Independent film makers are encouraged to contribute work before 6 July 2001.
For locations and more information contact Friends of the Earth Melbourne ph:(03) 9419 8700, email: foe@melbourne.foe.org.au

International Young Professionals Conference

2-6 October, 2001
Gold Coast, QLD

Aimed at bringing together young professionals aged 18 to 35 with the goal of developing workable solutions to poverty, addressing environmental degradation, fostering social institutions and building socio-economic progress, especially in developing countries.
Contact: IYPS Secretariat, ph:(07)3858 5524, fax:(07)3858 5516, email: info@iyps.org, www.iyps.org

World Solar Challenge

18-28 November, 2001
Darwin to Adelaide

Planned to arrive in Adelaide in time for the ISES 2001 conference (see below).
Contact: Chris Selwood, ph:(08) 8463 4690, email: wsc@saugov.sa.gov.au, www.wsc.org.au

World Renewable Energy Congress VII

29 June - 5 July, 2002
Cologne, Germany

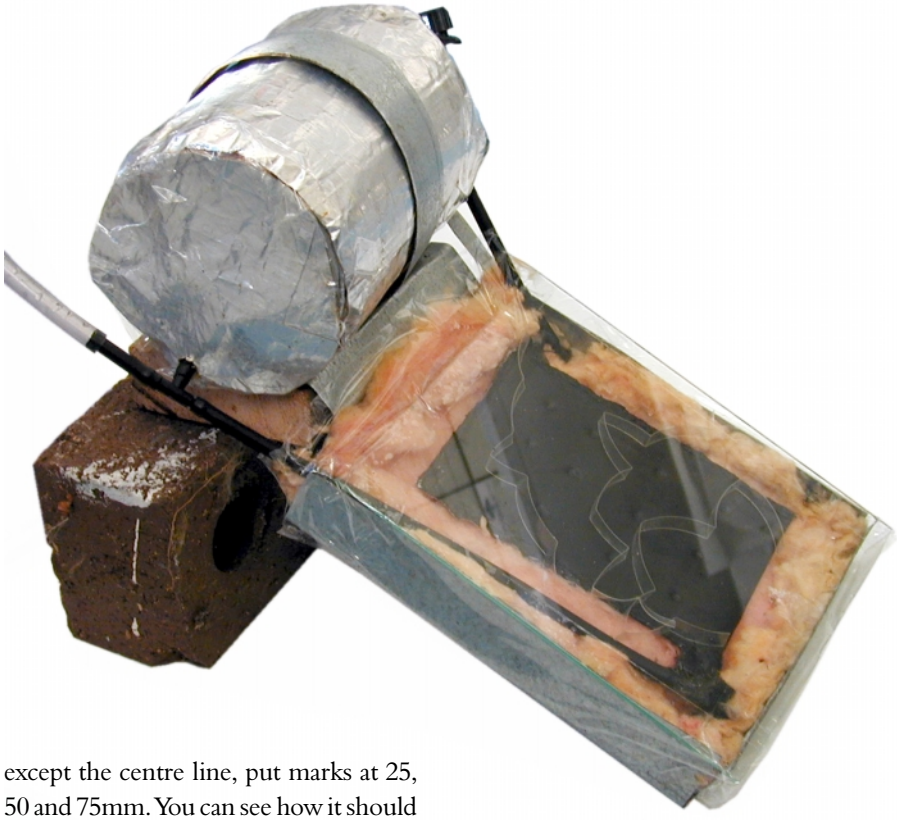
Aimed at ensuring renewable energy takes its proper place in the future. Covers policy, low energy architecture, PV technology, solar thermal, wind power, biomass, materials and fuel cells.
Contact: Professor Ali Sayigh, Congress Chairman, 47 Hilmanton, Lower Earley, Reading RG6 4HN, UK, ph:+44 1189 61 1364, fax:+44 1189 61 1365, email: asayigh@netcomuk.co.uk, www.wrenuk.co.uk

[Kid's stuff]

Noel's Treasures from Trash

To make your own Solar water heater you will need:

- a 450g Milo tin
- a jam tin
- a piece of tinplate 100mm x 300mm
- a piece of thin glass 210mm x 180mm
- some 4mm garden irrigation tube
- two 4mm tee pieces
- two 4mm elbow pieces
- some 4mm flexible tubing
- a 4mm tap
- a piece of flat galvanised iron sheet 240mm x 310mm
- about half a square metre of building foil insulation
- some fibre insulation—a piece from an old windcheater folded several times, or a wad of newspaper
- silicone sealant
- some clear packing tape
- flat black paint
- a couple of housebricks
- tinsnips, hammer, pliers, solder and a large soldering iron, a sharp knife, a 6mm punch



In the last issue we experimented with heating water using the sun's energy. Now we will make a solar water heater that works just like the real thing that you may have on your roof. The project can be a bit difficult, so you will need an adult to help you.

First we will make the collector, which is the most important part of this project as it takes the heat from the sun and transfers it to the water.

Draw a line across the middle of the 100 x 300mm piece of tin, as well as lines parallel to it at 30, 60, 90 and 120mm distances from the centre line, on both sides of the centre line. On each of these lines, except the centre line, put marks at 25, 50 and 75mm. You can see how it should look in Figure 1. Note that to get this tinplate you can cut up another Milo or similar tin that doesn't have ridges on it.

Now drill a 6mm diameter hole in a scrap block of wood about 3mm deep. Place each cross mark over the hole on the wood and make a dint in the tinplate at each mark using the punch and hammer. The dints should be 2 to 3mm deep.

Now, carefully bend about 3mm of each edge of the tinplate down slightly, and then fold the plate in half so that the dints opposite touch each other and form little pillars. Place a bolt between the two sheets at both points marked 'A' and squeeze the tin around it with pliers.

Now you need to solder the sheet together around the edges, right up to the bolts, but don't solder the bolts to the sheet. This will take patience, however, you might want to just do a few small solder joints along the edge and then seal the rest with silicone sealant.

Once ready, you need to cut two 50mm lengths of irrigation tube and insert them into the top and bottom holes in the collector after removing the bolts. When all this has dried, paint the front of the collector with the black paint.

To make the collector tray, measure in 30mm from the sides and bottom of the galvanised iron sheet, and 70mm from the top. The top is one of the short sides of the sheet. Cut out the rectangles from the corners and fold the three shorter edges up 90 degrees. Bend the

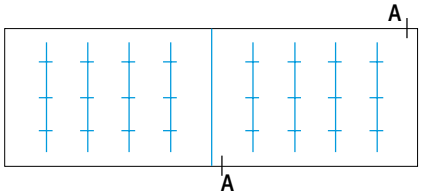


Figure 1. This is how you mark out the tinplate to make the collector.

top piece down at 45 degrees and nail it to a block of wood 130 x 100 x 30mm.

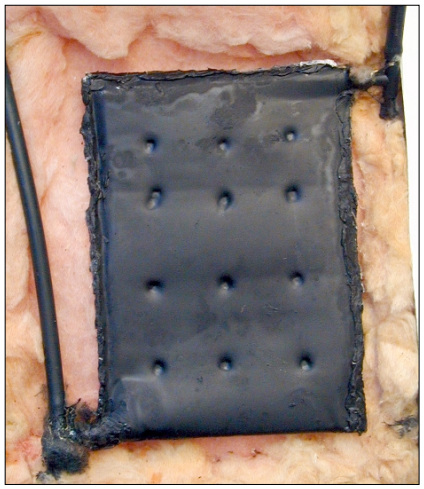
Place some insulation in the tray and place the collector on top of it.

To make the cold water header tank, take the jam tin and carefully make a hole in the side near the bottom of the tin, just large enough to take the end of the flexible tube. Push the end of a 400mm length of the tube into the hole and seal in place with silicone sealant. Put this aside to set for 24 hours.

Now you need to make the hot water storage tank. Make sure the lid is firmly in place on the Milo tin. With the tin lying on one side, make a hole at the bottom of the lid large enough to take the irrigation tube—it should be a tight fit. At the other end of the can, make a similar hole at the top.

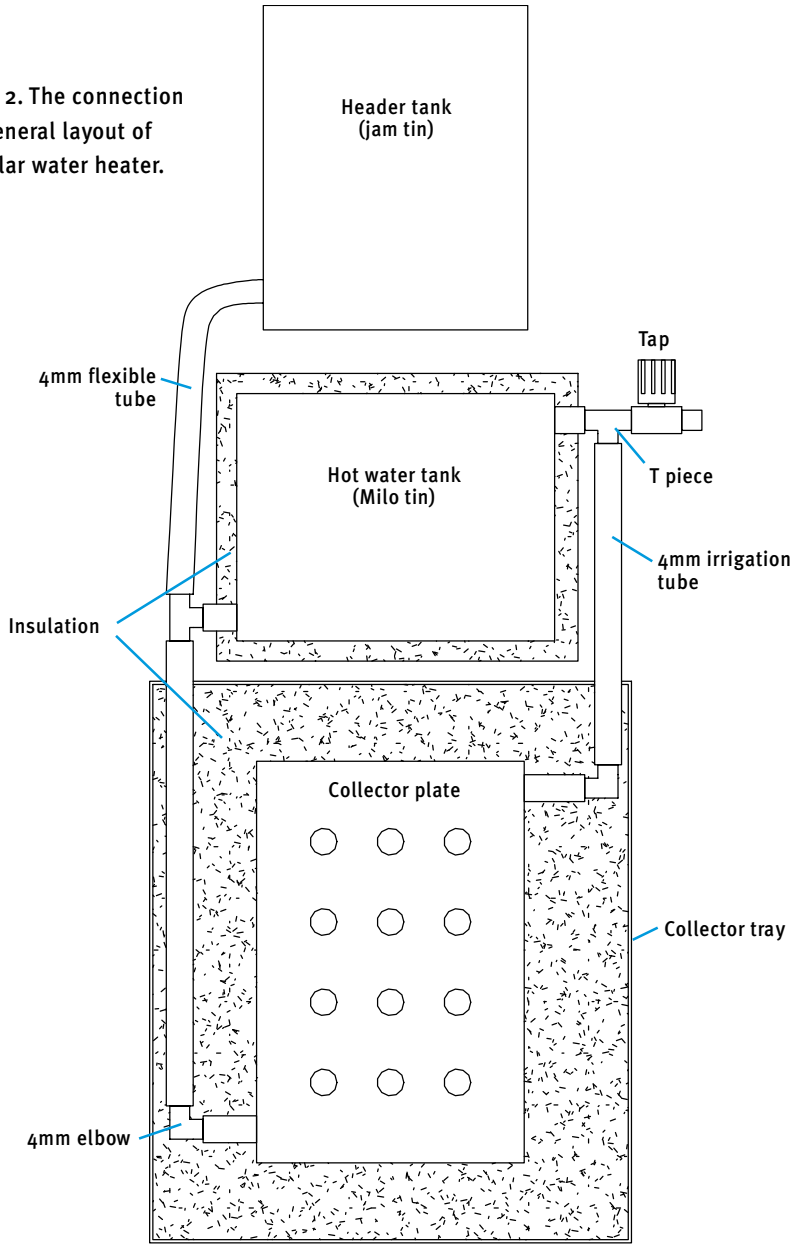
Into each of these holes fit a 50mm long piece of irrigation tube and seal into place. Fit a T piece into each of these short tubes (see Figure 2). Make sure the tin is watertight, and then wrap it in some insulation and cover it completely in builders foil insulation, making sure that the pipes stick out from the insulation. Hold it all together with clear tape.

Attach the tank to the top of the collector box with a strip of plastic cut from a plastic drink bottle. Now, make the rest of the connections between the tanks and the collector with the irrigation tube as per Figure 2.



The collector close up. Note the dimples that provide a degree of separation between the plate surfaces.

Figure 2. The connection and general layout of the solar water heater.



Place the glass over the collector, and tape it in place.

Setting up

Place the heater so that the tank sits on top of a brick. This should let the collector sit at an angle of about 45 degrees. Place the cold water header tank on another brick so that its output is slightly higher than the hot water tank. Fill it with water, and keep filling until water comes out of the tap on the hot water tank. Close the tap, and make sure that there are no leaks.

If all is well, leave the heater for an hour or two to make some hot water. Open the tap and see how hot the water has become, being careful not to burn yourself. Make sure there is water in the header tank to replace the water that comes out of the tap.

Send us your questions

If you have a problem you just can't solve, or want to know the answer to a general question about sustainable technology, drop us a line and we will do our best to answer your query.

Send your questions to:
***ReNew*, PO Box 2001, Lygon St North, East Brunswick VIC 3057.**

Renewable heating options

I am in the process of getting some form of heating for my house. It is situated between Sydney and Wollongong. The winters are temperate but the house is exposed to strong southerlies. The only gas available is LPG.

I have a heat pump for hot water and though all my neighbours have wood burning heaters I thought I might investigate the possibility of alternate technology as I have always tried to be environmentally responsible.

So what are my choices? Is photovoltaic a financially feasible option for a domestic situation?

Angela Sands
sangel@ozemail.com.au

Angela, you would not use photovoltaics for heating, this would cost you a fortune as it is a very inefficient way to produce heat. A good place to start is a solar box heater, such as the ones described in issue 68 of ReNew. *The article is also available our website.*

These collect heat directly from the sun and transfer it to air which is ducted into the house. While they do not work well in overcast weather, any cold but sunny days will provide you with considerable heating with a properly sized and constructed unit. We don't know of any commercial units, but they are quite easy to construct with basic tools and a little patience.

There are a few solar hydronic systems available, but they will also need some form of backup for cloudy days, and if LP gas is all you have, then that will have to do. It is a lot cleaner than burning wood.

Another option is to use a reverse cycle airconditioner, these are much more efficient than using electricity to produce heat directly, usually having an effective efficiency of over 250 per cent.

Lance Turner

Reusing car regulators

Is it possible to use an automotive regulator found on older vehicles as a basic regulator for a power system?

I understand that it won't have a cut-out mechanism or any of the other useful capabilities that come with a solar regulator, but I thought that maybe it could be used as a method of at least providing the correct voltage to a 12 volt battery from a solar panel.

Gerard Renehan, Broome WA

This is not generally possible with the average car alternator regulator. Car regulators work by measuring the alternator output voltage and varying the current in the alternator's field winding to control its output. This is completely different to a solar regulator, which has to handle the full solar array current, and generally just switches it in and out.

If you are looking for a cheap regulator, then you might want to consider one of the kit regs available, such as the Oatley Electronics unit. Alternatively, Dick Smith Electronics sells a 20 amp simple switching regulator that sells for around $70. Details of this regulator can be found in issue 75 of ReNew.

Lance Turner

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S.E.A SEAP-12-1K3	12v 1300 / 3900 watt	$ 1999
Latronic 412-BKZ-12	12v 1300 / 3800 watt	$ 1861
Latronic 518-BKZ-12	12v 1800 / 5000 watt	$ 2272
S.E.A SEAP-12-2K0	12v 2000 / 5000 watt	$ 2899
S.E.A SEAP-24-250	24v 250 / 725 watt	$ 499
Latronic 48-BKZ-24	24v 800 / 2800 watt	$ 1211
Selectronic WM1000-24	24v 1000 / 3000 watt	$ 1459
Selectronic WM1500-24	24v 1500 / 4500 watt	$ 1851
S.E.A SEAP-24-2K2	24v 2200 / 6000 watt	$ 2571
Selectronic SE-32	24v 2400 / 7000 watt	$ 2899
Latronic 525-BKZ-24	24v 2500 / 7500 watt	$ 2515
Latronic 530-BKZ-24	24v 3000 / 9000 watt	$ 2796
S.E.A. SEAP-24-3K0	24v 3000 / 9000 watt	$ 3357
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Solar Technology Designers Catalogue 2002

Now entering it's 13th year, this compelling 150 page master design manual / catalogue is endorsed by thousands of enthusiasts as their renewable energy bible ! This edition is substantially revised, and written in a clear and innovative style for your renewable enlightenment, by leading solar engineer and pioneer Christopher J Darker. cdarker@unisun.com.au

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UNIVERSALITY OF THE SUN (UNI-SUN) Ph 04 1893 4607
www.unisun.com.au

Low-cost greywater diverter

Diverting waste bath or shower water to use on the garden is a great idea, but not always the easiest to implement.

An Australian made water diversion valve, similar to the Suldi valve which we looked at some years ago, is now being manufactured by G J Products in Geelong, VIC. The valve fits standard 50mm drain pipes, or other sizes with the appropriate adaptors, and has a 25mm diverted water outlet for use with 25mm hose. You simply fit the valve, attach a hose, and flip the lever into the divert position, and you are ready to make good use of your waste water. Of course, you will have to check with your local water authorities as to the legality of diverting greywater for other uses.

rrp $33 including GST.

Manufactured by G J Products P/L, PO Box 66, North Geelong VIC 3215, ph/fax:(03) 5282 5823. Available from Going Solar, 322 Victoria St, North Melbourne VIC 3051, ph:(03) 9328 4123.

Fuel cells in Australia

In issue 75 of *ReNew* we looked at developments in fuel cells, and listed some companies working on this technology. One of those companies, H-Power Pacific, now has commercially available a range of fuel cell products, including a 13 watt educational kit, 35, 50, 250 and 500 watt portable power units, right through to to 4.5kW residential cogeneration unit capable of running the average home.

The systems use proton-exchange membrane fuel cells that run on either pure hydrogen for the smaller systems, or propane/natural gas for the residential unit. The hydrogen is stored in metal hydride cylinders for safety at around 250psi pressure, and a cylinder filling station is also available.

Distributed by H-Power Pacific, ph:(02) 9887 3116, fax:(02) 9870 7681, email: inquiries@hpowerpacific.com, www.hpowerpacific.com

Cleaner driving, but at a price

We don't often have vehicles in the Products section, let's face it, cars as they are now are just not sustainable, but Honda's new hybrid vehicle is a huge step in the right direction—and it's available in Australia!

The Insight uses a hybrid petrol/electric powertrain to achieve a fuel consumption of just 2.8 litres per 100km highway cycle and 3.6 litres per 100km city cycle—about half the fuel consumption of a Honda Civic.

The Insight uses a one litre, three cylinder unleaded petrol engine and a thin electric motor for propulsion, which helps it achieve the ultra-low emissions standard, which is 90 per cent below Australian emission requirements. Electricity for the motor is stored in a 144-volt nickel-metal-hydride battery pack. Power for the electric system is primarily sourced from regenerative braking, eliminating the need for an external power source. Other fuel features include the idle-stop feature, which switches off the engine when the vehicle is stopped, a lightweight aluminium body, and very low wind resistance. The insight comes with a 3-year/100,000 km warranty.

rrp: $48,900 plus dealer, government and on road costs.

For more information, contact your local Honda dealer, or check out their web site at www.honda.com.au

Natural floors

Carpets can be warm to walk on in winter, but they can be an environmental hazard too. Not only are they a breeding ground for dust mites, but when it comes to disposing of them, there are few options. Most carpet ends up in landfill, where it sits for decades if made from synthetic fibres.

International Floor Coverings has a range of natural fibre carpeting materials made from jute, sisal, seagrass and jool, a jute/wool mix. They are available in many different weaves and colours, and with different backing materials including natural rubber, so the whole carpet is compostable when it finally wears out.

There is a mix and match service on their web site where you can construct rugs of different sizes using different fabrics for the border and body of the rug. You can even see the cost of the rug as you create it!

Available from International Floor Coverings, 379 South Dowling St, Darlinghurst NSW 2010, ph:(02) 9360 8655, fax:(02) 9360 8755, email: ifc@tig.com.au, www.interfloors.com

Who needs batteries?

Batteries are always going flat at the most inconvenient times, but there is now an option that can replace conventional batteries in many small appliances.

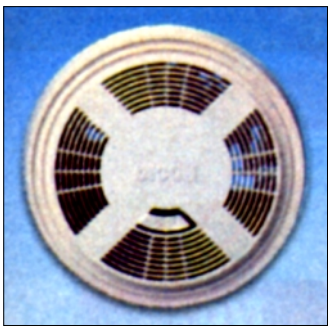
The Radio Lantern uses a device called the Liberty Power Generator, which is based on a thermo-electric module, and makes use of the wasted heat of the lantern, turning it into free electricity. The generator has no moving parts, no batteries, and it works day or night.

Small appliances rated at from 3 to 6 volts DC, such as radios, can simply be plugged into the power jack. The generator is available on its own, or can be bought already fitted to a range of different lanterns.

rrp: US$59.95 for the Freedom Generator. Lanterns complete with generator range from US$74.95 to US$94.95.

Manufactured by GW Industries, 7949 Silverton Avenue Suite #906, San Diego, CA 92126 USA, ph: +1 858 408 1777, fax: +1 858 408 1778, email: sales@radiolantern.com, www.radiolantern.com

Keep safe from fire without wasting power



With new safety regulations requiring all new homes to have hard-wired smoke detectors, many people on RAPS systems have wondered how they can comply without fitting 240 volt detectors that keep their inverters running constantly. We have been looking for an extra-low-voltage smoke detector, and have found one made by Dicon, a safety equipment company in the UK.

The detector runs on 12 to 28 volts DC, can be interconnected with up to 11 other detectors, has battery backup, and has a latching or momentary relay output, so it can be connected to security or other alarms. The detector draws 10mA during standby and 80mA when tripped. It uses the photoelectric method of smoke detection and so contains no radioactive material.

rrp: $150.75 plus GST.

Available from Farnell Components, 72 Ferndell St, Chester Hill NSW 2162, ph:(02) 9644 7722, fax:(02) 9645 1381, email: ausales@farnell.com, www.farnell.com. Dicon have a web site at: www.diconsafety.co.uk

Energy efficient torches

Osram have recently released a new range of torches featuring compact fluorescent tubes. There are three models, the tiny Dulux Mini, the Dulux Mobil and the Dulux Mobil Combi. The Mini uses two AA batteries to power a 3 watt compact fluoro tube, while the Mobil uses four AA batteries to run a 5 watt tube. The Combi is similar to the Mobil but not only has two settings for the fluoro—full and half power to conserve battery life, but also has a 5 watt halogen lamp for spot illumination.

We were able to trial all three models for a day and found their light output to be quite good. They were tested on rechargeable nickel-metal-hydride batteries, but the Mobil failed to light properly on these cells, while the other two worked well. Light output was better on all models using rechargeable alkaline batteries. The Mini measures a mere 90 x 65 x 20mm, while the other two models use a 40 x 55mm oval cross section. The Mobil is around 150mm long and the Combi measures about 185mm in length.

rrp: $20 for the Mini, $23 for the Mobil and $35 for the Combi.

Available from Going Solar, 322 Victoria St, North Melbourne, ph:(03) 9328 4123, www.goingsolar.com.au

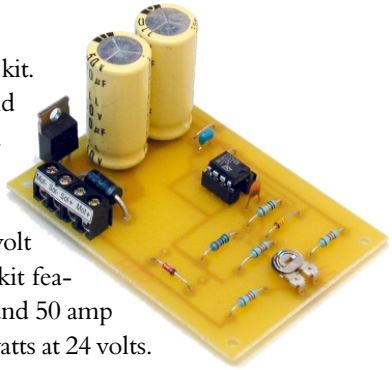
New uses for old tyres

Used car tyres undoubtedly pose a huge waste disposal problem, but these durable objects can have so many uses it is hard to understand why they are a problem at all.

There are a few companies using them, and one of those is Ecoflex Australia, who use them for all manner of building projects, from retaining walls (as seen here), to walkways, dams, bunkers, pavements, erosion control, river crossings and heavy equipment storage yards. The uses seem to be endless.

Available from Ecoflex Australia P/L, ph:(02) 4940 0178, fax:(02) 4940 0137, email: ecoflex@idl.com.au, www.ecoflex.com.au

It's back!



Finally, after a long delay, we have a new version of the popular build-your-own mini-maximiser kit.

Designed by Alan Hutchinson of Plasmatronics, this device allows loads such as pumps and motors to be driven directly from one or more solar panels without the need for batteries. The maximiser allows the solar panel to provide the maximum amount of power to the load, and can provide up to 40 per cent more water pumping per day from the same solar panel.

The kit comes standard as a 12 volt model capable of handling up to a 75 watt solar panel. A 24 volt version is available—remember to state which voltage you require when ordering. The new kit features a larger, easier to solder circuit board, and the kit comes with an upgraded 6 amp diode and 50 amp MOSFET. Adding a small heatsink allows the kit to handle up to 100 watts at 12 volts or 200 watts at 24 volts.

Note that this kit will continue to evolve, and may look slightly different to that seen at right. Kit includes circuit board, all components and instructions. No case is provided.

rrp: $27.50 for ATA members or $33 for non-members inc GST. Postage is $4 inside Australia

Manufactured by the Altrantive Technology Association, PO Box 2001 Lygon St North, East Brunswick VIC 3057, ph:(03) 9388 9311, fax:(03) 9388 9322, email: ata@ata.org.au, www.aya.org.au

An oven that blows up!

We have looked at many solar cookers over the years, but never an inflatable one! Originally designed to help reduce energy use when camping, the CookSack can be used to cook all manner of foods, or to preheat meals and water to reduce the fuel used for cooking.

The heart of this solar powered oven system is the CookSack, a polyester film bag with a clear top panel and a reflective base panel. The two panels are welded around their perimeter and are open at the base of the throat. The CookSack is oriented so it's open end is toward the sun. When the stand and pot are placed inside, the bag is inflated with the fan. The inflated CookSack forms a crude parabolic reflector that focuses the sun's rays on the black pot, heating its contents.

We were sent one of these units to do a product review, but unfortunately did not have any suitable days before going to print. The one sunny day we had was also very windy, resulting in the cooksack bag being slightly torn by the cooking pot stand, but not before it had raised the temperature of a pot of water by 15 to 20°C in less than 20 minutes. This cooker undoubtledly works, but is probably not suitable for windy conditions unless you put something between the stand and the bag and the bag and the ground.

The CookSack comes with everything needed to set it up and get cooking, including a coated black pot, the fan, tie-down cords, clips, pot stand, instructions and a mesh carry bag. The total kit weighs just 326 grams.

rrp: US$59.95

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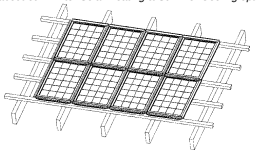

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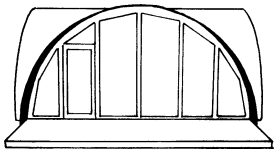

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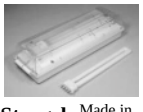

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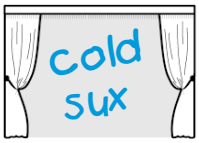

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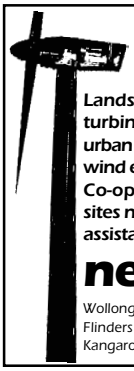

Solitary Splendour

Landscapes jammed with turbines are just as ugly as urban sprawl, and will bring wind energy into disrepute. Co-operatives and mono-sites need additional policy assistance.

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Advertisers' Directory

A man and his sunshine

Solar and wind-powered instruments were used to produce a unique music CD

Photo: Ernie Althoff

Ernie Althoff has been composing new music for 25 years. He has been composing with sustainable technology for considerably less. Constructing solar powered kinetic sounding devices, Ernie has relied on sunlight, wind and other outdoor variables to produce *Heliosonics*, a CD featuring 16 tracks of these devices.

The compositions consist of a number of machines operating simultaneously and being controlled by the natural elements. Recorded at several locations featuring a diversity of background ambience (cars, construction, wildlife), the pieces reflect the audio world of our everyday environment, where chaotic and chance happenings determine rhythmic and textual structure.

Initially constructing battery powered units, Ernie later switched to solar power, adding another chaotic element to the devices. Utilising the PV cell and motor from a number of Dick Smith Electronics educational kits, many of the devices operate in a manner not unlike a wind chime with a motor controlled pendulum. Unlike a wind chime the pendulum is constantly spinning (sunlight dependent) so Ernie divided the machines into two groups—one sounding continuously and the other sounding sporadically. This division of continuous and sporadic provides a simple reflection of sounds, such as the sea, cicada song and traffic hum against a sudden birdcall.

Featuring pendulums and sound sources constructed from pieces of bamboo, plywood, dowel, aluminium and tinplate, all 26 machines have been constructed with deliberate variety in mind and all sound uniquely different. The sporadic machines utilise a number of techniques to attain randomness:

1. having free-hanging sound sources that are not always in reach of the pendulum.
2. having the motor and pendulum on a biased swinging balanced beam, the sound sources only reachable through movement.
3. having an electronic switch carefully balanced to connect/disconnect power to the motor (this also controlling the one non-acoustic machine—a modified radio in a resonating chamber issuing a clicky hum.)
4. having a slight imbalance in the rotating pendulum, only sounding with erratic wobbles.

Early creations utilised batteries with the idea to create a constant base (for when the sun is hidden), but simplicity won out with there being no real need for constancy. The option of building an ensemble with deliberate relations between the machines (á la string quartet) was discarded with the embracing of individuality. The devices are not tuned to any key or scale, nor are they tuned to each other—they are tuned to themselves, depending on their composite materials and shapes for tonal quality.

The recorded pieces are but snippets of the limitless potentialities of such open ended, chance compositions. Each composition is an exercise in timbre and context, with factors such as machine combinations, relative position, time of day and choice of environments all being carefully considered.

A booklet of colour photographs with text descriptions of the machines and the 16 tracks accompanies the Heliosonics CD.

Heliosonics was a 15-month project funded by the New Media Arts Fund of the Australia Council.

For more information go to: www.netspace.net.au/~rlinz/nma/

Heliosonics CD available through Synaesthesia Records, Level 1/28 Block Place, Melbourne, ph:(03)9663 3551 and Readings Books, 309 Lygon St, Melbourne, ph:(03) 9347 6633.

Review by Edward Kelly

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