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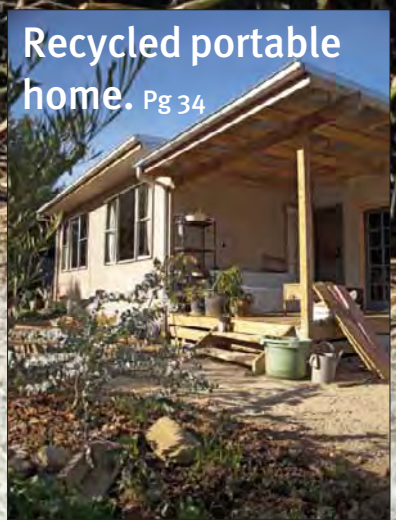
Recycled portable home. Pg 34

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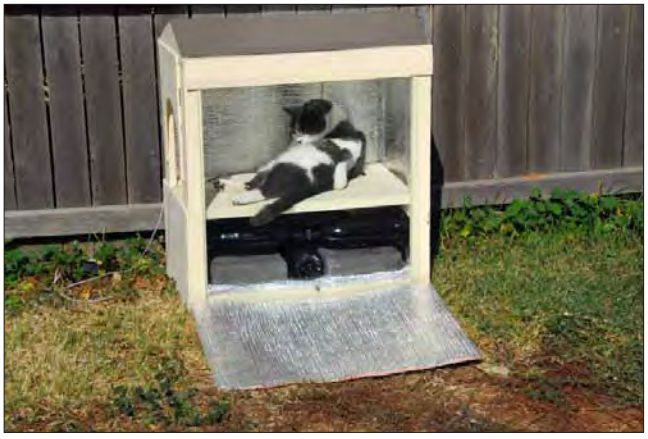
July—September 2010

features

The Alternative Technology Association turns 30 this year! See our centrespread timeline of the ATA's history from 1980.

Photo: Nick Stephenson

Reverse brick veneer 9 Star home designed by John Morgan, an ATA member since 1980. Page 22.



Practice passive solar design principles with a cat kennel—your pets will love it! Page 18.

Visit *ReNew's* new website at www.renew.org.au to discuss this issue's articles or to search the story archive.

regulars

Just what can you make from a VCR? A wind vane of course. Salvage It! Page 100.

A 7 Star water heater—one of many great Products in this issue. Page 86.

From the Editor

About ReNew

ReNew has been published by the Alternative Technology Association, a non-profit organisation that promotes energy saving and conservation to households, since 1980. *ReNew* features renewable technologies such as wind power, solar power and alternative modes of transport. *ReNew* includes practical examples of water conservation or reuse, recycling materials or ways to achieve energy efficiency at home. *ReNew* provides practical information for people who already use sustainable processes and demonstrates real-life applications for those who would like to.

ReNew is available from newsagencies, by subscription and as part of ATA membership. ATA membership costs $65 per year and offers a range of other benefits.

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Contributions are welcome, guidelines available at www.renew.org.au or on request.

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Next advertising deadlines: Booking 23 July 2010. Advertising copy 30 July 2010. Next editorial copy deadline: 23 July 2010.

A milestone issue

Welcome to the 30th birthday issue of *ReNew* magazine and the Alternative Technology Association, both born in 1980.

There's a select few out there who've been reading this magazine since 1980, way back when it was called *Soft Technology*, the publication of the newly-formed ATA. One of those people is sustainable housing pioneer John Morgan, profiled on page 22. Today John is just one of over 5500 ATA members, around 50 of them members since before 1985. No matter when you signed up to the ATA, or if you're just a casual *ReNew* reader, we hope you enjoy this issue.

To mark the 30th anniversary we've gone back to basics, looking in depth at some affordable yet energy efficient, no frills housing options. John's new home has a home energy rating of 9 Stars when all states are just implementing a 6 Star standard. His house requires no heating and cooling, is completely self-sufficient with its own electricity and water supply and cost under $150,000.

Abbie Heathcote's new home on page 34 was even cheaper because it is made from an old portable classroom. This recycled dwelling cost less than $50,000, proving that with a bit of recourcefulness, homes can be both affordable and sustainable, especially for first home buyers.

When discussing their new homes both John and Abbie say you really don't need to spend a lot to achieve energy efficiency. Perhaps they are both typical of their generation's scrimp and save mentality or they merely appreciate that sustainability is about simplicity and some good old-fashioned passive solar design. John says the more you spend the more embodied energy is likely to be in the building materials. Abbie believes that salvaging and using secondhand materials saves money and ensures a low-toxin home.

With inspiring sustainability pioneers like John and Abbie, ATA is still leading the way for a sustainable future.

The centrefold

After 30 years *ReNew* finally has its first centrefold. But never fear, while we sometimes joke that we need to try different things to bring sustainability to the masses, this foldout is a timeline of the Alternative Technology Association's history, marking what's been achieved since 1980. Put it up on your wall at work, on the fridge, or write to us with comments and additions. If you have a comment, write to us via our brand new website, which you can visit at www.renew.org.au

Jacinta Cleary

Cover photo: Ulrich Scmid's electric citroen. See his story on page 28.

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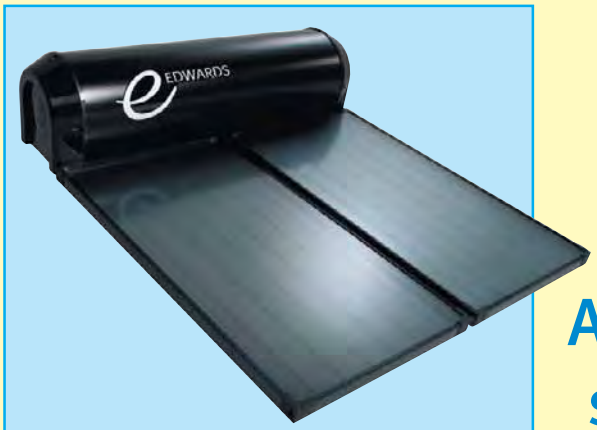

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Terms and Conditions

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

(2) The promoter is the Alternative Technology Association, ABN 57 533 056 318, Level 1, 39 Little Collins St, Melbourne, www.ata.org.au, Ph. 03 9631 1500.

(3) Prize supplied by Edwards Solar Hot Water, ABN 34 106 360 57, www.edwards.com.au, Ph. 1300 765 277.

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

(5) Edwards Solar Hot Water reserves the right to change specifications without notice.

(6) Paid ATA staff, members of the ATA board, Edwards staff, Edwards dealers and members of their immediate families are ineligible to enter.

(7) The competition runs from 15 March 2010 to 5pm EST on 15 September 2010, and subscriptions/memberships must be paid in full by this time and date.

(8) The competition will be drawn at 10.30am on 20 September 2010 at the Alternative Technology Association, Level 1, 39 Little Collins St, Melbourne VIC 3000.

(9) Prize must be installed within six months of draw date.

(10) The winner will be contacted by phone and will be notified in writing. The winner's name will be announced in ReNew 113 and Sanctuary 13, released in September and November 2010 respectively.

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

(12) To enter, subscribe or join the ATA using the subscription form in ReNew issue 111 or 112 (or a copy of it), or the form in Sanctuary 11 or 12, visit our websites (www.ata.org.au and www.sanctuarymagazine.org.au), or call the ATA on (03) 9639 1500.

(13) The competition is only open to Australian entries and includes delivery and installation within 200 kilometres of Australian capital cities. Edwards Solar Hot Water will cover standard install costs in other locations.

(14) Edwards Solar Hot Water reserves the right to change the brand/model of the system depending on the water conditions.

(15) Prize includes the supply and installation of a top of the range Edwards family sized stainless steel solar hot water system as well as a Clipsal Cent-a-meter valued at $7029.

(16) The winner agrees to assign any REC's (Renewable Energy Certificates) generated on this system to Rheem Australia.

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The *ReNew*/Edwards Solar Hot Water subscriber competition is proudly sponsored by Edwards Solar Hot Water, ph:1300 765 277, www.edwards.com.au

Up front

Ride the Talk

Tired of people not being able to 'walk the talk' on climate change, 54-year-old Alternative Technology Association employee John Knox is going to 'ride the walk' instead.

On a two-wheeled crusade John is going to cycle around Australia to advocate climate change awareness and energy efficiency in the home. Departing in July, John will spend six months on the road taking his message across the country.

In between pedalling John will be conducting public talks to deliver practical advice on how to reduce carbon emissions and tips on how to save energy and money around the home.

John will depart from Melbourne and travel in an anti-clockwise direction around Australia. Look out for him on a road near you soon. For more details or to follow John's journey go to www.ridethetalk.com.au

Alice gets greener

Alice Springs, one of Australia's eight solar cities, has recently taken off with construction commencing on a new solar power station at the city's airport.

The first of its kind in the southern hemisphere, the $2.3 million solar project will supply about 28% of the airport's energy needs. Using emerging concentrator photovoltaic technology, the solar power station will produce up to 600 megawatt-hours of electricity each year, the same amount of power used by about 70 homes in Alice Springs.

The station is expected to reduce greenhouse gas emissions by around 470 tonnes of CO_2 per year. The airport solar station is just one of five projects planned for the solar city in the coming years and is expected to be completed by August.

Other solar cities include Adelaide, Blacktown in Sydney, Central Victoria, Moreland in Melbourne, Perth and Townsville.

A step closer to solar plant

After months of mixed reports we are happy to announce the proposed 154MW solar plant for Mildura is looking like a real possibility again, for now anyway.

As reported in the last edition of *ReNew*, Sydney-based Silex Systems expressed interest in taking over the project after the previous company went into voluntary administration last September. Silex Systems has now teamed with construction company Thiess in a bid to build the large-scale plant, which was initially announced in 2006.

On top of funding grants from the federal and Victorian governments, an additional $120 million was also recently announced by the NSW government to take the $420 million plant one step further forward.

The Thiess-Silex proposal aims to create 1300 jobs in the Mildura area and if all goes to plan will begin construction in 2011.

Solar maiden flight

Offsetting the carbon emissions on your next flight might be a thing of the past now the world's first fully solar-powered plane has taken its maiden flight.

After seven years of design the Solar Impulse aircraft has finally taken to the sky for the first time at a military airport in Switzerland. The plane, which has the wingspan of a Boeing 747 and weighs no more than a small car, reached an altitude of about 3200 feet during the 87 minute test flight.

The aircraft is made from carbon fibre and is fitted with 12,000 solar cells, as well as rechargeable lithium batteries and four electric motors. Without the need for any fuel and relying simply on sunlight, the plane flew at about the same speed as a fast bicycle and has a top speed of just 71km/h.

The $82 million airplane is a proto-

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Fire-rated kit home

WE'VE covered some innovative homes in the last 30 years, including way back in *ReNew 88* when Tom Chalko wrote about simple and cheap ways to keep his house warm. What type of house was it? It was a RAL of course, a prefabricated kit home with a roof that falls to the ground, making it both energy efficient and somewhat bushfire resistant.

Since last year's Black Saturday bushfires, home construction in fire-prone areas has been forced to change. Construction and design needs to take into consideration the bushfire attack level (BAL). This determines the predicted level of exposure a home will be faced with during a bushfire and varies depending on where you are planning to build.

Given this, RAL Homes has updated the materials used in the RAL and re-released it as the RAL2. The iconic curved home now meets the highest BAL-FZ rating, making the home perfect for those with fire concerns, but also a viable option for anyone looking for cheap, quick, sustainable housing. The kit homes cost between $100,000 and $122,000, depending on size and the floor plan.

Customers can choose from eight different components to create their own individual living space with all kits having standard safety and building features. They use mostly plantation timber and other renewable and recyclable components in construction, meaning the energy used for production is lower than other buildings of similar dimensions

The homes are built on a concrete slab or on a steel sub-floor with the underside of the flooring lined with insulation. The curved colorbond roofing, which extends to meet the floor of the house, prevents debris and embers entering the roof during a fire.

The shell insulation has a flammability index less than five and protects all the timber panels and framing from contact with flames. The fire-resistant windows and sliding doors come with a minimum of 5mm toughened glass and stainless steel mesh screens, which can also be fitted with additional bushfire shutters. The 'RAL 2 Special' boasts recessed steel rainwater gutters which can reduce the build-up of leaves and flammable foliage.

For more information on the bushfire attack levels see www.buildingcommission.com.au

type for another solar-powered aircraft that the creators intend to circumnavigate the world in by 2012. Meanwhile the next challenge for the plane is a night flight, which will happen in the coming months.

Less red tape for NSW small wind, solar systems

The NSW government has released two discussion papers proposing state-wide planning laws that would make it easier to install solar and small wind systems across NSW and earn income from domestic systems under the NSW Government's feed-in tariff scheme. The changes would remove the need for many solar systems to obtain planning approvals or may provide 10-day approvals for some types of wind and solar systems.

As an example, solar electricity generation systems up to one hectare in size and domestic wind turbines up to 10kW which meet strict noise limits may soon be able to be approved in 10 days. The two discussion papers can be downloaded from the NSW Department of Planning's website www.planning.nsw.gov.au or by contacting the department's information centre on (02) 9228 6333.

New EV interest group

A vehicle that can do zero to 100km/h in three seconds? This is what the audience heard announced at the inaugural meeting of the Alternative Technology Association Electric Vehicle Interest Group. The group has formed in response to the large interest in electric vehicles at other ATA meetings. The group has an initial three point charter to: provide a link with students, to work with other organisations by forming collaborations and to pool the collective knowledge of the group for assisting individual members with their own projects.

The seventy audience members heard about electric car projects at CERES, an electric vehicle course being developed by Swinburne Tafe's School of Engineering and individual's submissions to electric vehicle design competitions.

Consistent with the charter of helping each other, many audience members indicated they have already gained practical experience on their own projects such as converting a BMW and a Volkswagen. As the name Electric Ve-

hicle Interest Group suggests, it is not just about cars—an electric ultralight, a motorcycle and a gymkhana EV were other projects mentioned.

Keep insulating!

The Federal Government has cancelled their home insulation program which was due to recommence in June this year.

Citing safety concerns and advice received from Dr Allan Hawke in his *Review of the Home Insulation Program*, the government announced it would not continue with the program.

Dr Hawke advised he has "grave concerns about the wisdom of proceeding with any further government supported home insulation program," prompting a swift cancellation by the government.

However, from an environmental perspective, insulation is crucial part of delivering on Australia's energy efficiency potential and needs the government's continuing support.

"Now more than ever, with the delay in the CPRS, a cheap and effective technology like home insulation deserves investment," said ATA chief executive officer Ian Porter.

"To scrap the rebate is an overreaction and inconsistent with other areas of government policy. The Prime Minister has recently set up a task force to recommend how Australia can improve energy efficiency and yet the government is walking away from the very technology that should be the first step in any investment directed at household energy efficiency."

Only about half of Australian homes are insulated, and heating and cooling account for 35% to 40% of home energy use at a time when domestic energy consumption is soaring.

The ATA estimates homeowners will pay 12 times the cost of insulation in wasted energy over the life of a building that is not insulated.

Green jobs update

Last issue we asked you what green jobs you would like to see created to help the environment and combat climate change. Since then the Victorian government has launched *Jobs For the Future Economy—Victoria's Action Plan for Green Jobs*, which might provide some direction in an area that most governments have previously left untouched. The plan includes a $5 million Solar Energy Hubs program to increase the installation of solar panels and the demonstration of fuel cell technology in 30 public housing properties, amongst other incentives.

Well done ATA!

AS WELL as celebrating 30 years of service this year, the Alternative Technology Association was also nominated for a prestigious award in April.

The nomination was in the Community category of the Victorian Premier's Sustainability Awards. The nomination was based on ATA's work helping householders make their homes more energy efficient and environmentally-friendly, in turn helping to combat climate change.

While ATA didn't win on the night, it was great recognition of ATA's work over the last 30 years. The award went to two organisations, FareShare and SecondBite, with both groups saving fresh food that would otherwise go to waste and distributing it to those in need, reducing CO_2 emissions from landfill and filling bellies at the same time.

Other winners at the awards night hosted by Sustainability Victoria were Geocycle in the Products or Services category for their Superblender that recovers energy from industrial waste, and Nillumbik Council in the Local Government category for their sustainability work after the Black Saturday bushfires. Free sustainable house design assessments were offered to affected landowners and assistance provided to rehabilitate properties with the help of Landcare groups.

Up front

Also relevant to the creation of green jobs is the latest report from the Workplace Research Centre which found that more green-collar jobs are needed if climate challenges are to be met.

The International Labour Organisation commissioned the *Skills for Green Jobs in Australia* report, which looks at supporting new jobs in emerging industries such as the renewable energy sector and the greening of established jobs.

One of the report's authors Dr Michael Rafferty told the *Sydney Morning Herald* that changes in government policy, such as changes to the insulation program, was hindering the growth of green jobs.

"The [green-collar] workforce will emerge regardless but it's been a … period in which political popularism has damaged the momentum," Dr Rafferty said. "Jobs are being lost in these innovative areas because the government is putting forward policies and then backtracking."

Meanwhile *ReNew* magazine is still collating your ideas on green jobs for publication in a future issue. Keep sending your ideas on potential green jobs in the food, water, energy, waste and transport areas to renew@ata.org.au

Built for the Bush

Travelling exhibition Built for the Bush is on the move again, this time to Wagga Wagga in NSW.

The project shows how 19th century rural homes used energy efficiency as a necessity due to material and skill restraints. These designs have since seen a resurgence, making an impact on contemporary green architecture and modern sustainable housing in Australia.

The exhibition will be at the Museum of the Riverina, Wagga Wagga, until July 18, then to the Temorah Historical Society until mid September.

For more information go to www.hht.net.au/education/resources/travelling_exhibitions

Upfront compiled by Sarah Dailey

Mandatory disclosure to improve energy efficiency of commercial buildings and eventually homes

A NEW national scheme to improve the energy efficiency of commercial office buildings has been introduced by the Federal Government.

The proposal requires owners of large commercial office buildings to disclose their building's energy rating and obtain a yearly certificate. The scheme so far only affects commercial building owners, with residential homeowners to get their turn in the coming years, with no date yet announced.

Failing to comply with the mandatory disclosure attracts heavy penalties of up to $100,000, leaving owners and prospective lessees and buyers questioning just what exactly this scheme is all about.

Announced in March by Environment Minister Peter Garrett, and to be phased in throughout the second half of this year, the bill requires commercial building owners with space 2000 square metres or larger to obtain a certificate stating the energy efficiency of the building and to disclose this before selling or leasing.

The certificate, valid for 12 months, will include a star rating, out of a potential five, of the building's energy efficiency and suggestions on areas the building could improve.

For example, five stars will signify the building has met best practice, while two stars will mean there's room for improvement. These ratings will hopefully provide transparency to potential buyers and allow them to clearly see what improvements the building needs before investing.

According to the Federal Government, the scheme will help cut greenhouse gas emissions, with 10% of Australia's emissions emanating from the commercial building sector.

Minister Garrett says the scheme will provide clear guidelines on energy usage, as well as potentially bringing down Australia's sick leave, quite a big ask from an annual certificate.

Photo: Nick Carson

The Council House 2 building in Melbourne might qualify for a 'best practice' mandatory disclosure certificate .

The scheme will be implemented in two phases. Disclosure for large commercial office buildings, commencing in July, is just the first phase. Phase two involves consideration of expanding the same disclosure to other commercial building types including hotels, shopping centres, schools and hospitals over the coming years.

According to the government bill, which was agreed upon in July last year, this scheme was designed to complement the now failed Carbon Pollution Reduction Scheme, or ETS. Research by the Australian Sustainable Built Environment Council indicates that energy efficiency improvements in the building sector would have lowered the cost of the ETS by lowering the costs of permits due to lower demand. As we now know, the ETS has since been shelved.

For more information go to www.environment.gov.au/sustainability/energyefficiency/buildings/commercial/disclosure.html

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Letters

Guerilla solar safety

I would like to comment on a statement appearing in the article 'Monkeying around with solar' in *ReNew* 111; "The home's circuit breakers and RCD will protect the user, in the same way they will if any other appliance fails".

RCDs operate by continuously comparing the current flow in both the active and neutral conductors of the protected electrical circuits. The supply will be automatically switched off if the current flow becomes sufficiently unbalanced, i.e. some of the current in the active conductor is not returning through the neutral conductor and is leaking to earth (possibly via a person). Any earth leakage >30mA can cause injury, death or damage.

It would seem to me that a very dangerous situation occurs if another power source (e.g. inverter) is connected to the installation downstream of the RCD. If an earth leakage event occurs, the RCD may not see a current imbalance of >30mA as the second power source is now supplying the leakage current. In this event the RCD will not trip, resulting in death, injury or damage such as a fire.

I commend ATA for publishing the article. I trust it will promote open discussion on this practice, leading to a better understanding of the critical safety issues involved.

Alan McDowall
Mackay QLD

Write to us!

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

Alan, you are correct, the inverter could cause a problem should someone accidently come into contact with the mains. We strongly recommend that anyone installing a small system such as this have it wired according to the Australian Standard for such systems and not plug it into a regular power point. While this will add considerably to the cost of the system, it will ensure your home's RCDs will continue to protect you.

Alternatively, consider setting up a small independent power system to run a few small appliances. We will be looking at a typical system of this type in a future issue.

Lance Turner

More power company probs

A year ago I acquired solar panels. I am with the electricity company Simply Energy and since the smart meter was installed I wasn't receiving any bills. (I also thought I had a bi-directional meter as I didn't receive any information). I finally received a red bill demanding immediate payment. I contacted the electricity company for an initial itemised bill.

Because my unpaid bill had reached the status of red it was handed to the debt collector side of the business. They don't have access to my details nor are able to put me in touch with the company. They told me they would send me an initial bill but didn't and at the same time demanded a due date of payment.

I spent the next three months contacting the electricity company demanding a bill. When I spoke about solar panels and feed-in tariffs, no one seemed to understand what I was saying. One rep wanted to send me a bill without any feed-in and said they'd fix that bit up later. I refused. The debt collectors also began texting me. This whole ordeal became very stressful, especially receiving text messages at work and arriving home to more red letters.

Eventually I contacted the Electricity Ombudsman and I only had to give my grievance over the phone. They contacted the public liaison representative at Simply Energy who promptly contacted me. It was only then I discovered I had a smart meter and was told that the public didn't need to know how to read them, which I was surprised about, believing they were supposed to assist us to monitor our electricity usage.

The bill finally arrived with the feed-in reading, but again I haven't received another bill since, but this time I went straight to the public liaison rep. I'm still awaiting this bill.

It concerns me that with smart meters the electricity companies have access to half-hour readings. Coupled with the outsourcing of collecting overdue bill payments, where they have no access to company assistants or your details to assist with bill discrepancies, it seems a recipe for undue pressure on abiding citizens.

I've also been surprised about the number of people in the electricity industry who know nothing about solar panels and feed-in systems. A few months after the panels were installed an electrician from the State Emergency Services (SES) assisted with removing a fallen branch near my electricity wires. The electrician spent more time enquiring about how the solar feed-in system worked. He hadn't had any professional in-servicing.

When the meter reader visited one day, I asked him how to read my new meter. He showed me how to access the readings and even told me how to boost an electric hot water service, but he knew nothing about solar systems and enquired about mine. I also believe the people who work at call centres have not been in-serviced about solar power feed-in systems which is why they often didn't understand what I was talking about.

Marie Cook

Wheelie not potable

I was just looking through *ReNew 110* and saw the wheelie bin rainwater collection article. I think you need to make it clear to readers that this water is not potable—these bins are not food grade,

and are highly likely to have toxic heavy metals in them to make them stable in sunlight. A study I heard of some years ago by Griffith Uni PhD student into home brewing found that some brewers were poisoning themselves by brewing in plastic garbage bins because of the heavy metals in them. Any rain water collection receptacle attached to a house really should be food grade. I would welcome your comments.

And thanks for your magazine, which is always full of interesting and accessible ideas.

Jane Shaw

It must have been an oversight that we didn't mention the water wasn't potable, but hopefully it was clear in the article that Stuart was only using the water for laundry and garden.

Jacinta Cleary

Something to celebrate

This year in Sydney there are exhibitions and events to mark the bicentenary of the arrival of Governor Lachlan Macquarie, arguably the greatest of our colonial governors. One of his achievements, however, will probably go largely unnoticed.

Macquarie had previously seen service in India and noticed climatic similarities in Australia, which prompted him to advocate the addition of verandas, which he had seen in India, to Australian buildings. Verandas have to be the best idea Australians have ever forgotten.

In the nineteenth century and the first half of the 20th century, many if not most Australian buildings had verandas. But with changes in building fashions, verandas became a rarity on new buildings. But if ever there was a time we needed verandas, it's now. Let me explain.

About 25 years ago we built a house incorporating a wide, surrounding veranda just outside Dubbo. It works wonderfully.

Firstly, the veranda keeps the sun off the walls except early in the morning and late in the afternoon. This means, with commonsense behaviour like opening the windows at night and closing them in the morning, we don't need airconditioning, even in hot inland summers. Money saved and less CO_2 emitted.

Secondly, when it's wet, we hang the washing under the verandah. No clothes dryer needed, more money saved, again less CO_2.

Thirdly, the veranda greatly increases our rainwater catchment area. This, along with a large inground tank, means that, even with raising three children, putting out water each day for the birds and kangaroos and a mere 600mm average yearly rainfall, we haven't had to buy water for over 20 years.

Lastly, it's somewhere for kids to play and ride their bikes.

What a great idea, maybe they should be compulsory!

Keith McCarthy

Roof colour feedback

I liked the article on roofs in *ReNew 110*. As a boiler engineer I know that emissivity is extremely important. Fortunately rusty iron has a high emissivity.

Any light, even visible and UV, imparts heat, it is that we can feel infrared as heat and not see it that people associate heating with infrared. Other frequencies cause heating as well and are just as important. This means that colour as we see it is not that important to the overall heat pick up, but the emissivity across the spectrum. Paint is an insulating medium. Car radiators painted black actually work less well than in bare aluminium.

A plate with equal emissivity on both sides will re-radiate the heat in both directions. If you can make the underside of the roof structure have a much lower emissivity than the top, more heat will be radiated away back to where it came from. Effectively this is what the new coatings are doing but in the paint layer. I wonder what a roof tile with an underside flash coating of aluminium would be like. Is there a highly reflective paint that could be applied? Conduction would still be an issue.

Insulation is not rated on reflectance, all R values quoted are on conduction and has little relevance when dealing with roofs in the sun. I really question the reason for the anti glare coatings. While not compromising the R value they drop the reflectance considerably.

If you can put a highly reflective insulation (on both sides) barrier of low mass (so it does not hold heat from radiation or conduction) under the roof, most of the heat is reflected back. This should largely negate the emissivity problem of the roof material. The cavity created can channel air to carry heat out by conduction.

I also believe that most insulation is not correctly installed and we in Australia neglect the benefits of reflective insulation and air gaps. Bulk fill insulation is placed against reflective insulation and plaster so conduction directly through the insulation becomes an issue for heat transfer. For best results there should be an air gap so heat is not conducted from the reflective insulation to the plasterboard.

This indicates our walls of 100 mm (90mm wood, 10mm plaster) are too thin to fit the batts. Walls need to be another 40 mm wider or better insulation like vermiculite insulation boards be used. Even two R1 reflective aircell insulation stapled into the wall creating three air pockets would out perform most wall insulation in real conditions, even if the total R value is less.

In Germany there are trials of phase-change materials in plasterboard giving it the properties of 750mm concrete wall or delaying peak heat by four to six hours. BASF have micro-spheres of organic compounds that change from solid to liquid in a small 2 to 4 degree range, say 18°C to 22°C or 20°C to 24°C. These are mixed into the plaster. The

Letters

temperature in the room does not rise significantly until the phase change is complete. You recharge the system by dropping 2°C under the change point—by ventilating at night for instance. There are products for floor hydronic heating and ceilings as well.

Martin Rieger
Technical Service Engineer

A more efficient TV

I just wanted to make a comment regarding the article Give your caravan a solar boost in *ReNew 111.*

I couldn't help but notice that almost exactly half of Peter's power demand for his caravan was for the TV! (15.1Ah out of 29Ah). Far be it for me to criticise those who enjoy watching the TV, however I did wonder if in this era of high-tech digital communications some less power-hungry alternative may not be possible? For example wireless broadband and/or satellite broadband to allow digital TV stations to be watched on a laptop anywhere in Australia. Is this not yet possible at a cost-effective price?

Stewart Dallas
Hamilton Hill WA

We did use wireless broadband on the laptop whenever we had an HSPDA signal, which is probably still the most power efficient option available to connect to the outside world. Satellite broadband and digital television services are all available at a cost, however in my opinion they require more of that precious power to get them onto a screen in your caravan than watching terrestrial digital or analogue TV whichever is available.

Peter Jackson

I've found that the lowest energy using TV setup is a netbook with a USB TV tuner dongle. Mine uses just 17 watts from the mains, much better than the average notebook.

We will be looking at low energy use entertainment/computer options in a future issue of ReNew.

Lance Turner

Inspired cycling

Reading your articles *Electric bikes—DIY style* and *Biking without the effort* in *ReNew 111*, I'd like to contribute my own very special experiences with a handcranked, foldable Greenspeed trike (www.greenspeed.com.au) equipped with a retrofit Canadian 250 HT Bionx motor kit (www.bionx.ca), a Swiss Schlumpf Mountain Drive (www.schlumpf.ch) and a recycled British microlight Shadow aircraft nose.

In the old days, without my Bionx wheel-mounted electric motor, I relied on human power and my friends had to wait until I slowly climbed up less steep hills. Now I have to wait for my friends.

Paraplegic since my rockclimbing accident in 1967, I always tried to extend my limits and sometimes I had to extend the rather narrow limits in other guys skulls. For people with the handicap of reduced mobility like me, the electric assistance enables undreamt of liberty of action.

Wolfgang Ernst
France

Bad SHW advice

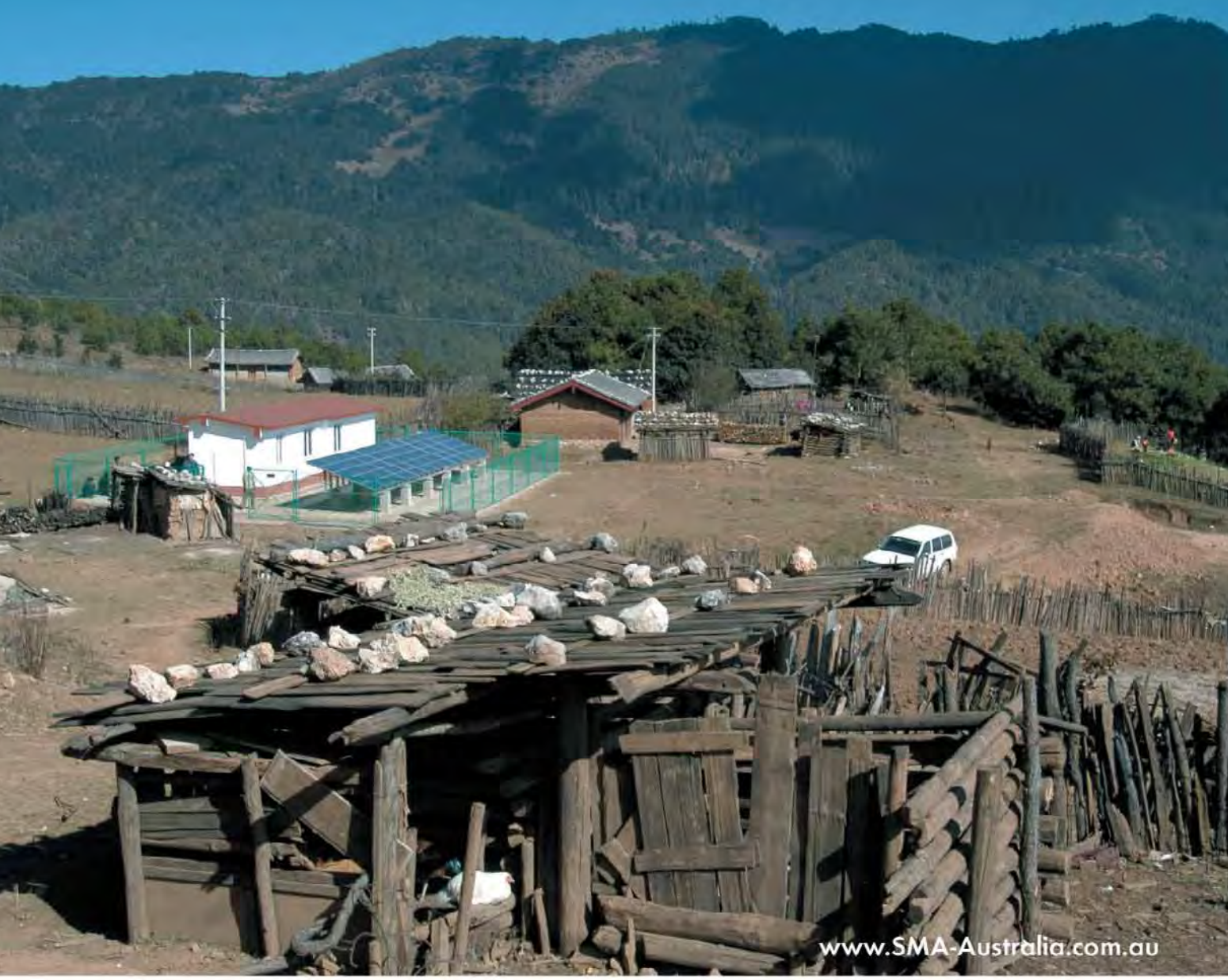
In Letters, *ReNew 111* Melina Miles described her new solar hot water installation. She is correct to be disapponted with the connection of the electric booster element. My wife and I are having a house built and have experienced similar comments from the electrician and bad advice from people.

Firstly, the Australian Standard AS3500.4 'Heated water services' states that the minimum hot water temperature must be 60°C (not 65°C). Next, it is indeed legal in Queensland to install a manual booster switch. The electrician may have said this because power from the switchboard has to be wired to the manual switch then to the element in the tank. He probably hadn't allowed for that extra cabling.

The manual booster switch works like this. When you have run out of hot water (due to a cloudy day or two) you can press the button and the booster will turn on and heat the tank water to the thermostat setting. It will then stay off until the next time you press the button. This will only work when your chosen tariff makes power available for the booster. The electrician suggested Tariff 31 because that is what has always been done for electric hot water systems.

If the solar hot water system is correctly sized and you are willing to use most of the hot water at night, then you will get the highest solar fraction out of the system. You could connect the booster on Tariff 11 and turn the element off and on (when required) using the miniature circuit breaker in the switchboard. This way you shouldn't boost very often but you can do it whenever you need it. Also, this will most likely cost less, even though Tariff 11 is dearer, because you don't have to pay the minimum charges for Tariff 31. Do note that the performance of your system depends on its installation and your hot water useage.

Stephen Bower
Narangba QLD



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Difficulty rating: ★★★☆☆

DIY solar cat (or dog) kennel

It's not just humans who love passive heating. Julian Edgar shows how to make a solar kennel to keep your pets warm this winter.

Here's a question for you: have you ever thought about building a solar cat (or dog) kennel?

If you live in a cold area it's a fun thing to do and your 'best friend' will appreciate it a great deal. And, perhaps even more interestingly, it also allows you to explore in a very practical way your skills and knowledge about energy-efficient house design.

It started like this. Having recently moved from Tamborine Mountain in the balmy Gold Coast hinterland to Bungendore, just outside Canberra (possibilities of snow, icy but sunny days) our cat, Ar-Chee, was feeling the change in climate. In fact, to get him out the door on even autumn days (let alone winter ones) required a great deal of persuasion. Far better from his perspective was to sit in the window of my north-facing office, bathing himself in the sunlight streaming through the window and letting the outside temperature look after itself.

Decades ago, when I lived in Port Augusta in South Australia, I built a solar cat kennel and the feline I had at that time adored it. I started that design with all sorts of elaborate ideas (movable shutters and reflectors, active vents and lots of other features) but the way the final design was actually used was simplicity itself. I did literally nothing and the cat came and went as she wished.

It worked brilliantly.

So this time, the sights were set lower and the outcome better fitted the task.

Photos: Julian Edgar

A very content cat called Ar-Chee. The solar function of the kennel works very effectively, even on cool cloudy-bright days.

Thermal mass

As with a house, the most important aspect to get right in an animal dwelling is to have sufficient thermal mass. High thermal mass is the characteristic of building materials that means they take a long time to heat up or cool down.

Most animal habitations are made from thin plastic, galvanised iron or plywood. These materials heat up quickly in the sun and cool down quickly as the temperature drops. However, they're widely used because they're easy and cheap. Since I wanted a design that was also easy and cheap, that led me straight back to a timber frame, colorbond steel roof and plywood walls.

The saving grace is that thermal mass can be easily added. Bricks, paving stones and water are all simple and cheap ways to add thermal mass.

I wanted a way to ensure that the thermal mass (think of it in this context as a 'heat storage facility') was warmed by sunlight and was then able to feed this warmth back into the 'house' as the temperature dropped. The fact that this heat storage was present would also quell the temperature rise that would occur in times of greatest ambient warmth, that is, in summer.

Design

I settled on a two-storey design. The upper storey comprised a plywood floor on which the cat would sit. Below this level was another compartment, inhabited not by the cat but instead by two concrete paving stones and seven 1.5-litre plastic bottles of water. The water bottles were painted matt black. The paving stones and bottles were spaced off the floor so that air could circulate all around them, and by using multiple 1.5 litre bottles, the water was also well ex-

posed. Technically, it had a high surface-area-to-volume ratio. The upper and lower storeys were connected by vents (that is, simple gaps) around the floor.

A full-length window fronted both the upper and lower storeys.

For most of the day, sunshine directly heats the lower storey's thermal mass, and to a lesser extent, the upper storey. As shadows lengthen, the sun no longer falls on the kennel window and the main living room starts to cool. When this occurs, air automatically circulates through the peripheral floor vents, bringing warm air up from the paving stones and water below. The result is that, when it gets cold, the kennel stays up to 10°C warmer than ambient, from as few as two hours to as many as five. Ar-Chee is brought inside at night; if the kennel had to stay warm all night it would just be a case of adding more solar heating area and thermal mass.

The solar-heated cat kennel is a two-storey structure clad in plywood with a full-length glass panel at the front. The concrete paving stones and black-painted plastic bottles of water in the lower section are heated by the sun during the day and then release heat when the temperature drops. Inside the kennel foil and foam insulation is used on the roof, floor and most of the walls (the exception being the open door on the left). As the animal gets used to the kennel, the open door can be replaced by a swing version that will keep more heat inside.

Construction

I could go on a lot about design dimensions, timber sizes and all sorts of other stuff. But the bottom line was this; I sized the front face to match the glass I'd already picked up from a garage sale, and the other dimensions mostly suited the pieces of timber I again already had. Most of the timber was pine slats from a bed, bought from the shop at the local rubbish tip. This meant the glass didn't need to be cut and the number of timber cuts was minimised.

It should be noted that making even a simple construction like this still takes plenty of time. Set aside a full day. I built the cat kennel with the help of my five-year-old son Alexander, so its construction took a little more time than it otherwise would. However, it was fascinating asking Alexander why we were installing water bottles in the lower storey and hearing him explain so clearly that 'the sun heats these up and then it keeps Ar-Chee warm'.

The roof was made from some off-cuts of colorbond roofing scrounged from a local building site and the walls from plywood salvaged from a discarded Thomas the Tank Engine play table.

I actually put the kennel into action while still uninsulated and unpainted. I thought Ar-Chee might more readily accept a kennel without the odour of paint. Even in this unfinished state it worked well, maintaining for hours an internal temperature more than 5°C above ambient.

Yet insulation is a very important part of the design.

Insulation and reflectors

For the best outcome with this solar cat kennel, insulating the wall, floor and roof was vital. Two purposes were achieved by using reflective foil backed with fibreglass (or similar). During the day the reflective foil bounces solar energy around inside the upper and lower storeys, better heating the thermal mass (and the animal occupant, if present), while at other times the insulation prevents heat from escaping through the surfaces, especially those in the lower storey.

Any building site in Australia will have sufficient free insulation off-cuts to provide enough for an animal kennel. If you end up with thicker fibreglass batts then great, it will be a very well insulated

The kennel in unpainted and uninsulated form. The water bottles and paving stones are easier to see here before painting. The panel gaps were caulked, the timber painted inside and out and then reflective insulation was placed on the inner surfaces.

enclosure. On the other hand, if you find only thin foil insulation, use multiple layers with an air gap between the layers.

Don't forget to insulate the roof. This will probably need to be organised before attaching the roof panel; the walls and floor can be insulated after they've been constructed.

You may want to add a fold-down reflector in front of the kennel. This will substantially add to the amount of solar insolation (i.e. energy) that can be directed into the abode and, when folded-up, will also insulate the glass panel that otherwise will shed lots of heat in the late afternoon and evening. However, I built a fold-up reflector with my first cat kennel and then found operating it every day a pain in the butt. Subsequently I just left it down. So, with the current design I've used a reflector that stays on the ground.

To encourage the animal to use the kennel I've started with a simple, open doorway. As the cat gains confidence, this can be changed to a swing-door that will help keep the heat in.

A design aspect I didn't use in the current kennel, but one which is quite viable, is to use an 'eave' overhang to provide shade in summer but not in winter. Like many aspects of this project, it really makes you think about those design criteria that apply to a full-size house.

Cost

My complete solar-heated cat kennel cost less than $15 in materials. Most of this cost was the matt black paint used within the lower storey and the caulking compound, which were the only items bought new. I enjoyed designing and constructing the kennel for three reasons: I like using my hands, it made me think again of the fundamentals of climate-friendly housing design and it amuses me greatly to see my cat so relishing his warm, custom-built house! ✻

Recycled materials

The prototype was made from scraps obtained for nothing or very low cost—colorbond roofing and insulation from a building site rubbish pile, glass panel from a garage sale, plywood walls from a discarded child's play table and pine timber from the shop at the local rubbish tip.

Julian Edgar's new column *Salvage It* starts on page 100.

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While the ATA turns 30, John Morgan's involvement with all things renewable spans a lot longer than three decades. Jacinta Cleary visits one of ATA's first members in his energy efficient home.

On July 29, 1981, households around Australia were gathering around televisions to watch the wedding of Prince Charles and Lady Diana. Belinda Morgan, like most people, was preparing a big night in (with champagne and chocolates) to watch the wedding with a couple of friends and her husband John. John had other plans though, and went to a seminar about heat pumps held by the newly-formed Alternative Technology Association. That night around 40 members met to share stories about heat pumps and their possible applications in homes. While the royal marriage was over by the mid 1990s, John and Belinda's own union is still going strong, despite a different opinion on what constitutes a 'good night'.

John Morgan joined the ATA in its first year in 1980 and has been a member ever since. While that involvement has spanned three decades, John says his interest in renewable technology has been more like 50 years, first triggered by an article in *Radio Television and Hobbies* magazine in 1960 (price two and six pence) about a home-made solar hot water system. John, completely taken by the article called 'The solar heater, how to build it' showed it to a friend in Fremantle where he was living at the time. His mate built the system, having previously heated his water with a wood heater. This experience triggered John's interest in all things renewable: "Fifty years ago we didn't have systems like this," he says.

Main photos: Nick Stephenson

John Morgan with issue 1 of *Soft Technology*, which was renamed *ReNew* in 1996.

Pioneer

John describes himself as an "electronic hobbyist since the year dot." Another apt description might be that John is ahead of his time, a pioneer of sorts, for solar power.

John's first career was as a teacher, starting with a primary school class of 73 students in 1956 and then moving on to secondary schools, specialising as a physics teacher. In 1976 he devised a major project on solar power for his Year 11 physics class, with students building solar-powered appliances such as solar ovens and water heaters, using parabolic dishes as solar collectors. The

Photo: John Morgan

Clockwise from top: the inspiring solar hot water article from a 1960 issue of *Radio, Television and Hobbies;* John's current home features thermally efficient reverse brick veneer construction, helping to push it to a 9 Star energy rating; John's house at Musk in Central Victoria used thermally efficient reverse brick veneer construction too.

students roasted a chicken in their very own solar oven and the project was repeated in years to come. John continued to lead the way on sustainability education, incorporating climate change topics into his classes from the mid-1980s. "Kids would go home, read the meter and report back," he says. "My main point (back then) was that when students got married and went to build a house, that they would build a sensible house."

Future-proof housing

John's own passion for a low impact future shows through three homes he has designed, two of which he built. While there is renewed interest in buried pipe cooling systems today, John installed a simple buried pipe system under his new home in 1982. The Morgans were rebuilding after their Dandenongs home was destroyed in a house fire. When the drainage contractor was digging a trench for the new home John saw an opportunity to lay some interesting pipe work. "Do me a favour and dig that thing a foot deeper than usual," he said to the contractor. John lay some 90mm PVC pipe in the trench. The contractor came back the next day to install the drainage pipes on top and filled it in with dirt. John's PVC pipes came up through the slab floor and vented cool air into the house. "It was an idea I had in mind for years," he says. "It worked well enough but was soon abandoned as the house was able to manage to stay cool itself."

John's next house was at Musk near Daylesford. It was built during the recession in 1992 so a combination of friends helping with the build and using recycled materials kept the costs down. John and Belinda installed a RAPS system on this home, a 2kW photovoltaic system, and have been living off the grid ever since. The property featured a micro hydro turbine until it

was decommissioned in 2004 when rainfall dropped substantially. The reverse brick veneer house was the site for the first Sustainable Living Fair in 1998 (now known as the annual Sustainable Living Festival) when 6000 people visited over two days. The organisers expected around 600 people. Nevertheless John was more or less the perfect host, showing as many groups around the property as was humanly possible.

While the design for his current home, completed in 2008, was going through the planning process, it achieved a home energy rating of 9 Stars according to the FirstRate software. "It's probably at least 9.5 or 10 Stars now with these drapes I've added." I tell him that I haven't come across any other Australian homes with such a high rating (a new compulsory 6 Star rating is only just being introduced in all states). "No I haven't either," he says casually, quite comfortable to be ahead of the pack.

The house looks to the future both in name and intention. It's named Galaxy Hill because the local area has good skies for star gazing; he hopes to build an observatory at home one day. "It's a climate changed house," he says. "I've designed it to take on board changes in the climate." The house has views of the 129 turbine Waubra wind farm just fifteen kilometres to the east. A few kilometres to the south of his property, possibly visible above the treetops, will be a smaller 29 turbine windfarm. It's fitting that John's retirement property will end up with views of wind turbines on two sides, although he chose the site because of its excellent solar and wind power potential.

Career change

In the early 1990s John complained to Belinda about a *ReNew* article on renewable energy courses.

"Now anyone can go to TAFE and get a certificate in renewable energy," he exclaimed. John, while already well-informed about renewable energy, held no qualifications in that area. In 1991 he enrolled in the Advanced Certificate in Renewable Energy at NMIT, attending classes at night while continuing his day job as a school teacher.

John at home with his 2kW photovoltaic system.

By 1994 he obtained the full TAFE qualification and in 1997 changed careers, leaving the high school system and becoming a renewable energy installer, working mostly in Central Victoria. By the late 1990s he was teaching renewable energy installation at TAFE while continuing to design and install household renewable energy systems.

While working in the industry he observed what makes people switch to a more self sufficient way. As an installer he often dealt with the women in the household. "As a rule it was the women who drove the move to renewable energy. Most see it as a lifestyle choice."

He's also observed impressive developments in solar technology, including amorphous panels to maximise solar potential, with larger panels able to get more of the early morning sun in winter. The move to sinewave inverters has also been positive, allowing greater reliability for solar households. Even at home John benefits from advances in solar hot water technology. He invested a few hundred dollars extra to buy high performance flat plate collectors. The system is a Rinnai Solar 26 with a 250 litre tank. "I don't need to turn on the gas boost for winter all that often but I probably would if I had a cheaper system. I've been using a solar water heater since 1977. Solar collectors today work much better than they did back then."

Knowledge

Now retired at 73 years of age, John has a lifetime of experience with sustainable homes, both as an installer and owner builder.

"It's not very attractive," says John of Galaxy Hill. "I chose to keep it simple and cheap." The house cost under $150,000, with John saying that building materials with a high-embodied energy will drive up the cost of a new home. John's theory is that getting the passive solar design close to perfect will eliminate the need for costly features such as heating and cooling (even sustainable but sometimes more expensive methods such as geothermal heating).

Continued page 26


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"If the design is sound then you minimise the need for additions."

Indeed Galaxy Hill has no artificial heating and cooling, with a comfortable year-round temperature thanks to John's GMI principle, which stands for glazing (double of course, triple if available), mass and insulation. "The temperature inside rises very slowly," he says, quoting temperatures of 34°C inside while 47°C outside on Black Saturday. The sun heats the thermal mass in winter and slowly radiates heat, while there's enough eaves and insulation to keep the house cool in summer.

If John ever registered another career change then a shift to government housing policy might be welcome. We'd be rapidly moving towards zero-emissions homes like his and cutting Australia's greenhouse gas emissions in no time.

Where does the ATA fits into his life today? When John retired a year or so ago he culled his list of subscriptions and professional memberships. The ATA membership was one of the few to remain. "ATA is saying something and doing something that needs to be said and done." His biggest disappointment is that there is not more public awareness about issues to do with climate and household sustainability, though. "I've been doing this for 50 years and still shouting into the wind. You would have thought after fifty years there would be a much bigger social movement."

In the meantime John will keep tinkering away on future projects including a glasshouse he's adding to the house. A fan will blow warm air from the glasshouse into the house via the bedroom that it adjoins. Other recent projects include a recently dismantled Air 403 wind turbine. "There was an engineering failure in the tower so I lowered it down and put it away." Apparently it took all day to put in three amp-hours so it wasn't working well anyway. But that doesn't matter, there's enough renewable energy generated at John's place to make up for that minor failure. ✻

A 9 Star house

Photos: Nick Stephenson

WHEN John's new home was passing the planning stage it achieved a 9 Star rating using the FirstRate software. How was this rating achieved in a house that cost under $150,000?

From the road the house looks like a space station because it is simple and white with solar panels on two sides of the roof and an array of antennas to facilitate John's amateur radio hobby. On closer inspection the house is constructed with reverse brick veneer, a technique that John adopted in the other two houses he built. The inner walls of the house are made from 90mm concrete blocks, the idea being that having brickwork inside the house is far more thermally efficient. The house is clad in eco-ply, which is made from mostly pine waste material. It's painted with highly-reflective paint that has a faint bluish-white tinge if you stare at it long enough. John mentions the albedo effect, whereby a surface with a high albedo such as snow, reflects more radiation into space, keeping the planet cooler. And light-coloured surfaces keep the house temperature down.

Three different types of insulation have been used in the walls. The outer layer is four inches of pink batt insulation, with a layer of foil insulation inside that, and a 50mm air gap between the foil and the concrete blocks. The perimeter of the slab has also been insulated with 1cm thick polystyrene. A quick look at the record of mid-winter temperatures shows how well the house performs. On a June night last year the outside temperature was 1.1°C overnight while it stayed 14°C inside. Heat collected in the concrete blocks during a clear sunny day releases into the house overnight. During the day a typical outdoor temperature was 13.4°C, while it was a snug 17.9°C inside thanks to the sun coming through the north-facing windows.

The home is built with bushfires in mind, with simple 'slip on' window shutters made from eco-ply off-cuts. These

can be placed over the windows on the south-east side, which faces a pine forest. They also offer more thermal insulation if need be during extreme heat or cold. The main entry has an airlock to offer greater protection during a bushfire and to help maintain an even temperature in the rest of the house.

The design in the two-bedroom home is very open, including double doors on both bedrooms to enable more heat flow through to these rooms. All windows are double glazed, a feature that John first encountered in the bitter-cold north of England when visiting his mother-in-law many years ago. John's custom-made blinds seal at the top of the windows, eliminating heat loss and possibly pushing the 9 Star rating even higher.

There's no skimping on comfort with a dishwasher, washing machine, microwave and other kitchen appliances all running off the photovoltaic system. John plans hot box cooking down the track, a slow-cooking technique shown in *ReNew 104* involving a blanket, a pot and not much electricity. The lighting is 36 watt fluoro strip lighting with instant switch-on. "Downlights would have left big holes in the ceiling in a thermal sense which results in heat loss."

Water is supplied from two 20,000 litre tanks and there's a solar-powered pump to move water from the nearby dam if needed. The solar system is 2kW with a 2.5kW inverter. "We've had 114 amp-hours already today with no sun and it's only lunch time." Eight panels face north-east and four panels north-west with the reason for this more scientific than a two-way bet. The north-east panels are directed to get the all important morning sun in winter. As the sun moves both sets of panels get sun, and later in the day, the north-west set still get the sun. In winter the amorphous panels also pick up glare from clouds. Needless to say there's significant power going into the battery all year round. As an installer he has the benefit of experimenting with what works best. "We had ten days of no sun recently and the storage capacity went from 100% to 59%. Then, after two days of good sun, we got back to 96%. That's very satisfactory."

The home is very open inside to enable air flow, and the reverse concrete block construction is on full display.

"In this home I was keen to demonstrate that standard elements are all that are needed for a satisfactory outcome. This house has no real architectural merit. It is intended as a test bed for a simple solution to a serious problem. I have no argument with the 'high tech' features that appear in many modern homes but they are not necessary and can be left out without loss of thermal performance. It helps to have a good builder, however! We did and the search for one is worth the effort."

Difficulty rating: ★★★★★

Dyane for a new millennium

When it came to converting a car to electric in New Zealand there weren't a lot of options for Ulrich Schmid. Then he found a Citroen 2CV.

In 2002 I became aware that using oil (petrol/diesel) the way we were could not go on forever. I wanted to do something about it so I hunted around to buy an electric vehicle. I discovered that almost all car manufacturers made one or more model of electric car, including Toyota, Honda, GM, Ford, Chrysler, VW, Citroen, Renault, Fiat and Peugeot, just to name the most important ones. There was also the Twike, Hotzenblitz, Think and other small producers of electric vehicles.

I could not afford an electric vehicle back then and it was impossible to import a left-hand-drive vehicle into New Zealand without owning it overseas. I decided to produce biodiesel from used vegetable fat and oil as an interim solution and have been running all our cars and tractor on 100% biodiesel since 2004.

It looks like a regular 2CV, but being electric and charged by solar, it's a lot easier on the planet.

I visited my mother in Switzerland in 2005 which gave me the opportunity to go to London to look at the only right-hand-drive electric vehicle available at the time, a Citroen Berlingo Electrique. There was a garage which serviced these vehicles and I was very impressed by them. Unfortunately they had stopped making them a month before I arrived.

The following year I became aware that MES-DEA in Switzerland were converting Renault Twingos and Fiat Pandas to electric, however, these brand new cars were rather expensive. I found an earlier model for a better price, but the company would only sell them in Switzerland and Northern Italy; I would have to own it for three months in Europe before I could bring it to New Zealand. I applied for an exemption from this rule but it was declined on the grounds that it was more dangerous to drive a left-hand drive vehicle in New Zealand! My options were running out. To buy a converted Hyundai Getz from Australia was as expensive as buying a Renault Twingo from Switzerland.

Which car?

There was only one choice left and that was to convert a car to electric myself. The car needed to have a range of 80 kilometres, have four seats and large wheels. We live in a rural area with dirt roads and I have to take the children to school and go shopping in the nearest town, Whangarei, which is 35 kilometres away.

It had to be a light vehicle—between 550 and 700 kilograms. There were only two suitable cars in New Zealand: a Suzuki Alto or a Citroen 2CV. As the Suzuki has smaller wheels and a lower allowed maximum curb weight I focused on a Citroen 2CV. This car was never sold in New Zealand but I was lucky to find a Dyane 1973 model in very good condition and bought it for NZ$4500.

What system?

A friend of mine had converted a Daihatsu with an aircraft starter motor and lead-acid batteries. It was a two seater and very heavy with a maximum range of 30 kilometres per charge. I decided on an AC system due to the higher efficiency it offered. The weight is about the same for equivalent power, however, the price is higher. I compared prices at the time and the choice was an Azure Dynamics motor and controller. This was exactly the drive that BEV in Australia use for their Hyundai Getz conversions.


TN9907

Under the bonnet. At left you can see the electric motor, controller and framing for the front battery pack. Below, after everything's in place.

Battery choice

Lead-acid batteries were too heavy, while nickel metal-hydride (NiMH) and lithium ion were not readily available. That left only two other available choices. One is the Zebra battery made by MES-DEA in Stabio, Switzerland. This is a proven nickel sodium-chloride (Ni-NaCl) system that operates at 300°C. Unfortunately they would only sell a minimum of 10 batteries, which are very expensive. The other option was the Thundersky lithium iron-phosphate ($LiFePO_4$) battery. It is also a proven battery made in China but slightly less efficient per weight. The price is better though. To match the voltage of the motor I decided to get 50 of the Thundersky TS-LFP-90 AHA batteries and hoped that would give me at least a 100 kilometre range or maybe more.

This Citroen only takes electrons for fuel!

Gear box

Now the question was whether to leave the existing gearbox in or get a motor with gears and differential. The Dyane does not have enough clearance between the brake drums for such an arrangement, so the gear box had to stay.

Adaptor plate

The next thing was to accurately make an adaptor plate to fit the motor onto the gearbox. First I had to take the internal combustion engine (ICE) out. This was great fun because everything came out in one go! I made the adapter plate from a 50mm thick piece of aluminium.

Weight distribution

Before I started to take the old ICE parts out of the car I went to the local refuse tip to weigh the car. The front axle was 420 kg and the back 200 kg, a total of 620 kg. By weighing all the parts I took out I could figure out how many of the new batteries to put in the front and back. The motor, the controller, the DC to DC converter and 21 batteries fit in the front. The rear battery box fitted neatly in the luggage compartment behind the back seat, with still some luggage space above it. The charger fits nicely on top of the inside part of the right wheel cover.

Assembly

After touching up a few rusty parts I mounted the new motor on the gear box using the existing rubber mounting pieces of the ICE to support it. Then all the batteries were put inside, with the battery management system (BMS) units mounted on each battery. Batteries and BMS were all connected and the wiring tidied up.

Instrumentation

I decided on an Xpert-Pro battery monitor. It is rather expensive but a very nice and small instrument with all sorts of functions, the main ones being: voltage (V), amperes (A) and capacity (Ah). I have a 165 volt system so I had to install a 10:1 prescaler since the battery monitor is built for lead-acid batteries.

Speed and mileage are shown by the original instruments. I also installed an inertia switch in case of a crash. There is a built-in relay to stop me from driving off while charging, a forward/reverse switch, a switch to turn off the regenerative braking, an emergency stop push-button between the driver and passenger seat and a secret off switch to prevent the very unlikely scenario of the car being stolen.

The Citroen is charged from mains power. The home's solar array produces more energy each year than the car requires, so this is certainly a solar-powered EV!

The regenerative braking switch is necessary to change gear while driving, as I have taken the clutch out to gain extra space to fit the motor so that I didn't have to extend the front grille of the car. The controller has an adapter plug to plug in the computer so I can check and adjust the parameters or to follow real time information about motor, battery and other functions while driving if necessary.

Driving experiences

Having an EV, I have learned to drive more economically, using third gear to do all the driving up to 95km/h, with the exception of our steep 21 degree driveway, for which I use second gear. If I have to drive fast on a highway I might switch to fourth gear.

Charging and power consumption

I charge the car whenever I return from a trip. This will change soon as I am installing a special socket for night power which is about 55% the cost of normal electricity. I purposely put a 1.3kW solar system on our shed roof to run my electric car on solar power. Hence I call my car 'solar citroen'. This system produces about 1800kWh a year and the car has used around 170kWh for just over six weeks, or about 1500kWh per year.

Any excess electricity produced by the solar panels gets used by the household or fed back into the grid at full price. With a bit of cheek I could say that driving in my electric car charged

Specifications

Weight: 800kg
Motor: 13kW, 3-phase AC, air cooled
Acceleration: far better than original motor!
Maximum speed: 104km/h
Range: around 100km in the hilly area
Cost: NZ$25,000
Conversion time: four to five weeks over a six month period
Expected kilometres per year: 15,000

by a grid-interactive system with a cheap night rate actually gives me money back!

Driving to town on my own uses about 146 watt-hours per kilometre (Wh/km), or 170Wh/km with local hilly driving and usually an extra passenger or two. This works out to NZ$3.84 per 100 kilometres or NZ$4.47 per 100 kilometres respectively. Using a night rate will make this around 40% cheaper.

Comparable costs for an average diesel or petrol car are about NZ$10 to $12 per 100 kilometres not counting the cost of oil, air and fuel filters, cooling fluid and transmission oil. With the batteries having a cycle life of 3000 cycles at a 70% discharge or 2000 cycles at an 80% discharge, I should not have to change the batteries for at least 10 years. Even then they will probably still be good enough for my short trips.

How to drive an electric car

When driving an electric car try to use as little energy as possible. You have to understand that regenerative braking (if you have it) only gives back a certain percentage of the power that you theoretically could have. Therefore when driving you try to drive in the zero power use mode whenever possible, meaning you cruise with the accelerator pedal in middle position between accelerating and regenerative braking. For example, when driving towards the top of a hill don't go full speed over it but instead just have enough speed to roll over it and then cruise without power or use regenerative braking down the other side as far as you can go. In other words, look and think ahead!

In town I use regenerative braking almost exclusively for slowing down and mostly I do not need the brake pedal at all. The other secret is not to drive fast. Driving above 60km/h means the air resistance really starts to cost you energy. So go as slow as you can afford. Air resistance increases by the square of the speed and the power required to overcome it increases by the cube of the speed!

Driving with the above points in mind is really easy, in fact nicer than with ordinary automatic cars because you basically only use one pedal. Of course the above points are not always possible to implement with all the traffic today and the impatient fellow drivers. However, having a car that everybody knows is slow like the Dyane is a great advantage. People are more forgiving!

All drivers, whether in electric, petrol or diesel cars, should follow the above guidelines and their fuel consumption would be reduced instantly by 10% to 20%.

Reactions

Most people look at my car, the main reason being that there are very few of this model in New Zealand. Some realise that there is almost no sound. Children seem to be the ones that discover that it is electric because they notice the socket at the rear.

A few critics ask what I do when I run out of power. I usually tell them that I have a very long power lead and that there are many more houses along the road than petrol stations. They would have to walk a lot further with a petrol can if they run out of petrol. It does not occur to them that you do not let the situation happen anyway, similar to when you drive a petrol car.

I have since added another 4.3kW of solar panels to get ready for my next electric car! We also have 40 evacuated tubes on our roof for hot water. The neighbours are very curious about my projects, especially the electric car. It gets them thinking when I tell them that it costs me only NZ$2.70 per 100 kilometres to drive the Dyane. Maybe they will do something about it when the oil price goes above $100 again! ✻

Special thanks to Chrissy and my children for accepting me being a bit busy sometimes during the conversion of the Dyane. Of course without the help of Gary Baxter, my friend the electrician and Bob Smith a friend and engineer it would have taken me twice as long to finish the job!

Thank you to Etedoron Z Mucy for his work documenting Ulrich's story. This is an extract from a booklet on Ulrich's experience, originally written by Etedoron. More information on Ulrich's Citroen Dyane can be found at www.evalbum.com/2808

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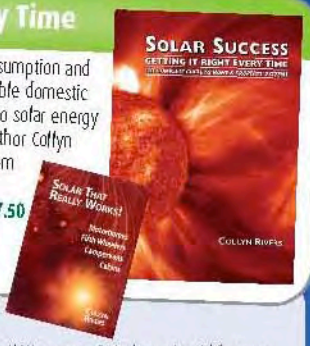

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12 Volt 10 Watt	Cat. ZM-9093	$89.95	12 Volt 80 Watt	Cat. ZM-9097	$449.00
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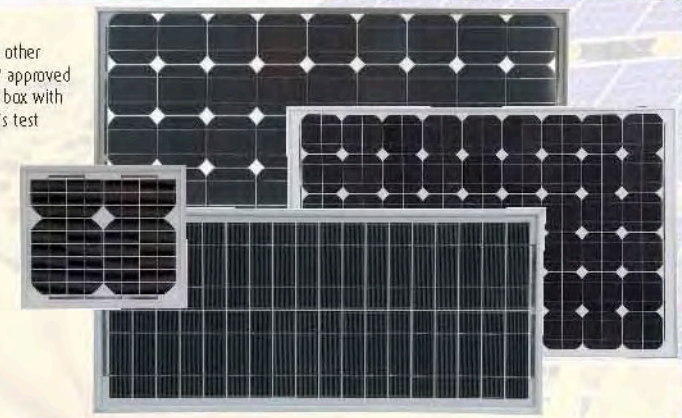
12 Volt 40 Watt	Cat. ZM-9095	$249.00	24 Volt 175 Watt	Cat. ZM-9099	$949.00



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Portable classroom home

This simple, energy efficient home was once part of a school. It will be a place of learning once again when it opens for *ReNew's* Open House Day in late July, writes Jacinta Cleary.

When it comes to building houses, Abbie Heathcote has tried almost everything.

In the 1960s, Abbie, a painter of landscapes, was drawn to the bush at Kangaroo Ground on Melbourne's northern outskirts, building a mudbrick home.

In the 1980s she built an inspired home near Castlemaine in Central Victoria. Everything was done by hand and building materials salvaged from the tip, the bush and the roadside including tree trunks, stone, mudbricks, rocks, cow dung and sand dug from the riverside. This was undeniably an artist's home, with a roof garden and an indoor dry creek bed. It took almost five years to build.

It was a different story with Abbie's current home in Castlemaine, with the project taking only 13 weeks to complete. She had a head start with this dwelling, as it is made from a single portable classroom.

Just 20 kilometres away in Kyneton is BRB Modular's 'graveyard', home to hundreds of demountable ex-classrooms. Abbie found a classroom slightly larger than most, meaning she could include two bedrooms, small as they are, so that her daughter can stay from time to time. The home has similar proportions to an inner city apartment, with an open plan living and kitchen area and a small bathroom/laundry. The main difference is that this 60 square metre 'box' has a 24 square metre deck added to it, with views that will only get better once the newly-planted trees grow up.

Anyone who went to school in portable classrooms might remember that they were incredibly cold, at least in the midst of a southern winter. Heating the rooms was hopeless because they are essentially steel or timber shells. To counter this, Abbie has added wall, floor and ceiling insulation, with the wall and ceiling insulation made out of recycled plastic bags. During an early morning visit after an overnight frost there's no heating on but the full sun coming through the windows is enough to keep warm. Abbie says the house can stay warm until 9pm.

Photos: Nick Stephenson

The rear of the portable ex-classroom house with a deck added.

The house is orientated for the best solar access, with the main living room windows facing north to make best use of the low winter sun. In summer the sun is too high to come through the windows, however, the sun can be a nuisance in late summer as it gets lower in the sky. Abbie's sister gave her some reflective blinds, which she describes as a bit like double glazing. In winter she

draws them down once the sun moves off the windows to prevent heat loss. In summer she does the opposite, pulling them down if the sun is a nuisance.

This is not a high-tech sustainable home, instead it's an example of sustainability from simplicity. The appeal lies in its small environmental footprint, with recycled materials used where possible, very low energy use, especially to heat and cool the home, and incredibly low water use. Abbie will eventually get a grid-connected photovoltaic system, but she's so energy conscious that the system would be small.

"I have tried to build a non-toxic house, hence all the old stuff, which I also happen to find aesthetically pleasing," says Abbie. "I got lots of stuff from garage sales, such as the gas stove, double sink, laundry trough, toilet and cistern, gas pot belly, bathroom light, fan and heater, window and door, tiles and curtains. My furniture is old colonial pine which I have had for nearly 50 years and I get stuff from family friends and garage sales."

Construction

Abbie helped prepare the foundations herself, digging out holes with an old saucepan, her face in the dirt. "If I can do it myself I'll do it," she says. "Why pay someone else?" She did employ a local builder to assist over the 13-week construction period, working alongside him and paying by the hour, rather than getting a quote for the entire job, which she says can be more expensive.

The classroom was delivered in two halves and reconnected on site by staff from the modular company. Abbie once again found herself face down in the dirt, this time under the classroom connecting the foundations to the turnbuckles.

The eaves were rotten and needed to be rebuilt as was the hardwood floor, which was replaced with pine. The insulation went in, internal walls went up, plaster lining was added and the transformation of a portable to a house was nearly complete. The cladding at the front of the house was rendered with cement, making it unrecognisable as a classroom.

Abbie chose not to invest in a solar hot water system: "I don't believe in using a lot of water," she says. Instead she has a Bosch instantaneous gas hot water system. The water is only heated when needed and she can set the temperature. If she's having a shower she might only set it to 40°C or if she's washing dishes she can make it hotter at around 70°C.

Abbie became water conscious while living at her other bush properties, collecting water from dams and living through droughts. She collects as much water as she can indoors for reuse on the garden and has a small 1000 litre rainwater tank also for garden use.

Why a portable?

People associate country living with big homes, but, now in her late sixties, Abbie wanted to downsize and live somewhere that required less maintenance. She wanted to be close to the centre of Castlemaine, and from her new home

Reflective blinds help keep heat in.

ReNew Open House Day

IT MAY not look like it can fit many people inside, but Abbie Heathcote's house will be open to the public in late July when *ReNew* magazine presents Designed for a Sustainable Future—an open house day in Castlemaine.

Four properties will be open on the day, each one a different example of sustainable living. See a DIY smart home for those on a budget, a home retrofitted under strict heritage overlays, a beautiful example of sustainable design and a very special example of community living at a property with four dwellings and shared energy and water supplies.

After visiting the open houses, attend a Q&A session in Castlemaine with a panel of sustainability experts. Find out about renewable energy at home, water tanks, passive solar design and planning issues from those in the know.

Designed for a Sustainable Future is held in partnership with the Mount Alexander Sustainability Group and is part of the annual State of Design Festival.

Date: Saturday 24 July.

Time: 12.30pm: Registration and welcome in Castlemaine; 1pm to 4pm: Visit open houses; 4.30pm to 5.15pm: Sustainable home Q&A session in Castlemaine.

Cost: Free, registrations required. To register please email renewhouseday@ata.org.au.

More details: For addresses and maps please go to www.renew.org.au

To find out more about the Mount Alexander Sustainability Group go to www.masg.org.au and to find out about other events in the State of Design Festival go to www.stateofdesign.com.au

ReNew Open House Day

As well as Abbie's house, three other properties in Castlemaine will be open on July 24.

Cooperative living

This inspiring property, known as Myrnong, features not just one home but four. The residents in the cooperative share water and energy supply including this 3kW solar system. All homes feature passive solar design, with Lucy and Maurie's home featured in *ReNew 110* (inset) for its buried pipe cooling system. We'll feature Myrnong in the next issue to show you how a cooperative like this works.

Beautiful and sustainable

This new home is a prime example of contemporary passive solar design. For visitors this is a chance to see triple-glazed windows in situ. The owners have tried to ensure the house is carbon neutral, with electricity from a 1.5kW grid-connect PV system.

Heritage retrofit

Visit this 100-year-old retrofitted Edwardian house. Making changes when living with a heritage overlay can be a challenge, but this household knows how it's done, with greywater and rainwater systems, drought tolerant garden, photovoltaic system and energy efficiency measures throughout.

she can walk or ride everywhere. She says that houses on this scale are "in demand" because there are very few small dwellings in Castlemaine, or most other country towns for that matter.

Abbie has worked in one of the lowest paid professions her entire life, but through a lot of hard labour and clever decisions has managed to own homes. "One of my interests is to see how much money I can save," she says, which is another reason for her low electricity and water use. Her new home cost under $50,000 and sits on an eighth of an acre block that she subdivided. She lived at the front of the block for several years in a house that she relocated: "I converted an old wreck, retrofitting big north-facing windows and putting in insulation."

This shrewd approach might yet help many people enter the housing market, living in retrofitted portable classrooms, a place of misspent youth for some but possibly a home at last. ✻

Approximate costs

Portable classroom: $3000
Delivery and reassembly: $3500
Foundations: $2000
Labour: $13,000
Materials: $13,000
Electrical, plumbing, gas: $12,000
Sewerage costs extra, plus $38,000 for subdivision

Photos: Nick Stephenson

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Heating your home with the earth

Geothermal heat pumps are relatively new to Australia. Lance Turner takes a look at what they are, how they work and where you can get them.

Heating and cooling is one of the biggest energy users in the modern home and can account for around 38% of all home energy use, according to the Department of Climate Change and Energy Efficiency.

With rising energy costs, and the greenhouse emissions produced by energy production, it makes sense to reduce your energy use as much as possible.

Many people, such as renters and those in rural areas, are rather limited in their heating options. Using electricity to produce heat directly is very inefficient in the overall fuel cycle and produces more than three times the greenhouse gas as using natural gas. However, natural gas is still a fossil fuel, so unless you are carbon offsetting, it is not the best alternative.

Wood is considered by many to be a carbon neutral fuel and therefore environmentally friendly. However, that's not always true. Chopping down trees doesn't just destroy the tree, but usually the whole ecosystem. Plantation timber is better, but there's a huge amount of firewood in Australia that comes straight from native forests. Further, many people burn wood in slow combustion heaters, which control the burn rate by restricting airflow to the fuel. This results in excessive smoke creation, as well as generating unburned gases like methane, which have a much stronger greenhouse effect than the CO_2 the trees absorbed originally in order to grow. So, wood, in many cases, is not as green a fuel as most people think.

Another option is pellet heaters, which make use of agricultural and sawmill waste in the form of small pellets. These are a great option in many cases, but they only serve to heat one or two rooms. If you need to heat the whole house, as people with children usually do, then you need central heating.

This leaves heat pump systems, which have several advantages. The first is that they make much more efficient use of the electricity they use. Instead of using electricity to directly generate heat in resistive elements like regular electric heaters do, they use the electricity to operate pumps and fans to shift heat from outside to inside.

It's much more efficient to simply grab heat from one place and dump it in another. And the great thing about such systems is they usually work in reverse as well, taking heat from the home and dumping it outside in summer. Obviously, this is commonly known as air conditioning in summer!

A quick science lesson

But how can they get heat from outside when it's so much colder outside than in? Surely there's no heat to gather? Well, to a human it may feel cold, but in reality there's a huge amount of heat available, even when it's zero degrees outside. Indeed, at 0°C, it's actually 273°C hotter than the absolute coldest it could be! This figure, called absolute zero, is when there is literally no heat available. At that temperature, all molecular motion ceases and things can get no colder. Absolute zero is around -273°C, much colder than it is outside on even the bitterest winter days. So, there's plenty of heat out there, you just have to gather it up and concentrate it so that it becomes useful.

This is what a heat pump does, whether it's your reverse cycle air conditioner or your heat pump hot water system. Even your fridge is a heat pump and works by trying to heat the inside of your home

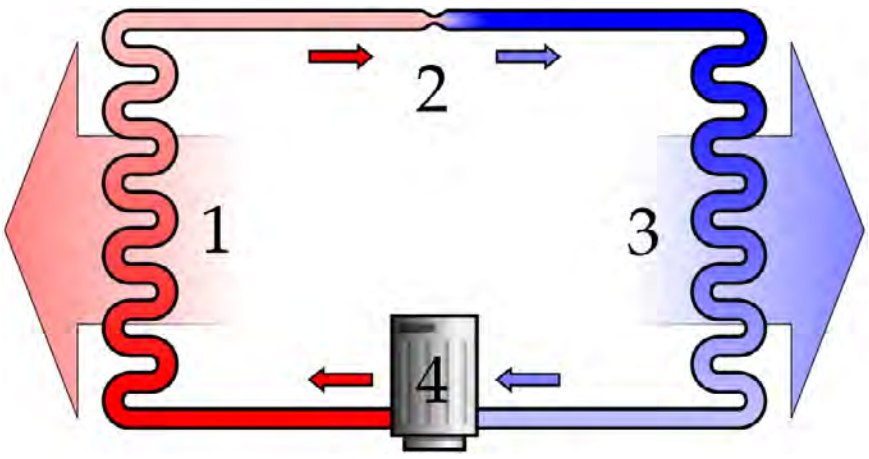

Figure 1. A simple heat pump.

1. Condenser coil (hot side heat exchanger)
2. Expansion valve (gas expands, cools and liquifies)
3. Evaporator coil (cold side heat exchanger)
4. Compressor

Red: Gas at high pressure and temperature

Pink: Gas at high pressure and reduced temperature

Blue: Liquid at low pressure and greatly reduced temperature

Light Blue: Gas at low pressure and warmer temperature

using the heat from inside the cabinet, hence it gets cold inside.

How it works

A simple diagram of a heat pump can be seen in figure 1. The working material inside a heat pump, called the refrigerant, comes in many types, but two common ones nowadays are R134a (1,1,1,2-tetrafluoroethane) and R600a (isobutane). There's a link to an extensive list of refrigerants at the end of this article. Refrigerants are fluids with very low boiling points. This allows them to convert from a liquid to a gas inside the heat pump system, depending on the temperature and pressure where they are.

As many of you will know, when a liquid evaporates it expands into a gas, absorbing a great deal of heat in the process. This is essentially how a heat pump works. The liquid flows through the expansion valve into an area of lower pressure where it expands and becomes a gas, in the process sucking up a lot of heat. This is why the evaporator coils in a heat pump feel cold. Heat is gathered at the evaporator and transferred to the condenser via the compressor. At the condenser the refrigerant becomes a liquid again due to being compressed and so liberates the heat, making the condenser hot. This is what heats your home in a heat pump system.

Because the heat is being collected from the ambient air, this type of arrangement is known as an air source heat pump.

Heat pumps move a lot more energy in the form of heat than they use to do the moving. This ratio of energy moved to energy used is called the co-efficient of performance, or COP. A typical air-sourced heat pump might have a COP of 2.5 or 3, meaning that for every 1 kilowatt-hour (kWh) of electricity used, 2.5 or 3kWh of heat will be moved.

Ground source systems

As it's name suggests, a ground source heat pump gathers heat from the ground, or uses the ground as a heatsink. Ground source heat pumps can be more efficient than air-sourced pumps, for two main reasons. The ground has a much higher capacity for absorbing or providing heat than air does. Also, the ground temperature is usually more stable than the air temperature, depending on how far into the ground you measure it.

This is a set of heat exchanger loops ready to be installed in a pond.

This means that during winter, the heat source (the ground) will often be warmer than the air and so can provide heat more effectively. In summer, when you are trying to dissipate heat, the same applies; the ground will be a lot cooler than the air.

A variation on the ground source heat pump is the water source heat pump. This works like a ground source unit but the heat exchange coils are immersed in a large body of water such as a dam or lake.

This has the advantage of providing not only a very stable temperature for the heat exchanger to work with, but also near perfect thermal coupling, as the water is in contact with 100% of the heat exchange coil surface. Often, ground source heat pump heat exchangers are buried along with a water drip system that can be used when the soil becomes too dry and loses its ability to absorb heat from the heat exchanger. Water really is an excellent heat transfer medium.

Another advantage of ground source heat pumps is that not only can they provide heating and cooling for a home, they can also provide hot water. Some systems are designed to do both, some are not.

Direct exchange or loop

The above description is not the end of the story though. There are two main types of system—direct exchange and loop exchange systems.

In direct exchange systems, the refrigerant flows from the heat pump unit through pipes into the buried heat exchanger outside. In this type of system, the loops are usually arranged in the ground vertically, being dropped into a number of bore holes.

Because the refrigerant is exchanging heat directly with the ground through the wall of the heat exchanger pipes, it is called a direct exchange system.

The other type of system is a loop exchange system. The refrigerant is

contained inside the heat pump device itself, and exchanges heat via a heat exchanger which has water/antifreeze mixture flowing through it. This type of system requires a great deal less refrigerant, but has the disadvantage of requiring a separate water pump and controller to circulate the water/antifreeze through the heat exchanger.

The other end of the water loop can end in one of two ways. In a closed loop system, the water flows through a continuous loop, from the heat exchanger in the heat pump unit out to the ground or water source heat exchanger coils and back again. It is a closed loop and the water mixture in the system is always a known quantity.

In an open loop system, water can be taken directly from a lake or dam and circulated through the heat exchanger in the heat pump unit. It is then returned to the lake or dam. The disadvantage with such a system is that you have to filter the incoming water to some degree to prevent clogging of the pump and heat exchanger.

Loop exchange systems are generally less efficient than direct exchange systems due to the added energy used for the cirulating pump. Also, in a direct exchange system there is only one level of heat exchange—directly between the refrigerant and the ground or water body. With the closed loop exchange system there are two levels of exchange—once from the water to the ground or water body, and then from the water to the refrigerant.

Ground heat exchangers

As mentioned above, heat exchange coils can be mounted vertically in the ground in bore holes. This results in a space saving system and may be the only option for many suburbanites, where houses are getting bigger and yards smaller.

Vertical heat exchangers are usually made of copper or a similar pipe. In corrosive environments they will usually need the addition of a sacrificial anode or other anti-corrosion system.

If you have a lot of space to play with, then a horizontal heat exchanger could be the way to go. These come in two common configurations—flat and vertical (not to be confused with the borehole type above).

In a flat system, large areas of soil are lifted to form a wide flat trench. The coils, often made of a low cost material like poly-pipe, are laid into the trench and then covered with soil. The depth at which the coils are laid will often depend on where you live—should the system take advantage of seasonal variations in soil temperature, or should it be laid further down where temperatures are more stable and there is a longer seasonal thermal lag.

The other trench system involves narrow trenches only a few hundred millimetres wide but quite deep. The coils are laid on their edge instead of flat. The advantage of this system is that the trenches are much smaller and faster to dig so there is less disruption to gardens.

With water sourced heat exchangers, the coils are laid into the water body and held down with weights.

Inside the home

Once you have your heat collected from the earth, how is it used?

Some systems work much like ducted air conditioning, heating or cooling the air and distributing it around the home via ducts. These systems are often used to replace gas central heating, and so convert a heating-only system into a heating and cooling system.

Other heat pump systems use the collected energy to heat water, which becomes the thermal storage. The water is then circulated around the home in the traditional manner of hydronic heating systems—through underfloor coils or wall-mounted radiators and the like. Some water storage geothermal heat pump systems can also provide hot water for general use and some can even heat swimming pools.

Conclusions

Which system you choose will depend on a number of factors, including your land and available space, soil type, whether you need hot water as well as heating, and the number of people in the home. These are decisions only the homeowner can make, but it pays to talk to as many suppliers as possible so that you can compare systems.

However, this is where problems occur, as there are still very few suppliers of these systems. We looked around and found the ones listed below and there are probably a few others, but the options are limited compared to the US and many European countries.

The main reason for this is probably cost. Geothermal heat pumps are one of the most expensive heating systems to install but one of the cheapest to run. They will normally pay back the extra installation costs in under 10 years, yet many people simply don't have the money to spend up-front on such a system. ✻

Geothermal heat pump suppliers

Enviroplumbers: ph:(03) 9783 0101, www.enviroplumbers.com.au
Direct Energy: ph:(03) 8598 0686, www.directenergy.com.au
GeoExchange: ph:(02) 8404 4193, www.geoexchange.com.au
Earth To Air Systems: ph:1300 780 216, www.earthtoair.com.au
Geo Air Services: ph:0414 258 505, www.geoairservices.com.au

Resources

Heat pump explanation: http://en.wikipedia.org/wiki/Heat_pump
Geothermal heat pump explanation: http://en.wikipedia.org/wiki/Geothermal_heat_pump
List of refrigerants: http://en.wikipedia.org/wiki/List_of_refrigerants

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Looking on the 'bike' side

What makes cycling to work so attractive across Europe? Simon Waugh looks at why bikes are everywhere else but here.

On a trip to Europe late last year, I was struck by how much the humble bicycle is used as a viable alternative to cars and public transport. Sure there are a few enthusiastic cycling commuters back home in Australia, but from where I sit, they really are in a minority.

Amsterdam

It was impossible to miss the hordes of European cyclists as I started my trip in Amsterdam, a city with a long and illustrious cycling history. Amsterdam was home to the first urban shared bicycle scheme way back in the 1960s. Nowadays just about everybody seems to have a bike of their own. I wandered about with my jaw dragging along the ground, stunned not only by the number of cyclists but also by the sheer variety. They have bikes for every occasion, be it commuting, carrying the children to and from school or to bringing home the groceries. If there is somewhere worth going in Amsterdam, it's worth getting there on a bike, even if you live on the city's fringe.

To solve the problems faced by those who commute from the outer suburbs, the City of Amsterdam also operates a 'Park and Bike' scheme, whereby commuters can park their cars in designated areas and use bicycles to complete their journeys. This is a not-for-profit scheme, with the cost of bike rental being covered by the parking fees and any shortfall being made up from city funds.

So why is it such a good thing that thousands of city dwellers choose the bike as their primary means of transport? We all know cars gobble up fossil fuels and spew out noxious fumes, but here are a few little bits of trivia to drive home the point (excuse the pun). Bike use increases the closer one gets to city centres. This is hardly surprising, but it's worth pointing out that travel times for car journeys increase in reverse order. For the average family car, every litre of fuel burnt results in around 2.3 kg of CO_2 released into the atmosphere.

In many parts of Europe, bikes get their own 'bikeways' separated from cars by dividers.

Photos: Simon Waugh

Dublin

From Amsterdam I travelled to Dublin, a city whose cycling habits are already familiar to me. I grew up there and covered countless miles cycling through my school years, until I left for Australia ten years later. Back then the city traffic was already bad, but cycling was popular and the bicycle was the ac-

cepted means of travel for the majority of schoolchildren, university students and a high percentage of commuters. Sadly, the economic boom of the nineties saw a huge leap in car ownership and a corresponding drop in bicycle use.

However, the chronic traffic congestion meant that car use could only increase so far, before movement on the roads during peak hours became almost impossible. The recent economic implosion in Ireland must surely bring a return to earlier levels of bike use. In spite of the above comments there has been an encouraging interest in green issues in Ireland including sustainable architecture, alternative energy sources and finally, a city bike-swap scheme that started last September.

The scheme comprises around forty stations with a total of around four hundred bikes. The bikes are free for thirty minutes of use, after which they cost a nominal fifty cents for the next thirty. Borrowing fees increase with loan duration, to encourage short borrowing times and ensure availability. Membership costs 10 euros for a year, but non-members can use the bikes by providing a credit card number.

Barcelona

After Dublin my next port of call was Barcelona, which hosts a similar share scheme, known as 'El Bicing'. Started in 2007, this is very similar to the Dublin scheme; it initially offered around 750 bikes at some 50 stations, but the total now stands at nearer to 6000, available at over 400 locations. The number of registered users has now increased to a staggering 100,000. Clearchannel, which operates the El Bicing scheme, has been given a ten-year contract and also operates similar schemes in the European cities of Oslo, Stockholm and Lyon.

Freiburg

The city of Freiburg, in Germany, was my final destination before returning to Australia. It's worth pointing out that

A multi-storey bike park, Amsterdam. Australians can only wish for these sorts of facilities!

Freiburg promotes itself as a green city, which is centred around the university. Residents are encouraged to use public transport or bicycles, and over 400 km of dedicated cycle lanes are available. Cyclists can ride in both directions on one-way streets and a third of all streets are reserved for bicycle use, making cycling an easy and attractive option.

The Freiburg suburb of Vauban has been designed for complete car-free living; residents are required to confirm annually that they do not own a car. If they do they must banish their vehicles to a paid car park on the edge of the town. Cars are allowed to travel along residential streets, but only slowly (typically 30 kph) and parking is not allowed, resulting in car ownership levels of around 5%. The car-free concept

Bike share in Australia

THINK the bike share scheme sounds like a good idea? Well, Australia is starting to catch on, with most capital cities now proposing similar schemes.

Comparable, but on a much smaller scale, to the successful scheme in Amsterdam, bike sharing will be launched on Melbourne's streets any day now. The initiative from RACV and the Victorian Government, to be known as 'Melbourne Bike Share,' is to offer a greener transport alternative for Melbourne residents.

Six hundred bikes will be on offer from 50 stations set up across inner Melbourne. Use of the bikes will cost an annual subscription of $50, or $2.50 a day for casual users. The issue of helmets has not been ignored, with RACV planning more than 1000 helmets to be made available with details still to be confirmed.

Next in line is Brisbane, where 200 car parking spaces have been removed to make room for bike stations for its 'CityCycle' program. Brisbane will have 2000 bikes on offer across 150 stations and plans to have at least 90 of these operating by the end of the year.

It is likely the success of these schemes will determine how quickly other cities roll out proposals too.

Sarah Dailey

Bike share schemes are common in Europe, such as this one in Dublin.

has been applied to varying degrees in other European cities, notably Amsterdam, Vienna and Hamburg.

Bicycle incentives

One morning in central Amsterdam I stood outside an office building and watched as most of the workforce arrived by bike, briefcases stowed behind. It started me thinking about how this cycling culture might work in Australia.

The most obvious problem I could think of was the climate. The few friends who regularly cycle to work consider themselves lucky if their workplace offers showers. It's not hard to imagine what might happen if twenty, or even fifty workers turned up on a hot day, all needing showers before they could start work. And then there's the thorny issue of secure bicycle storage, because none of us wants to leave our beloved bike where it might be vandalised or stolen.

The current batch of 'green' office buildings typically tends to offer around six bicycle spaces, a drop in the ocean of what is needed. There are substantial on-going costs associated with provision of bicycle-friendly streets and bikes get stolen too, not just cars. Parking must be provided, even if each space is tiny compared to that required for even a small car.

The high-rise bike park outside Amsterdam's central station was designed to offer about 2500 spaces, but there are usually closer to 4000 squashed in at any time. A refurbishment is currently taking place and will be finished sometime in 2012 to include sheltered parking for around 10,000 bikes!

As seen in the photos, helmets aren't mandatory in Europe, which greatly encourages the casual borrowing schemes. Such a scheme is planned for Melbourne in the near future, with the helmet issue yet to be satisfactorily addressed. The absence of dedicated cycle-ways is another concern. I have noticed a huge increase in marked cycle lanes on my local streets, but not separate carriageways, which tends to be the case overseas. That white line doesn't give me much comfort as the cars roar by a few centimetres from my elbow.

It is reported that less than 10% of commuter journeys in Australian cities are made by bike. In many European cities this figure is well in excess of 50%. Perhaps, all other issues aside, what's really keeping bike numbers down around here is attitude. Hopefully this will change in the future, as cities and commuters catch on to the ever growing trend of cycling. Just remember, always look on the bike side! ✻

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Investing *for* the environment

Kate Allsopp looks at the tricky business of ethical investing and how your financial choices can both help and hinder the environment.

Would you support uranium mining or the pulping of old growth forests? Would you invest money towards supporting cotton growing in the driest continent on earth? How about the manufacture of arms? I am guessing the majority of *ReNew* readers would say absolutely not.

Well, do you have bank shares? And do you know if the bank you have shares in has lent money towards these above practices? And when your super fund uses the term 'sustainable' to describe their investment criteria, how can you be sure it matches your definition of sustainable? The point being, no matter how ethical we are with our money, sometimes it's hard to know where exactly our funds are going, and how much we can trust the investment decisions of the banks. For example, one of the larger 'sustainable' investment funds in Australia invests in BHP Billiton, which happens to own a uranium mine; not a place all of us would like our money going towards.

Photo: Nick Stephenson

Renewable energy generation is just one area where you can invest ethically.

What is ethical investing?

Ethical investing or 'Socially Responsible Investing' (SRI) as it is often called, involves taking into account environmental, social and governance (ESG) considerations when making investment decisions. The purpose is to direct your money towards investments that reflect your social and environmental convictions and to avoid areas you are opposed to.

There are numerous ways to invest ethically. You can invest in shares by buying them direct or buying into a managed fund. You can place your money into community banks or banks/credit unions that support social and environmental positives. You can choose a superannuation fund that is ethical. Or you could invest in ethical property trusts. The list goes on. This article concentrates on managed funds.

Is it ethical?

A large number of investment companies now use the words 'sustainable' or 'socially responsible' to describe their investment products. The *Responsible Investment 2009* report from the Responsible Investment Association Australasia (RIAA) lists the biggest responsible investment fund managers in Australia. It is interesting to see the range of what is considered responsible. Out of the top 10 (by invested value) only two firms are entirely focused on ethical investments—Australian Ethical Investment and Hunter Hall. In some cases it is hard to find the 'ethical' investment among the other investment products on offer. It can also be hard to find out what exactly they mean when they say they are ethical.

So how do you go about choosing an ethical investment? It all depends on what you regard as ethical and how 'green' you want to go. According to Hunter Hall's Executive Director and Ethics Analyst Michael Walsh, it's all about transparency as well as the screening process. Hunter Hall started a 'deep green' investment fund in 2007 to go with their other 'lighter' green funds. The deep green fund uses positive and negative screens to select the companies to invest in, and then publishes a list of the companies that make the cut on their website. That way a prospective or existing investor can know exactly what companies they are investing

in and can discuss the reasoning behind the inclusion of companies before going ahead. Mr Walsh also recommends reading the Product Disclosure Statement, a legal requirement for all investment products that should highlight the fund's investment criteria.

According to the same report, Australian Ethical Investment is considered the 'deepest green' of the investment companies in Australia. They use both positive and negative screens for all their investment funds, list all the companies they invest in on their website and engage with companies to improve their sustainability. "A key aspect of ethical investing is knowing exactly what your money is doing," says Adam Verwey from Australian Ethical Investment. This means you need to look at the complete portfolio of companies that the investment fund is investing in, not just the top 10. As Mr Verwey points out: "If your investment fund can't provide you with a full portfolio listing, then the chances of there being greenwash would be high."

AMP Capital is financially the largest responsible investment manager in Australia. AMP Capital's Sustainable Share fund uses the ESG approach, along with their in-house research team. They have a list of 200 indicators they use to judge a company's ESG performance before they undertake the financial analysis. According to AMP Capital's Senior Investment Specialist Angus Dennis, there is a strong link between the financial success of a company and their ESG performance. When asked about AMP's inclusion of BHP Billiton in its sustainable fund Mr Dennis explains that although they use negative screens, if a company has less than 10% invested in the 'unethical' business they will include it. He makes the point that 10% is considered a "strategic material exposure" and AMP is attempting to get a practical balance between having a diversified portfolio and sustainability. As a company approaches the 10% mark they tend to drop it from their investment portfolio, so as a result most of the 'unethical' components are less than 5%.

Why invest ethically?

Besides just making you feel good, ethical investment can make a difference. By buying shares in 'ethical' companies you are allocating capital, and start-up capital, towards companies that have a positive impact on society and the environment. This allows those companies to expand and gives new companies a chance to succeed. Take for example the renewable sector. The more that people invest in this sector the more chance there is the sector will start to get a foothold in the energy world.

Michael Walsh from Hunter Hall likens the importance of ethical investment to the start up of the internet. If people had not supported companies like Google, we would not have the internet we have today. Industries like renewable energy need capital to develop and become mainstream. If we want a more sustainable world we need to invest in companies that are sustainable.

You can also direct money away from companies that have a poor environmental or social record. This can make capital raising difficult. A good example of this is the recent problems Gunns had raising capital for their new pulp mill in Tasmania as a result of a high profile publicity campaign by environmental groups.

As a shareholder, you often have voting rights which can be used to pressure companies to improve their ESG performance or raise the awareness of issues. According to RIAA's report, while it is still unusual in Australia, the US has an increasing level of shareholder support for resolutions on environmental and social issues. In Australia in the last five years there have been no specific shareholder resolutions that related to an issue of social or environmental responsibility—we appear to be more worried about what the CEO is being paid and who is on the board. By contrast, in the US the average level of shareholder support for environmental and social issues increased from 9.8% of shareholders voting to 15.4% in 2007.

Teaching and paying local farmers to plant local hardwoods for harvest instead of felling trees in the Amazon is the focus of a number of ethical investment projects, such as the Cochabamba Project (www.cochabamba.coop).

If we want a more sustainable world we need to invest in companies that are sustainable...

Australian Ethical Investment is attempting to change this woeful statistic, while also increasing the sustainability performance of Australian companies, by setting up the Climate Advocacy Fund. This fund will actively engage with companies, through activities such as resolutions at shareholder meetings relating to climate change, and how those companies intend to address the risks to help ensure sustainable operations. You need the support of at least 100 shareholders to raise a resolution, and The Climate Advocacy Fund has made arrangements with 100 people willing to support the aims of the fund.

Show us the money

Do ethical investments make as much money as standard investments or do you have to suffer for your values? A recent article in *The Sunday Age* reported that ethical investment managed funds returned 47% last year, which was 7% more than mainstream share funds. Over the longer term results are less conclusive, but you have to take into account that 10 years ago there were only two ethical investment funds in Australia. It is obviously fund dependent, and some ethical funds invest in a higher percentage of smaller companies, which can be more volatile than investing in the established larger companies. The 'deeper green' funds also exclude sectors, so in Australia—which has a very mining-heavy stock exchange—this can mean you miss out on gains from particular sectors, for example a mining boom.

Looking to the future there is an argument that says ethical screening of companies reduces risk and is likely to be a growth sector. If you have a sustainable business, both financially and environmentally, then you will be better placed to survive the new 'carbon economy'.

But, as they cheerfully seem to say in the investment arena, past results are no guarantee of future performance! ✻

Methodologies used by funds

Negative screening avoids investing in companies that operate in certain industries, for example uranium mining, tobacco and the coal industry. **Positive screening** involves investing only in those companies whose goods and services have a positive impact on society and the environment, for example renewable energy, sustainable property and sustainable agriculture.

Research is a general term that means the investment fund conducts research on companies' environmental, social and governance **(ESG)** performance and any associated risks or issues that could possibly impact on investment returns. This practice supports the idea that those companies that maximise their ESG performance are more likely to provide superior investment returns. '**Best of sector'** means the investment funds are open to investing in any sector, but they select the companies with the best ESG practices to invest in. The idea is that this should encourage other companies within the sector to improve their ESG performance.

Kate Allsopp is a former CEO of the Alternative Technology Association.

Further information

For more information on ethical investment read the RIAA report *Responsible Investment 2009*, found online. Besides covering ethical investment it also lists ethical investment companies, ESG indices and details on the Cleantech sector. Go to the RIAA website at www.responsibleinvestment.org

Other resources

www.hunterhall.com.au
www.australianethical.com.au
www.ampcapital.com.au
www.climateadvocacyfund.com.au
www.ethicalinvestments.co.uk

This article should not be taken as financial advice.

Mum, what was the Great Barrier Reef like?

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Mapping a sustainable future

Sustainability pioneers with a 'can do' attitude, the Alternative Technology Association (publishers of ReNew) has helped thousands of households lighten their footprint on the planet.

One evening earlier this year a group of long-term ATA members gathered for a drink or two, facing a wall of paper. Key moments in the ATA's 30 year history were in turn documented on this wall, helping to start the timeline you see on the following pages.

While everyone was there to map-out key dates and events in ATA's history since 1980, it was the pre-ATA period that was discussed first. After all, what happened in the lead up to an event can be as interesting as the event itself. A flurry of activity from the mid 1970s actually planted the seed for the Alternative Technology Association, with people spurred on by an already apparent over reliance on fossil fuels and a desire to make other renewable energy options a reality.

Some present on the night talked about the year 1973, significant for the oil crisis when the Organisation of Arab Petroleum Exporting Countries declared an oil embargo on the United States, causing shortages around the world. In 1976 the Fox Uranium Inquiry cast a critical eye over uranium mining in Australia, and at the same time Friends of the Earth was in full swing, campaigning against nuclear power and the use of uranium, but also looking for a positive alternative.

With a desire to make other renewable energy options a reality, a meeting was called in 1976 to discuss what this positive alternative could be. Two hundred people turned up instead of the anticipated 40, with people out on the street waiting. The Alternative Technology Cooperative (AT-Coop) was formed and work began on newsletters, radio shows, displays and a retail outlet, all to promote sustainable alternatives.

By 1979 the AT-Coop had stopped holding meetings, but in 1980 got a second wind and reformed, this time as the Alternative Technology Association that we all know today. By June 1980 the ATA published the first issue of *Soft Technology,* now *ReNew,* because they wanted to keep regional members who couldn't attend meetings up to date.

Without the seed being planted in the 1970s, the next stage, the formation of the Alternative Technology Association, would not have happened. It makes you wonder what might develop from our actions today, be it forming local climate change action groups or internet campaigns to promote sustainability. Years on, those groups might still be making a difference like the ATA.

Thanks to those who helped map the timeline that evening including Michael O'Connell, Michael Harris, Steve Ingrouille, Rachel Ollivier, Kulja Coulston, Libby Anthony, Colin Goodwin, Donna, Luckman, Ian Porter, Alan Pears, Noel Jeffery, Wendy Clarke, Chris Moss, Damien Moyse, Anton Vikstrom and Craig Memery.

Andrew Blair's account of ATA's early days, written for the 20th anniversary in 2000, can be read at *ReNew's* new website www.renew.org.au

Sustainability Pioneers

The Alternative Technology Association's first 30 years

Note: A more detailed timeline can be found at www.renew.org.au
We welcome amendments and additions to the timeline. Please email renew@ata.org.au with updates

subgreen design
creative sustainable graphic design

Thanks to subgreen design for timeline design
www.subgreendesign.com.au

1970 - 1979

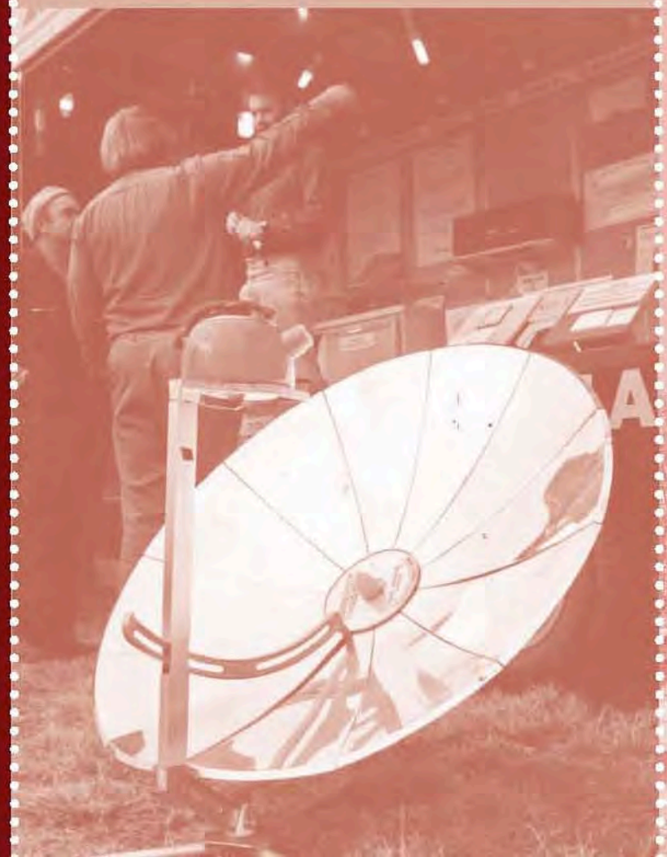
Pre-ATA: The formative years and the AT Cooperative

1976
- Friends of the Earth anti-uranium campaign was looking for a pro-active alternative
- First meeting held in Carlton. Alternative Technology Cooperative was born

1976 to 1979
- Alternative Technology Cooperative produces newsletters, radio programs on 3CR, holds monthly meetings in a church hall in Carlton and establishes workshop in Collingwood

1978
- Alternative Technology expo held at Ringwood
- Going Solar established
- Alternative Technology Cooperative slowing down

1979
- Alternative Technology Cooperative ceases operating



1980 - 1985

Alternative Technology Association history from 1980

1980
- Alternative Technology Cooperative restarts with the name changed to Alternative Technology Association and a new structure introduced
- First *Sun* members newsletter published
- First issue of *Soft Technology* magazine published

Early 1980s
- ATA members start taking displays to festivals and shows

1983
- ATA members start building the solar workshop at CERES with the help of a $3000 grant. Total build costs $10,000 thanks to volunteer labour and the help of Collingwood TAFE stonemason students
- ATA starts visiting solar-powered houses

1984
- ATA produces its first book *Alternative Technology Australia* with the best content from the first 12 issues of *Soft Technology*. Print run of 2500 copies
- ATA starts to run courses on retrofitting, alternative building techniques, solar electric systems, solar greenhouses, DIY wind power and solar hot water. Information kits are produced, some of which later evolve into booklets
- ATA constitution changed to allow for branches

1986 - 1990

Mid 1980s
- Alan Hutchinson builds ATA's first computer

1986
- Solar workshop finished
- ATA submission to the MREC inquiry into electricity generation and correct insulation regulations. Many recommendations appeared in the final MREC report and helped drive policy including 1991 insulation regulations

1986 to 1989
- Work begins on an early version of the solar shuttle

1987
- ATA receives a $3000 grant to produce the first solar trailer
- ATA employs its first staff member to do part time membership admin
- ATA moves offices to the new Friends of the Earth Centre in Brunswick St, Fitzroy
- Wind generator constructed by SECV at Breamlea, Victoria (see ATA ownership 1995)
- First prototype of a model solar car made

1988
- ATA policy framework for Victorian Parliament Natural Resources and Environment Committee on Energy Supply Options for Victoria

1989
- ATA moves to Ross House
- First energy display trailer up and running and tours Australia twice
- ATA becomes a member of the Community Energy Network, providing policy input to the Federal Government on an ongoing basis
- ATA produces *The Renewable Solution* which sets out a renewable energy path for Victoria. The booklet was produced for the Bill Keepin tour of Australia on the greenhouse effect. The booklet was used for ATA's submission to the state and federal government inquiries on the subject

1990
- ATA produces *Build Your Own Green Technology* book with the best articles from *Soft Technology* magazine

1991 - 1995

1991
- First full colour cover on *Soft Technology* magazine
- ATA membership hits 1000
- ATA submission to the Senate Standing Committee on Industry, Science and Technology on *Reducing the Impact of the Greenhouse Effect*. Also submissions to the Victorian Government policy paper on *Renewable Energy and Energy Conservation* the Renewable Energy Authority (now Sustainability Victoria) five year plan and SECV *Power Grid Strategic Plan*

1992
- Renewable Energy Trust established
- *Soft Technology* distributed to newsagents for the first time
- The EnergyMobile is constructed and starts touring Australia. This was ATA's biggest ever display vehicle. It weighed 7 tonnes, was 10 metres long with numerous energy displays and working solar and wind systems. It had its own bedroom, kitchen and even a washing machine
- ATA goes national and starts establishing interstate branches with the first established in Sydney
- Noel Jeffery's first Treasures from Trash column in *Soft Technology*

1993
- ATA Canberra branch formed

1994
- ATA Brisbane branch formed
- Solar Shuttle built and starts touring the country

1995
- ATA purchases Breamlea wind generator from SECV
- ATA Coffs Harbour branch formed
- ATA launches website
- Planning for ATA magazine relaunch commences

mid 1990s
- ATA/ANZES merger discussions

1996 - 2000

1996
- Breamlea wind generator sold to ATA member Michael Gunter due to cash flow crisis
- *Soft Technology* renamed *ReNew: Technology for a Sustainable Future*
- ATA Cairns branch formed
- ATA Energymobile retired

1997
- Alan Pears first column for *ReNew* magazine
- ATA recycle factory built
- ATA's Hot 100 project to install 100 solar water heaters launched

1998
- First face-to-face meeting of all the interstate ATA branches
- ATA moves offices to the Solar Workshop at CERES

1999
- ATA/Greenpeace solar shower demonstration, held around the time of the Victorian gas crisis
- ATA biodiesel production commences

late 1990s
- Solar Shuttle sent to schools
- Second edition of Stuart McQuire's *Water Not Down the Drain* released

2000
- ATA New Zealand Northland branch formed
- Solar panels installed on ATA solar workshop
- Perth branch formed

2001 - 2005

2002
- New ATA logo created
- Adelaide branch formed
- ATA Cool Communities Project
- Water tank to flush the loos installed at solar workshop
- ATA participated in the inaugural Solar House Day
- ATA's Power Bill Saver Service launched

2003
- ATA International Projects Groups formed with first projects in East Timor
- ATA Greenhouse Action project
- ATA Energy TaskForce Project
- Lance Turner identifies LEDs as lighting of the future in *ReNew* magazine
- ATA participated in the Sustainable Housing seminar series held across Australia
- Commenced an Australian-first trial of different types of greywater systems to test the usability of the technology from a user and environmental perspective

2004
- ATA Energy Smart Home Rating project
- Launched *Wind Power: Plan your own wind power system* booklet
- Submitted a range of submissions to regulatory reviews on demand management, energy efficiency and distributed renewable energy.
- Launched *Reaching for the Stars—An Assessment of the Impacts of an Assumed Extension to Victoria's Five-Star Energy Rating for Residential Buildings* report

2005
- *Sanctuary: sustainable living with style* magazine launched
- Released research report *Impediments to Grid Connection of Solar Photovoltaic: the consumer experience.*

2006 - 2009

2006
- Sunraysia branch formed
- Advocated for consistent national and state policies that encourage greater use of rainwater, greywater and stormwater
- Conducted greywater seminar series
- Advocated the benefits of small-scale embedded generation technologies such as grid-connect solar power

2007
- Sydney branch becomes two: Sydney West and Sydney Central
- ATA International Projects Group Village Lighting Scheme launched in East Timor
- Updated edition of *Water Not Down the Drain* book released
- Conducted stage 1 of research into the viability of domestic wind turbines in urban areas
- Campaigned for the introduction of feed-in tariffs to encourage the installation of small-scale renewable energy
- Celebrated the 100th issue of *ReNew* magazine
- *Sanctuary* magazine expanded from annual to biannual

2008
- Blue Mountains/Central West branch formed
- Soil analysis research conducted to investigate the potential short and long term implications of greywater use
- ATA played an active role in the design of state-based energy efficiency schemes in South Australia and Victoria
- ATA made various submissions on energy market reform and energy efficient appliances
- Attended over 50 home shows, environmental expos and community events across Australia
- ATA is the sole representative from the environment sector on the National Water Reform Roundtable

2009
- Warkworth New Zealand branch formed
- ATA's receives biggest grant for International Projects Group
- *Sanctuary* magazine expanded from biannual to quarterly
- Conducted research into bathroom products and greywater
- Stage 2 of research into the viability of urban wind completed
- Advocated for changes in the design of the Renewable Energy Target and the Carbon Pollution Reduction Scheme bills
- Active member of the national steering committee to develop and review the functionality of smart meters
- *Sanctuary* magazine website launched
- ATA's *Renters Guide to Sustainable Living* booklet launched

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Solar lift in a strawbale home

Designing a lift for a remote area power supply was easy with the right kind of planning, write Marg Locarnini and Marg Bailey.

Having purchased our dream block of land—65 acres of almost untouched bush in Gippsland—we thought we had plenty of time to think about building the home of our dreams as a retirement project. However, as John Lennon said, 'life is what happens while you're busy making other plans'. So, a few dramatic life changes later, we reviewed our timeline; we sold the city house and moved to the block to get on with it.

We planned and researched our building options for four years by attending workshops and courses as time and money allowed. Given that the block is at an altitude of about 640 metres and on the weather path up to nearby Mt Baw Baw (a popular ski destination in Victoria), we knew we needed to prepare for hot summers and cold winters. The block is very steep and fully treed with messmate, mountain ash, blackwood wattle and tree ferns.

We decided to build with strawbale because it offered many advantages such as insulation and is easy for two women builders to work with. We proceeded to divide the responsibilities. Marg L got power, water and poo management; and Marg B ended up with strawbale and the building side of things.

Reasons for a lift

Given the slope of the block, we wanted to minimise the footprint of the slab, but maximise space and the view. A two-storey house would achieve these objectives. We have both worked in aged care and have older friends and family in our circle. Given that the top storey of the house has the croissant and coffee deck (east end for breakfast) and the gin and tonic deck (for western sunsets), we did not want anyone to miss out on these treats. We also want to stay in the house as long as possible, and arthritis or accidents could make using stairs a challenge.

What's behind the door? It's a solar-powered lift of course!

This led us to install a lift in the house, and with the property off-grid, the lift is powered entirely by solar electricity. We had requested our draftsman to make the downstairs wheelchair-accessible, which was partly achieved, but not as fully as we had hoped. However, our request for a lift was met with skepticism and disbelief by many people.

Living off the power grid (and off the planet in some people's opinion) presented some difficulties. We researched the power needs of lifts and chose a suitable commercial one. Just as we were about to start negotiations with that company, they switched all their lifts to three-phase power. That was the end of that. We did eventually find a company that was happy to work with us and develop the idea. Ron Lewis at Master Lifts in Port Melbourne did a site inspection and saw only the possibilities.

We all embarked on a journey of innovation and exploration. Ron worked with our concreter as a small lift-well had to be incorporated into the slab at the time of pouring—150 mm in total depth, with specific width/length dimensions. Ron also worked with Geoff and Simone at Sustainable Impact in Yarragon to design a solar system to power the unit.

Our 2.64kW RAPS system has a Selectronic PS1 6/48 sinewave inverter, with eight 6 volt batteries and 16 panels, which is ample to operate the unit and all our other electricity requirements. The property has a back-up generator for the months when there is less sunshine.

The lift runs off a RAPS system. The main consideration was getting an inverter that could support the power surge requirements of the lift.

The lift's features

The lift is called a Contessa 1000. It has fully automatic operation with 240 volt single phase power. It has its own aluminium shaft so it takes up minimal space, allowing for easy installation into a new building and no requirements for a separate machine room. A small cabinet is all that's needed. There's an emergency battery in the event of household power failure plus excellent safety features; it cannot accidentally fall, it can only be driven down.

The lift also has VVVF controls. VVVF stands for Variable Voltage Variable Frequency and this unit controls the drive characteristics of the lift, providing soft start and soft stop with a higher running speed between floors. It's very comfortable and travels at around 0.15 metres per second.

Installing the lift

Prior to installing the lift the strawbales had to be up to the second storey roof height and compressed. These were trimmed and the lift well lined with plywood to ensure no straw could get into the workings and that the lift well had the exact dimensions required.

Removable trusses had to be installed into the roof cavity to allow them to be moved on the day of installation when the plumber also had to remove some of the previously completed roof directly above the lift well.

When the day finally dawned, everything was in place; the preparations for ensuring a safe process were meticulous. The semi-trailer arrived with the lift, which comes with its own shaft. We had a dogger to assist the crane operator and he was very busy with the whistle. After two hours of setting up, the actual task of raising the lift off the truck, getting it vertical, lifting it above our roof and lining it up, positioning it perfectly above the lift well and easing it in took all of six and a half minutes. It was nerve-wracking and enthralling at the same time.

A lift company staff member was in the lift well to gently guide it to its correct alignment and bolt it into place. The power box and wiring were installed in the spare bedroom and a telephone was installed in the lift because it is a legal requirement.

Given that we are still waiting for the stairs to be built the lift has been very useful, not just for human cargo but for heavy items such as tubs of render, furniture and things the builders need. On low-power days, we use the lift a few times only and rely on a ladder for the rest of our trips. On summer days when batteries are full there is no limit.

The lift company do annual maintenance checks. It has been in for 16 months and we have not had any problems at all.

Is it worth it?

The question on many people's minds might be 'what is the bottom line?' If we need to go into a hostel because we require aged care, ingoing fees can be up to $400,000 or more. That is a lot of money and would require the sale of our home. So, for about 10% of that, we have a lift that just may mean we can stay here a whole lot longer and buy in the support we need.

Some people ask why we did not opt for the stair lifters that run along the edge of the staircase. These often do not take wheelchairs and many people don't feel secure on them. They also require larger amounts of power, especially at start-up, which may overload our solar system. They are also not that much cheaper, so we think it is $40,000 extremely well spent. *

Sturdy strawbale construction.

The installers' experience

SOLAR installers are not necessarily used to powering lifts, and lift companies might not be used to operating their products on solar power. So what did the other parties involved in this project make of the two Marg's solar powered lift?

Simone at Sustainable Impact in Yarragon looks back at the solar lift installation with pure delight, exclaiming how smoothly it all went.

"We integrated the lift within the normal RAPS system. We asked all the regular questions about daily power use to determine the size of the system, such as 'how often do you use the dishwasher?', and in this case, 'how many times will you be using the lift each day?'

"The lift's start up consumption is quite a high draw, so it was a challenge to find an inverter with a really strong output to match this draw. That was the only hiccup. Everything else was normal," says Simone.

Ron Lewis from Master Lifts says that this lift installation was made easy by the knowledgeable clients. "I found the two Margs to be absolutely fastidious about researching every aspect of their house construction, and great emphasis was placed on the 'heart' of the house, the solar power generation and storage.

"Having such well versed and competent builders meant that our contribution to the project was easy. All the right questions were asked by the two Margs, so the relevant problem areas were covered in advance as a consequence."

The house is two storeys to make best use of the views, but a lift was installed so the residents could live comfortably in the home in old age.

As far as the lift goes, there were savings to be made because it was manufactured within its own shaft so structural load-bearing walls such as precast concrete or concrete-filled blockwork were not needed. "It is simply a case of the customer supplying a timber stud wall on one side of the lift shaft, then fixing thick bracing ply to the inside face of the studs. The lift is then fixed to that wall, so it is plumb, square and true; the large majority of the lift's load is supported by the house slab, the wall fixing being solely for the lesser purpose of lift stabilisation.

"Another customer saving is the lift's compact size, especially speaking in terms of its vertical dimensions; costly roof modifications and/or extensive slab engineering is usually able to be avoided."

Contacts:
Master Lifts
(03)9645 6119
Sustainable Impact
(03) 5633 2778

Micro-hydro buyers guide

If you need a reliable power supply then a micro hydro turbine can be a good source of clean electricity, writes Lance Turner.

Falling water can be used to generate either mechanical or electrical energy. Water is a reliable, renewable and pollution free energy source, at least in areas that haven't suffered reduced rainfall in the last decade.

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

Why buy a micro-hydro?

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

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

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

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

Turbine types and siting

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

The Platypus Power range is available in DC battery charging and AC output designs.

Flow rate (in litres per second of water flowing through the unit) and head (the vertical height that the water falls) are the two major factors governing the amount of power available from a site. Several dif-

ferent types of turbine have been developed to cope with a variety of situations, such as a high head with a low flow rate, or a low head with a high flow rate.

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

Impulse turbines

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

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

The Pelton wheel is probably the best known and most commonly used of the impulse turbines. The Turgo is very similar, but has a slightly higher efficiency. Both types run at relatively high speeds, allowing them to be directly coupled to a high-speed generator, but Turgos will spin at a greater rpm for the same size jet diameter.

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

The Crossflow turbine is somewhat different. It uses a cylindrical type rotor through which the water passes twice. It can be used with virtually any head (1 to 200 metres). These systems are good for water pumping as well as for power generation.

Reaction turbines

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

The new PowerSpout units from EcoInnovation use SmartDrive washing machine motors as very efficient generators.

The Aquair generator is a novel form of reaction turbine, designed to be fully submerged in a water flow to generate electricity.

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

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

AC or DC?

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

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

If you have a good flow of water all year round, an AC turbine may be the best option. These produce power at 240 volts AC, just like mains power, so you can draw power from the turbine directly without the need for batteries, inverters and the like.

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

Buyers guide

Power control

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

As an example, if you have a 1kW turbine and are using 200 watts from it, then the other 800 watts will be fed into the load dump. If your load increases to 650 watts, then the excess 350 watts will be dumped. This system can be achieved in several ways, but one method is to switch in load dump elements of varying sizes in the right combinations to form a load dump of the correct size.

Civil works

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

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

Buying a turbine

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

Once you have these details worked out, you can then start thinking about the type of turbine you want. The table at the end of this article will help you decide which turbine is most suitable for your requirements. If more than one turbine seems ideal, then look at other factors, including price and maintenance requirements.

Other turbines

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

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

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

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

Table is on page 64.

Search the *ReNew* archive at www.renew.org.au for DIY waterwheel articles.

Calculating available power

So just how much power can you expect to get from your creek or stream, and how do you calculate the size of turbine required?

The total available power (in watts) from a turbine running in a particular flow of water can be determined by the calculation:

$P = n \cdot g \cdot h \cdot q$

where:

P = power (watts)

n = turbine efficiency (as a fraction: 60% is 0.6)

g = acceleration due to gravity (9.81m/s^2)

h = head (in metres) ⋆

q = flow rate (in litres per second)

For example, a turbine with a 50% turbine efficiency running at a flow rate of 20 litres per second on a 10 metre head would have a theoretical turbine output of 981 watts. This is not the electrical output, which would be less, depending on the efficiency of the alternator/generator.

⋆ For still water, this is the difference in the height between the water inlet and turbine outlet. Flowing water has an additional component added to account for the kinetic energy of the flow. The total head equals the pressure head plus velocity head. However, as flow rate varies it is often best to ignore this component when doing calculations. You must also consider frictional losses in the pipe—too small a pipe means a reduction in the effective head. Frictional loss tables are available online.

Micro-hydro at its best

This freezer/ice-making cold storage room is powered from a 40kW micro-hydro turbine in the Solomon Islands.

Earlier this year drums, bells and cheering echoed through Masupa Village in the Solomon Islands as the new micro-hydroelectric turbine started up, shining light on the turbine house and foreshores.

Pelena Energy was commissioned to design and construct the project, which cost AU$120,000 and was fully funded by a Rural Electrification Development fund. Over 13 days over 200 community members constructed a 12-metre-wide concrete weir, a concrete settling tank and forebay, finalised the digging of a trench, and joined and buried over 300 metres of 200mm diameter PVC pressure pipe for the penstock. They also constructed the turbine house, installed the turbine and generator with all electrical controls and constructed and assembled a freezer room to produce ice and store fish ready for market. Preliminary training to technicians in operation and maintenance was also provided.

Most of the new turbine's electricity will go towards operating the freezer room, with the community's first esky load of fish delivered to Honiara on February 11. The next stage of the project is to construct a transmission line to the village to provide lighting and help improve income opportunities for the Masupa community.

The A'ero Freezer Room Trust Committee was formed to manage the power station and freezer. The trust includes members of the landholding tribe that play host to the facility. This project empowers the rural community to manage their own resources and boost economic activities through fishing, in turn opening up job creation within the community.

Videos of the construction can be found at www.youtube.com/profile?user=pelenaenergy

Top: Inside the turbine house; Left: The cold room helps the community with the preservation of food.

Brand (Made in)	Model	Rotor type	Rotor material	Voltage	Power	Head range (metres)	Flow range (litres/sec)	Generator type	Regulation	Warranty (years)	RRP Inc GST ($)	Comments
Aquair (United Kingdom) Energy Matters ph:1300 727 151 www.energymatters.com.au	Aquair UW	Reaction	Ductile aluminium	12, 24, 48VDC	100W	NA	Up to 12 knots (6m/s) flow speed	Permanent magnet	NA	2	$1,780	Immersion turbine suitable for medium to fast flowing streams and rivers.
Aqatek (New Zealand) Electric Systems Ltd ph:(0274) 437 007 bjhowell@xtra.co.nz www.electricsystems.co.nz	Aqatek 1000	Crossflow	Stainless steel	12, 24, 48VDC	Up to 1kVA	2.5 to 90	0.2 to 3.5	Permanent magnet	Shunt	3	NZ$1,850 inc GST	Requires charge control system, typically a load diversion system costing $600 to $800 incl GST depending on site specifications.
Energy Systems & Design (Canada) Alternative Power NZ Ltd (03) 547 6397 altpower@xtra.co.nz	Stream Engine	Turgo	Bronze	12, 24, 48, 96VDC	Up to 1000W	3 to 150	0.7 to 9.5	3-phase brushless	Load dump regulation	1	NZ$5,500 plus GST and freight	-
	Low Head Model	Propellor turbine with draft tube	Synthetic			0.3 to 3.00	20 to 63				NZ$6,300 plus GST and freight	-
Mainland (New Zealand) Alternative Power NZ Ltd (03) 547 6397 altpower@xtra.co.nz	Mainland SW series	Turgo	Stainless steel	12, 24, 48, 96VDC	Up to 1000W	5 to 60	Up to 20	3-phase brushless	Load dump regulation	2	NZ$4,500 plus GST and freight	-
PowerPal (Canada) Water Recycle Group ph:(02) 6296 1933 sales@waterrecycle.com.au www.waterrecycle.com.au	Water Recycle Group sells the PowerPal range of turbines, from 200 watt to 50kW. Unfortunately, they did not supply information for the guide table.											
PowerSpout (New Zealand) EcoInnovation Limited enquiry@ecoinnovation.co.nz www.powerspout.com	BE (Battery Enabled)	Pelton	Nylon GF30	12/24/36/48/110VDC or wild AC and custom voltages to order	Up to 1.2kW. Can be stacked up to 10kW. Use online calculator	3-100	0.1 to 8	3-phase brushless PMG adjustable	External battery regulation extra	3 - subject to service schedule	US$1,299	Includes freight to all global destinations. Excludes import duty, GST, VAT etc. Heads up to 120m and turbines to 1500W available to order. All manuals online. Discounts for stacked turbines.
	ME (Mppt regulator Enabled)			90 to 120 DC MPPT regulator delivers 12/24/36/48 DC to batteries			0.5 to 8		Internal 120VDC electronics and 1.5kW dump load supplied. MPPT regulator extra		US$1,798	
	GE (Grid Enabled)			350 to 400VDC					Internal 400VDC electronics and 1.5kW dump load supplied. Grid tied inverter extra		US$1,798	
	HE (High voltage Enabled)			300 to 500 wild AC					Transformer pack for 12/24/48VDC battery charging supplied. External battery regulation extra		US$1,798	
	DE (Dealer Enabled)			Sample, not a working unit	NA	NA	NA		NA	NA	US$400	Includes freight to all global destinations. Excludes import duty, GST, VAT etc. Dealer visual sample only, non-working model.
	EE (Education Enabled)			12VDC	Up to 50W	30-50m	0.1 to 0.5		None needed	3	US$999	Includes freight to all global destinations. Excludes import duty, GST, VAT etc. Education version that drives a 12VDC light for use on a domestic tap. Education providers only.
Pelena (Australia) Pelena Energy ph:(02) 6657 1720 www.pelena.com.au	Crossflow Single Nozzle	Crossflow	Stainless steel	Depending on generator type. Typically 230/400V 50Hz	0 to 85kW	8 to 50	20 to 232	Brushless synchronous alternators or induction generators (for grid connects over 10kW. Option for DC generation.	Pelena Electronic Load Control for standalone units. Customer specific PLC control for grid connected induction generators.	3 for turbine, 1 for generators.	POA, with the smallest packaged units starting at $46,000.	Stainless steel is the main material of construction. These turbines have been designed primarily to service a range of heads, flow rates and required power outputs to maximise commonality of parts, especially spare parts like bearings, seals, and belts (where used).
	Crossflow Two Nozzle				0 to 131kW	8 to 42	20 to 426					
	Crossflow Three Nozzle				0 to 137kW	8 to 33	20 to 566					
	Crossflow Four Nozzle				0 to 74kW	8 to 18	20 to 557					
	Pelton Single Nozzle	Pelton	Stainless steel or combination of stainless shaft and CI buckets		0 to 150kW	25 to 140	10 to 137					
	Pelton Twin Nozzle				0 to 250kW		10 to 274					
Platypus Power (Australia) Ph:(07) 4055 8057 plapower@netc.net.au www.platypuspower.com.au	PM1000	Hybrid impulse	Stainless steel	12, 24, 48	0.75kW	8 to 100	0.5 to 15	Permanent magnet	GVX 25	2	$5,860	
	U3000			12, 24, 48, 110	1kW	4 to 50	1 to 30		GVX 25		$6,490	Ideal for long transmission.
	Q2/150			240	1.8kW	20 to 80	3 to 12	Induction	SG104		$6,988	
	Q3/150			240	2.3kW	20 to 90	3 to 15		SG104		$7,560	
	Q4/150			240	3.2kW	20 to 90	5 to 45		SG104		$8,378	
	PP5/150			240	5kW	25 to 110	7 to 48		SG104		$9,355	
	PP7/150			240	7kW	25 to 110	7 to 55		SG104		$12,760	
	PP10/200			240	10kW	40 to 110	16 to 60		SG104		$13,840	
Stream Engine (Canada) Rainbow Power Company Ph:(02) 6689 1430 info@rpc.com.au www.rpc.com.au	Stream Engine	Turgo	Bronze	12, 24, 48	1.9kW	5 to 150	0.5 to 9	Permanent magnet	Extermal load dump	2	$3,900	-
Tyco Tamar (Australia) Tyco Tamar ph:(03) 6394 3132 tamar@tamar.com.au www.tamar.com.au	Tyco Tamar no longer manufacture household micro-hydro units. They now manufacture mainly for utilities and companies with a need for hydro power between 10kW and 5MW. Each system is designed and manufactured to each client's need.											
Walsh River Micro-Hydro (Australia) Planetary Power ph:(07) 4096 2420 info@planetarypower.com.au www.planetarypower.com.au	LH6-180	Banki-crossflow	All welded mild steel	DC battery charging, switch selectable from 12V to 108V	25W to 1.6kW depending on site	0.8 to 8	6 to 18 @ 1m head, 9 to 32 @ 3m head, 14 to 52 @ 8m head	Baldor CDP series DC generator	Linear series regulation using AERL Hydromax controller	2	$3,500 to $4,900 depending on configuration	Developed to provide economical and reliable micro-hydro power for very low head sites.
	LH6-300				40W to 600W depending on site	0.8 to 3	10 to 31 @ 1m head, 14 to 43 @ 2m head, 16 to 53 @ 3m head					


FACT #5
THE MOST COMFORTABLE THING IN THIS PICTURE ISN'T THE COUCH
And it's not the rug or the table. In fact, it's the windows. Did you know that by choosing the right performance windows you can keep your house cooler in summer and warmer in winter without sacrificing energy efficiency?
For all the facts you need to know about windows visit SeeBeyondWindows.com/renew
SeeBeyond is a trade mark of CSR Building Products Limited. DISEGNO VIR2845R
DO YOU REALLY KNOW WHAT WINDOWS CAN DO?
SeeBeyond
SeeBeyondWindows.com

The national picture

Business leaders need to lead the way when it comes to action on climate change. Alan Pears looks inside the mind of those at the top to see what's holding them back.

THERE HAS been a lot of discussion about the motives of the climate denialists. But the problem is much worse than just dealing with denialists. The very fabric of our society drives business leaders to block action.

If I was CEO of a greenhouse intensive business...

What is going through the mind of a typical CEO of a large, multi-national greenhouse intensive business that confronts the possibility of stronger climate policy? Here is my attempt to enter the mind of one.

"First, I need to maintain short term profits, even if it is at the expense of future success of the business. I am two years into my five-year contract: I need to look good in 2013. Also, my shareholders discount future benefits heavily, and the value of the business as estimated by many financial advisers is linked to a multiple of its annual profits. So not many people are particularly interested in the long term.

"Second, I need to outsmart my business competitors. So, even though I accept climate change is real and I am driving a strong strategy to cut emissions and position my business for success in a low carbon economy, I need to keep this very secret. Indeed, if I 'accidentally' let it slip out within business circles that I am a climate sceptic, I oppose early action, and we're not doing much to prepare my business for a low carbon future, this may trick my competitors into doing less. So I will gain long-term advantage over them.

"Third, the business has a lot of capital sunk in to existing assets. Running them for longer without having to invest in major upgrades to cut emissions is a high profit strategy in the short term.

"Fourth, the louder I scream, the more likely a delay in the introduction of a carbon price, and the bigger the handouts I'm likely to get from the government to shut me up. These deliver me windfall profits that will help me to position my business as a winner over the longer term. They will also undermine the position of emerging low emission technologies and business models that compete with me. And delay leaves me the option of 'voluntarily' acting to cut emissions to improve my public image.

"Fifth, if I were to support stronger action on climate change, I would be undermining the electoral prospects of Abbott and the Coalition. The Labor CPRS deal, in the end, was very generous to my business, and the delay they have announced takes a lot of pressure off for the rest of my employment contract. But life would be even easier for me under the Coalition. So, though Labor seem pretty much under control now, I can't afford to support them.

"Even if the Greens get the balance of power in the senate after the election, not much is likely to happen for some time. Labor feels threatened by the potential of the Greens to steal their votes and the pragmatists in Labor would resist toughening their approach under pressure from industry. The Greens would be pushing for much stronger action consistent with what the climate science says needs to be done. Negotiations are likely to be painfully slow.

"So the smart strategy for me is obvious. Visibly support delay on the grounds that early action would destroy the economy. (I really mean *my* business short term profitability and *my* reputation as a successful CEO may suffer a bit, but I can't say that!) Argue for massive assistance packages in any response scheme with the underlying threat that I'll move my business offshore (which I might do anyway, because of the high Australian dollar and labour costs). Quietly fund spoiler groups that oppose climate response. Secretly work hard to develop strategies that will maintain our global (not necessarily Australian) profitability in a low carbon economy. And do a few high profile things that show my company is 'genuinely concerned' about the environment. Problem solved. Too bad for humanity, the economy and the Earth."

To act effectively on climate change, we need mechanisms that ensure business leaders think more long-term and consider the broader public interest. Without such changes, we are doomed to a divisive battle between business leaders who are acting rationally (within their business context) and civil society. The alternative is for socially responsible shareholders and businesses, including financiers, to apply pressure to others to act in the public interest, or for a courageous government with real vision to take on the bluff of big business. We're in real trouble.

Hazelwood pressure

Hazelwood is Australia's most greenhouse intensive large power station and

the Victorian Government is under increasing pressure from the community to do something about it. For example, Environment Victoria has released a study showing how it could be replaced by a mix of other options by 2012. An announcement of some action before the election late this year would certainly help electorally.

The jigsaw is being assembled. First, the contracts for Victoria's aluminium smelters will shift from Hazelwood to Loy Yang from 2014 and 2016. This alone will cut the smelters' emissions (and future carbon costs) by around 20%. The government is keen to build a 'new generation' coal plant, believed to be around 400 megawatts—a quarter of Hazelwood's capacity, with emissions per unit of electricity around 40% lower and 'carbon capture ready'.

Energy efficiency improvement, cogeneration and renewable energy could provide the rest of what's needed, so Hazelwood could be shut down one generating unit at a time over the next few years.

Also, the recent CPRS negotiations have indicated that it might be cheaper for the Federal Government to just buy Hazelwood and manage its closure than to waste billions of dollars on 'assistance'. So both the Federal and Victorian Governments could potentially restore some of their credibility on climate change.

Energy Efficiency Task Force: a 'step change'?

The deadline for submissions to this process has now passed. It will be interesting to look at the submissions and see what the government makes of them. They are available at www.climatechange.gov.au/government/submissions/pm-task-group/paper.aspx.

The bar has been set high: to propose a step change that will make Australia an OECD energy efficiency leader, instead of being a laggard. To do this will involve challenging some powerful interests and deep cultural factors. We can't afford not to succeed.

It's interesting that an advisory group, comprised of key political interest groups, has been set up to provide input to the process. Maybe this is an attempt to avoid the CPRS disaster by negotiating deals to build support during the development process.

Insulation and halogens

The attacks on the insulation program seem to go on forever. I'm still waiting for people to focus attention on the real problem: the fact that fire authorities have known for years that halogens have been causing fires, yet have failed to address the core problem. Why haven't fire, electrical and building authorities solved the safety problem by banning lamps that generate too much heat when covered by insulation? In 2007, fire authorities reported that halogens caused around 40 fires in Melbourne alone, so they've known about the problem for years.

The present approach of blaming the insulation is back to front. Leaving big gaps in the insulation around the lights undermines the effectiveness of the insulation; indeed, it can halve the overall insulation value! In the 21st century we should be able to safely insulate our buildings, and that means authorities must ensure that all electrical equipment is safe when covered by insulation. ✻

Alan Pears is an engineer and educator who has worked in the energy efficiency field for over twenty years. He is Adjunct Professor at RMIT University and is co-director of environmental consultancy Sustainable Solutions.

GreywaterWatch: salt and soil

Salt in soil can sometimes be a problem. The Alternative Technology Association's GreywaterWatch Trial tested the effects of greywater use on soil structure, with a focus on sodicity, writes Anjali Brown.

With the boom in greywater reuse around Australia, fears about the effects of greywater on human health and gardens have been raised, stressed over and dismissed by many. Regulators have produced guidelines to mitigate public health concerns and laundry and bathroom products are popping up with 'greywater safe' labelling. End of story? Not quite…

We are far from completely understanding the effects of greywater reuse on people and the environment. In *ReNew 104* ('Greywater and your soil') and *ReNew 107* ('Soaps, shampoos and soil'), we discussed the outcomes of research undertaken by RMIT University and ATA that found sodium, which can pose challenges for soil structure and health, was common in bathroom products.

How can we test for evidence of sodic soils due to greywater irrigation? There are so many variables in greywater use which make testing a challenge, such as the combination of products used, water quality, water temperature, irrigation frequency, rainfall, soil type, concentration of reactive components and the level of filtration/treatment. The interactions of these variables can affect the likelihood of sodic soils, so ATA's research officer, Michelle Quach, proposed to collect data through field-based monitoring rather than a purely laboratory-based approach as a way of addressing the many variables involved. And who better to get involved in field-based monitoring than ATA members.

Cracked earth is typical of highly sodic conditions.

Testing

Between January and March this year, seven ATA member households con-

Sodicity explained

Maintaining soil structure and health is extremely important. It is key to promoting soil biodiversity, a keystone element in many ecosystems. It is also vital for promoting and ensuring plant health, reducing the impact of run-off on aquatic ecosystems and keeping building foundations stable.

Salts such as sodium chloride are common components of wastewater. We excrete salts into wastewater through sweat and urine and most bathroom and laundry products have high concentrations of salts. Salinated freshwater has long been a problem for wastewater treatment plants, a problem that is now also falling into the hands of greywater users.

Even when greywater and wastewater is treated the salts are not extracted. Salty water draining into soil is therefore also a problem for onsite wastewater systems in non-sewered areas as well as for households with greywater treatment systems.

Soil sodicity challenges

Soil sodicity is a relative of soil salinity. In simple terms, sodium ions attach to clay particles and cause those particles to no longer stick to each other when wet. This causes unstable soils to erode and the soil becomes impermeable to plant roots, nutrients and water.

According to the Australian Academy of Science almost a third of Australian soils could be considered sodic. Soil sodicity causes poor water infiltration, surface crusting, erosion and waterlogging. Sodic soils also carry clay particles into waterways and can contribute to turbidity in rivers and wetlands.

Photo: David Johns

Special purple greywater pipe.

ducted fortnightly soil and water tests as part of ATA's GreywaterWatch trial. The trial covered a broad cross-section of soil types ranging from sandy loams to heavy clays.

Each fortnight the household products used immediately prior to testing were noted, and the pH of the greywater was then tested. In some instances, householders also measured the electrical conductivity of the greywater, which is an indicator of the level of saltiness. Dried soil aggregates collected from greywater-irrigated and non-irrigated areas of the test sites were submerged in greywater and tap water and observed for dispersion and slaking, which are indicators of soil structure stability. The higher the degree of slaking and dispersion, the poorer the soil structure.

Householders were also asked to record evidence of plant health decline, waterlogging and any other observations deemed interesting or relevant. Each household described the design of their greywater reuse system and the regularity with which they irrigated.

Results

The majority of trial results indicated that soil irrigated with greywater was less structurally stable than soil irrigated with mains water.

One interesting result, however, showed that when hair conditioner was used in the bathroom, slaking was less severe than when it was omitted from the greywater. Further testing of this could confirm whether or not this generic type of conditioner is actually beneficial in improving soil structure.

Soils low in clay generally showed little evidence of soil dispersion. The one household that was irrigating on clay soil though found the characteristically low permeability of clay a challenge. This household has been using class A recycled water which contains alarmingly high levels of salt. This salty, or brackish, water might have been impacting on the health of some beans, causing scorched and yellowish leaves and poor growth. This household would benefit from more specific testing of their treated wastewater to determine its sodicity.

Overall, this short trial has shown there is ample evidence that greywater is having an impact on soil health. More than anything, though, it has highlighted the need for further data collection and testing to understand this area of science more clearly.

The next stage

Developing GreywaterWatch further depends on funding. A key element in the design of GreywaterWatch is that participating households and the wider community should benefit from ATA's research by receiving information on best practice greywater reuse and plant, garden and ecosystem protection. Trial members have already received personal feedback on the results of their testing. ATA is keen to develop the project to undertake community monitoring on a much larger scale.

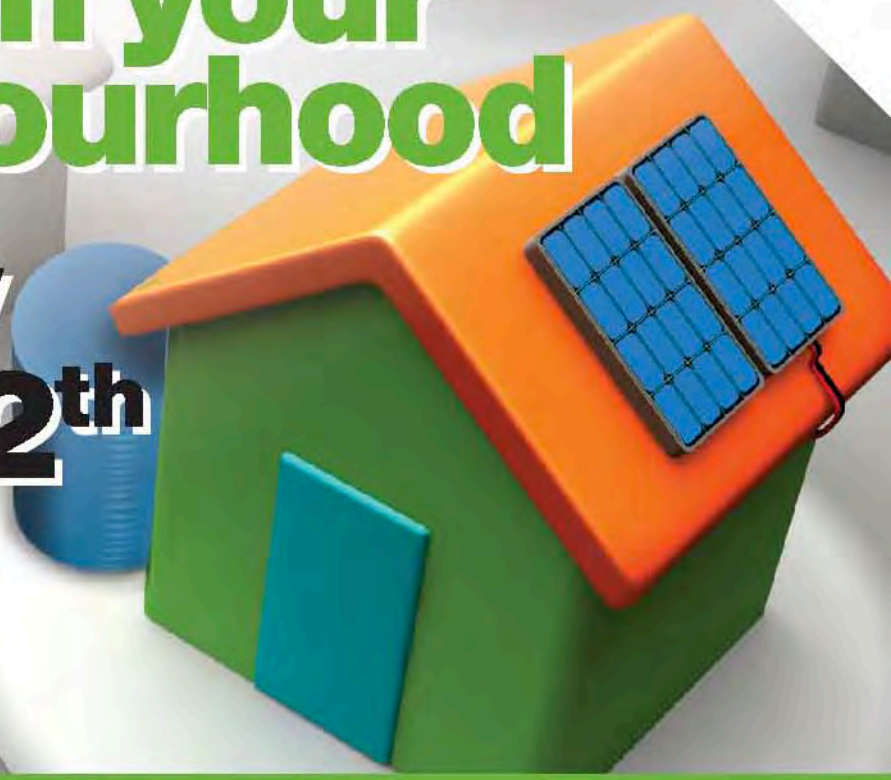
Community monitoring through GreywaterWatch will help researchers gain a better understanding of the effects of sodium and the nature of sodicity in Australian landscapes by helping them focus on key questions to be answered with controlled experiments. It will also empower community members to engage in best practice greywater reuse and help develop mitigation and remediation strategies to combat sodic soils to promote healthy, biodiverse gardens.

One possible long-term outcome is that widespread best practice greywater reuse will play a big role in persuading manufacturers to reduce the levels of sodium found in their products or even to cease using sodium altogether. ✻

Thank you to the trial participants and the many ATA members who put their hands up to be involved.

SUSTAINABLEHOUSEDAY

Visit a Sustainable House in your neighbourhood



Sunday Sept. 12th

sustainablehouseday.com

Sustainable houses throughout Australia will be opening their doors for you to look inside on Sunday 12th September.

These homes showcase the best in green renovations for all types of housing. See the real benefits of a sustainable house up close, ask questions of the owners, and learn from their firsthand experience. You can meet professionals and connect with products and services to apply the ideas you see, to your own home.

Check out the website for house locations and details in your local area – and admission to all houses is free.

Sustainable House Day 2010 is proudly presented by Solar Shop Australia

SOLARSHOP AUSTRALIA

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Building better smart meters

Following on from last issue's smart meters guide, Craig Memery writes about ATA's efforts to make smart meters smarter for householders.

Smart meters have generated a lot of attention in recent months. Since January 1, Victorian households have been paying additional metering charges between $67 and $104 per year to fund the installation of smart meters, along with their associated communication infrastructure and network management systems, in 2.5 million homes.

Late last year the Victorian Auditor-General released a damning report into the Victorian Advanced Metering Infrastructure (AMI) program, highlighting numerous failures by the state government in its development and implementation. The report criticised "inadequacies" in the advice and recommendations given to the government on the project. It said the advice and analysis "lacked depth" and gave an incomplete picture of the economic merits, consumer impact and project risks of smart meters.

Whenever the Victorian government takes on a major project, it does so with fanfare: billboards spring up about 'Building Better Schools' or 'Building Better Roads'. So why has there not been publicity on 'Building Better Electricity Networks' for smart meters? Maybe someone realised that a multi-billion dollar program which primarily benefits energy businesses at the expense of consumers was going to be a pretty hard sell.

If the Victorian government thought it was going to slip this under the radar it was very mistaken. Consumer organisations have been protesting long and loud about the problems with smart meters, particularly their impact on low-income households. In response to this pressure, Energy Minister Peter Batchelor recently announced a moratorium on time-of-use electricity tariffs while consumer groups were belatedly consulted.

Aside from issues about the cost and lack of benefit to consumers, the Alternative Technology Association is concerned that Victoria's smart meter technology is just not that smart.

ATA and the National Smart Meter Program

While the Victorian program has received a lot of attention in the media, most people aren't aware of the National Smart Meter Program.

In 2007 a council of Australian energy ministers announced that smart meters will be introduced in states and territories where smart meter networks will have a positive cost benefit; that is, where (according to modeling by a consultant) the total cost of installing smart meters will be less than the total financial benefit.

If a positive cost benefit sounds like a difficult thing to measure accurately, that's because it is, and a heap of assumptions are made in place of confirmed cost. This can result in significant error, particularly when dealing with a complex program such as the rollout of smart meters, as evidenced by the massive budget blowouts experienced in the Victorian program.

A key failing of the Victorian program was the lack of consultation with consumers, and the ATA is doing its best to make sure this doesn't happen in the national program. The ATA's energy policy team is representing members and other energy consumers through participation in a number of committees into the national program, such as the Business Requirements Working Group.

This working group comprises representatives from distribution businesses, energy retailers and some state and federal government departments. Its main task has been preparing recommendations on the minimum functions of smart meters.

For example, all smart meters will have an inbuilt display on the face of the meter. Typically this will be in the form of an LCD screen which will display a range of values that are scrolled through by pressing a button on the meter. The working group decided which values should be displayed on the meter. At the ATA's insistence, there has been agreement to include the power demand (in kilowatts or kW, as distinct from the energy used in kilowatt-hours or kWh) of the customer's home. Without this, consumers would not be able to tell how much power they are using at a given moment.

Given that power demand is so important to a consumer on a time-of-use or critical peak pricing tariff, you would think that displaying the power demand would be obvious. However, as it is only of benefit to consumers, the ATA had to put up a bit of a fight for it to be included under the national program. The Victorian program, which is independent of the national one, does not require meters to display power consumption (kW), which the ATA sees as yet another shortcoming.

Perhaps the biggest battle the ATA has had in the national program is over the functionality of twin-element meters. Twin-element meters are required wherever separate circuits need to be measured, such as a controlled load on a different tariff (similar to how an off-

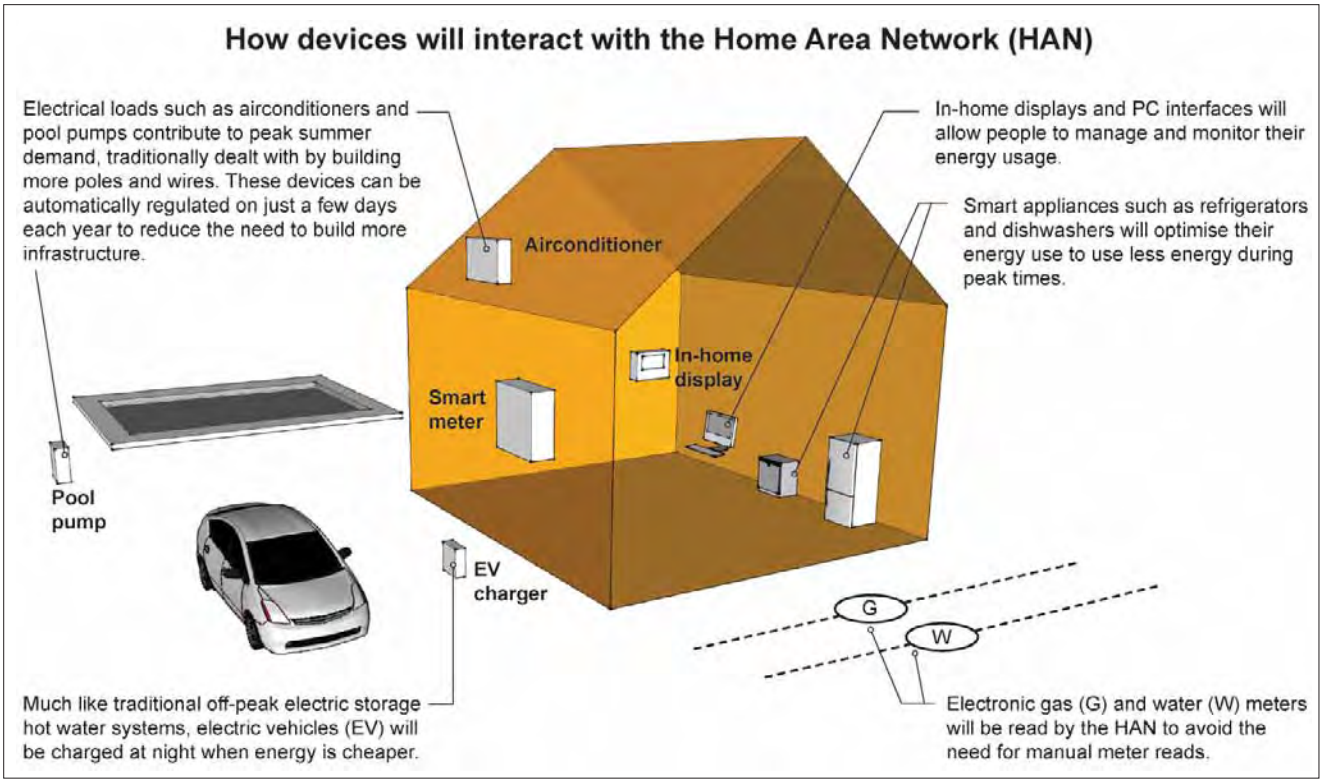


Illustration: Nick Stephenson

peak supply works now) or to measure the output from solar photovoltaics separately to the consumption in a home, which is needed for calculating the gross feed-in tariffs in NSW and ACT.

The ATA believes twin-element meters need to be able to totalise the energy and power values across both elements of a two-element meter, while retaining the ability to measure each element separately. This means that solar power system owners with a two element meter will be able to see the output from their solar array separately to their consumption on site, as well has how much power and energy they are importing and exporting, regardless of whether they receive a gross or net feed-in tariff.

Although the ability of a meter to perform this calculation should be reasonably straight forward, and without it the ability of twin-element meters to meet a range of other requirements would be compromised, winning the agreement of the working group took many hours of discussion over a number of monthly workshops, and we are pleased to report that we got our way, to the benefit both of members with photovoltaics and consumers more broadly.

Home Area Networks

Possibly the most exciting opportunities offered by smart metering is the HAN, or Home Area Network: an information and automation portal that can communicate between the smart meter network and the customer.

The HAN relies on an interface, such as a wifi radio built into the meter, to allow features such as:

- Load control: switching individual devices on and off according to either a time profile, time-of-use tariff prices or a signal from the distributor.
- In home display: devices or software programs that show consumers detailed information about their energy use and allow them to manage their energy use.
- Metering of other utilities: the potential exists for the HAN to be used for receiving data from electronic water and gas meters.
- In the future, interaction with smart appliances, which (similar to load control) will improve their own operation to achieve better energy efficiency, cost savings and potential carbon emissions reduction. Bear in mind that shifting loads from expensive yet lower carbon daytime peak energy to more coal-based off peak generation may save money but at the expense of higher emissions.
- And possibly in the less distant future, your HAN (or other part of a smart meter which controls loads) will be able to manage the charging of your electric vehicle.

The HAN interface is mandatory for all smart meters under the national program. The ATA will continue to advocate on behalf of its members and other consumers to ensure that the benefits of the HAN are delivered to consumers and that this remains a priority wherever smart meters are introduced. ✻

Craig Memery is ATA's Energy Policy Advocate and can be contacted via craig@ata.org.au with any queries about smart meter policy.

Solar hot water: moving to a split system

Gayle Russell encountered a whole new world when buying her first active (or split) solar hot water system after owning two low-fuss passive systems.

We've had solar hot water in both the homes we've lived in since 1994. Both hot water systems used close coupled systems (a flat solar collector with a 320 litre tank on the roof) also known as passive systems. They are inherently simple and really cost effective.

A passive system operates by thermosiphon, using the different densities of hot and cold water to circulate water within a closed system. Heat causes water to rise up through the collector, drawing in cooler at the bottom, thus circulating water in the system.

I decided to install an evacuated tube split system (which had a 30 tube collector) for my investment property in Launceston last year. Split systems (also know as active systems) can also be of the flat panel type. With these systems the hot water storage tank is at ground level, usually in the laundry, but it can also be outside the house. My tank is 250 litres.

I discovered that split systems need add-on technology involving a pump, a one-way flow valve, a varying number of sensors and an electronic control unit in order to move the heated water from the solar collector on the roof to the storage tank on the ground. These systems have to work against the natural flow of heat energy, which seeks to go up, not down. Hence electricity is used to pump the heated water from the collector into the hot water storage tank.

I compared this to my home passive system where the hot water component of our power bills has been as low as $1.50 per quarter: now that's great economy. The manual override switch ensures we only put the booster on as needed, for example, after one and a half days of wet, cloudy weather.

Active solar water heaters have the advantage that only the collector is on the roof.

The installation of my split system got off on a wrong foot right from the start. The installer, contrary to my instructions, installed the evacuated tubes on the back roof of the house for his own complex reasons, one of which was to keep them out of sight of the street!

The north-west exposure of the tubes was hindered by a considerably higher roof ridgeline to the north-east and a large walnut tree to the west. This limited the system's capacity to gain winter sun on this north-east facing property. It is critical to ensure your installer understands that the system needs to be placed in the best position to achieve maximum solar gain.

It took me months to unravel why the system wasn't working effectively. It was through this process that I learnt about the three sensors (roof, upper tank and bottom of tank), pump (operational on general tariff mains power), position of the heating element at the base of the storage tank, the controller and temperature differentials needed to get the pump to move hot water from the manifold on the roof down to the storage tank. I also learnt that the system had no timer to regulate the heating of the booster element. This has finally been remedied.

My tenants frequently switched the electric booster on before going out to work in the morning to ensure a hot shower when they got home. The heating element is at the bottom of the tank so the water at the bottom was being

heated. The inlet sensor (at the bottom of the tank) would then record the temperature of this heated water. If the heating element was positioned halfway up the tank then a more accurate indication of the water temperature could be gained.

To understand the system you need to grasp that the roof sensor needs to 'talk to' the inlet sensor via the controller. The sensors need to register a given temperature difference, in my case 12°C, to get the pump to switch on and pump the hot water from the roof down to the storage tank. This becomes an issue if the inlet sensor (bottom of tank) reads say, 46°C and the roof reads 53°C or, 47°C bottom and 57°C roof respectively, as I recorded. With these temperatures there was inadequate differential to switch the pump on to move the hot water from the roof down to the tank. Effectively there was no solar gain, even though there was adequate sunlight. In the end I eventually found out that a timer can resolve this problem.

Bit by bit I learned that for solar split systems to be effective the tank should be at least half full of cold water in the morning. If you boost in the morning or during the day, on a day when there is sunshine such that the tank is full of hot water, you effectively defeat the purpose of having a solar hot water system.

It is essential to have a one-way, non-return valve in the line immediately after the pump to stop the possibility of hot water loss from the storage tank; my system didn't have one. On a cold night for instance, if the solar collector is colder than the tank the hot water from the tank can thermosiphon up to the collector on the roof. The collector can then radiate the heat to the cool night air and the now-cold water descends back down to the storage tank, in effect wasting the hot water in your tank. The orientation of the valve, as per the manufacturer's instructions, is critical and the valve, sometimes, will not close when swarf or other debris gets caught in the valve seat.

Thankfully the evacuated tubes have now been moved to the best part of the roof (front roof) to maximise solar gain and a timer has been installed to ensure that any boosting only occurs between specific times such as late afternoon or early evening. My tenants have informed me that the system is working much more effectively. Their next power bill will be the final indicator.

With the greater complexity of split systems I can see why people give up on trying to understand how to more effectively manage them and in so doing, save money and reduce greenhouse gas emissions. If a passive system for evacuated tubes had been an option (evacuated tubes with an actual storage tank on the roof) when I was looking to install the solar hot water system I would have gone for it. Thankfully, some of these are now coming on the market. ✻

Active systems have the disadvantage of added complexity due to the need for pumps, controllers and temperature sensors, thus increasing the likelihood of problems.

Tips for consumers

Passive system

Pros

- The simplest type of system
- No pumps or controllers, gravity does the work
- Short pipe runs between collector and tank, reducing losses

Cons

- Roof must support weight of tank
- Tank must be on north facing roof, regardless of where water usage points are
- Needs active frost protection in some areas
- More difficult tank maintenance
- Doesn't look as good (subjective)

Active (split) system

Pros

- Tank can be located on ground, close to water usage points
- Roof only has to support weight of panels
- Easy tank maintenance
- Frost protection done by controller
- Cleaner appearance—more suitable in heritage areas

Cons

- Long pipe runs between collector and tank, requiring good pipe insulation.
- Requires pump and controller, which adds to cost
- Added complexity increases chance of system faults

Comfortable in the tropics

Want to live in the tropics and avoid getting hot under the collar? Sarah Dailey talks to Queensland residents who have beaten the humidity and explains how you can do the same.

Building a sustainable home is not a project to be entered into lightly, even more so when you live in a tropical climate. It's probably not obvious to think of but living in the tropics guarantees more than just sleepless sweaty nights plagued by mosquitoes. The daily rainfall, the cyclone and flooding threats, as well as the perpetual high temperatures means your home needs to be built to withstand conditions that most southern states dwellers rarely have to consider.

Which is why Daryl Douglass, convenor of the Alternative Technology Association's Cairns branch, has done things so right. His home in Far North Queensland is an example of how sustainable design and tropical housing can be incorporated perfectly.

When building or relocating to a tropical climate there are countless design factors that come into play, the first of them being orientation.

The home is sheltered by a large number of native and exotic trees, including melaleucas planted by a previous owner. Further back sits the perimeter of old growth rainforest, where native trees have grown close to 12 metres high. The orientation of his home on this block of land provides cyclone protection and is the first of many design factors Daryl considered when planning this family's unique home.

Daryl found inspiration for the construction of his house when he was swimming at the local beach, soaking up the views of his new surrounds over the mountains. Planning on moving from Brisbane, he expected a conventionally designed house would look out of place in the rainforest. He sketched some rough outlines and began to work out the technical side of the construction process. "Originally the design was to fit into the rainforest setting, with liveability, comfort and cost always in the background," says Daryl.

Daryl's tropical home is made of pavilions shaped like yurts.

Construction and design

Due to minimal temperature variation in Australia's tropical regions, ensuring your home is well insulated is crucial to maintain comfort. Lightweight or low mass construction will also help cooling, as will elevating the building to permit airflow beneath the floors. Daryl has done this in his home by elevating his floor by 900mm to allow floor cooling, as well as rapid drying in the wet season. This technique also reduces cyclonic pressure waves against the walls. Daryl's home is octagonal shaped, which might not sound important, but the shape buffers against cyclonic winds becausethere are no large flat surfaces. The design is based on traditional yurts.

The frame and cladding of the house is plantation cypress, with hardwood beams and lintels secured with steel skeleton cyclone-rated footings. There are insulating batts in all the western walls of the home and whirlybirds on each extremity with vents inside the walk-in-robes and kitchen. By building his home where he did, trees shade Daryl's east and west walls which limits sun hours on the roof to just four hours a day, essential for keeping the temperature as low as possible.

"Our home is very comfortable to live in," says Daryl. "In the winter, we close all the windows and hang drapes to keep the heat in. We use the waste heat from cooking to heat the kitchen and lounge with a small fan heater for some mornings in the middle of winter. It gets really cold up here, sometimes as low as five degrees, but we've only been that low about five times in the 13 years we've been here. The heater just takes the chill off first thing. Mostly, we use warm foods, like porridge, and clothes to keep warm," says Daryl.

Beating the humidity

The design of Daryl's home has allowed

him to capitalise on the breezes that waft through the valley. The house has large windows that allow for the entire wall to be opened to the afternoon breeze. "We have a large airy veranda in the middle of the house. We are surrounded by native animals of all sorts, even some very rare ones, and in the flowering time, it's like living in a walk-in aviary. There is just so much life and we are part of it. Open the windows and louvres and the outside comes inside," says Daryl. A pond positioned on the western side further helps cool the breeze that drifts through the house and verandah. Being innovative is important when living in the tropics and seeking comfort from the humidity requires clever thinking. "We move around to find the most comfortable spots."

But as much as sound building and thoughtful design will help provide comfort in the tropics, humidity is still a tough beast to beat. Select light-coloured roof and wall materials and ventilate all roof spaces. In Daryl's case ceiling insulation is not required as roof ventilation keeps the roof cavity relatively cool. Daryl doesn't need air conditioning either, with air conditioning units often futile with such humid air. Instead the home is fitted with ceiling fans. "In summer, the temperature rarely gets above 32°C," says Daryl. "The ceiling fans go most of the time to circulate the humid air and reduce mould growth." Put all these design elements together and you have a comfortable Queensland home that ticks all the boxes for sustainable tropical design.

Sustainable House Day

Due to the unique conditions of tropical building it is helpful to understand how residents like Daryl have done it so successfully. Sustainable House Day this September 12 is the perfect chance for potential homebuilders and renovators to get inside homes to catch a rare glimpse of how sustainable design works in the tropics. Two hundred home owners across the country will open their front doors to the public, including the trickier ones in the tropics, to showcase how they managed to adapt their homes to tropical conditions as well as their secrets to energy and waste management.

One such home, in the Northern Cairns suburb of Manoora, is to be opened for display for the second year running. Now owned by residents Steve Ryan and Alessia Mortari the house was originally built for public housing in 1974 by the Queensland government. The pair have retrofitted the house into a sustainable and comfortable home for the tropical climate and it is one worth exploring to gain ideas on the day.

Steve and Alessia retrofitted this ex-government-owned house for a tropical climate.

Retrofitting

Similar to Daryl's home, the house is passively cooled with ample windows and louvres to provide cross ventilation. The backyard of Steve and Alessia's house is filled with trees to provide extra shading but is also a productive suburban food farm. It includes composting

A 1kW solar system on Steve and Alessia's retrofitted house.

facilities for waste disposal, around 20 fruit trees, chooks and abundant vegetable gardens. Steve says the garden is one of the most important features of the family home and is another way to keep the bills down. "When the garden is maintained and working well, it probably saves up to $50 a week on fruit and vegetable costs. The garden has been harder to maintain with a toddler around, but still supplements our groceries substantially," says Steve.

Retrofitting an existing building gave Steve and Alessia an opportunity to increase comfort in their home as well as help the environment. They fitted the house with reflective bubble insulation under the existing ceramic tile roof. This can reflect up to 95% of radiant heat and reduce the temperature inside the home. "The house was very hot and uncomfortable and the changes have made a dramatic difference to the comfort levels in the house," says Steve.

In addition, the house is worth visiting to see their 1kW grid-connected photovoltaic solar system. This system can result in a 60% to 70% reduction in power bills when combined with the household solar hot water system. Steve says the family's electricity bills are now as low as $80 per quarter. The family cashed in on the government rebates and bulk buy schemes and saved thousands of hard-earned dollars on their water tanks and solar equipment. "It was pretty cheap for what we got, and we knew we would have kids on the way and reduced power bills, reduced grocery bills and added value to the house would be useful as we moved to a single income household," explains Steve.

So if you have an old home and want to start over, or are feeling inventive like Daryl, Sustainable House Day might be the perfect excuse you need to get started on your project. Steve Ryan says having their home open for display is to demonstrate that a sustainable lifestyle is not impossible and can easily be replicated by others. He says retrofitting their house has made it a pleasure to live in the tropics. "An ordinary house can be retrofitted by someone with no building experience at an affordable price. All the solar and other equipment is great but the biggest saving and lifestyle impact is having a garden that feeds you and a house that keeps you cool without running up huge power bills." ✻

Sustainable House Day

Sustainable House Day is on Sunday September 12, with up to 250 homes open across the country. Architects and builders will be on hand at many of the homes to provide expert tips while visitors to this year's event will be able to see sustainable features such as solar systems, ventilation, water harvesting and recycling, shading, thermal mass, double glazing and window treatments. For full details visit www.sustainablehouseday.com

Home energy ratings in the tropics

FROM May 1 this year new houses and major renovations in Queensland must achieve a minimum 6-Star energy equivalence rating. To achieve a 6-Star rating in Queensland certain criteria must be fulfilled such as northern orientation of living rooms, natural ventilation through windows and doorways, shading with wider eaves and awnings, increased insulation in roof space and walls, treated glazing and light-coloured roofs and walls.

For tropical residents the increase to 6-Stars is causing quite a stir. As Daryl Douglass says "It is based on southern designs." As mentioned, Daryl has used sustainable design techniques in his house such as a suspended floor, as well as a central verandah to promote airflow, and casement windows, none of which are taken into account to gain a 6 Star rating. "Our house is full of things like this, but not one of them means anything in the star ratings as they stand. Luckily, the Tropical Green Building Network has raised these issues with the minister and hopefully a more 'tropical' model will be forthcoming. Until then, the star rating in the Far North is not worth a cracker!"

The move to 6 Stars will happen in all states by 2011 thanks to aCOAG agreement last year.

Scheffler dishes: hot to trot at CERES

CERES community environment park in Melbourne is bringing simple solar cookers to the people, writes Bryce Gaton.

Imagine a large community centre cooking for 1000 people a day using only the sun's heat? There's no need to imagine, it's a reality at a spiritual university in Radjasthan, India, thanks to the Scheffler dish.

In fact, in many places in the developing world, Scheffler dishes are a common sight for providing cheap, clean and carbon free energy. Sadly, this simple and practical technology has not made an impact in the developed world and to date none have been built in Australia.

So what is a Scheffler dish? Put simply, they are a very simple tracking, parabolic solar concentrating dish. Their trick is that they focus all day on a single fixed point in front of the dish. As a result, the dish can be outside a home and focusing on a point on a kitchen wall for instance; perfect for cooking or collecting heat for other purposes!

Their unique geometry sets Scheffler dishes apart from better known complex dual tracker systems. This is because Scheffler dishes are a single axis tracker, with a manual adjustment being made a couple of times a week to compensate for changes in the sun's position over the seasons.

The designs were first introduced by Dr Wolfgang Scheffler (sometimes called the 'father' of parabolic dish development), with the first prototypes built in rural mechanical workshops in Kenya and India. Scheffler's aim was to ensure the construction methods and materials remained within the workshop capabilities of people in the developing world by using standard workshop tools such as welders, grinders and hand tools.

Scheffler dishes can be used individually or in large arrays, like this community steam cooking system.

As a part of this philosophy, Dr Scheffler both actively supports development of the dishes and offers the plans as an open source technology. His efforts and support are augmented by a growing band of workers and organisations who build and develop the dishes around the world. The largest of these organisations, Gadhia Solar Pty Ltd, was set up to assist the distribution of Scheffler dish technology throughout India and abroad.

Scheffler dishes can be built in two configurations, either 'lying' or 'standing'. A lying dish has the dish in an almost horizontal position, with the focus point above and to one side of the dish. This is ideal for siting outside and below a balcony for instance, focusing the heat onto a cooking plate or pot.

A standing Scheffler dish has the dish standing more or less vertical with the cooking region in front of the dish rather than above it.

There are various advantages and disadvantages of each construction type, as detailed in Table 1.

Schefflers in Australia

Why are there no known examples of Scheffler dishes in Australia? Part of the answer lies in their very simplicity ('it can't be that easy!') and the not-for-

Reflector type	Advantages	Disadvantages
Lying reflector	Generally easier to construct	Cooking area is very high above ground, depending on latitude
	More power in summer than winter	
	Cooking area can be integrated into a house or balcony	
Standing reflector	Cooking area is at a comfortable height when standing freely	Construction of cooking area and stand is tricky. Cooking area needs a bigger secondary reflector, so is less efficient
	More power in winter than summer	

Table 1. Advantages and disadvantages of Scheffler dish configurations.

profit, low-tech model that it is developed through. The technology does not offer the mega-profits that many businesses look for, nor the cost savings through mechanisation of the process: it is designed to be a labour- rather than machinery-intensive build.

This is where CERES and its mission to promote practical and appropriate technologies comes in. With the assistance of several state and federal grants, CERES plans to build several Scheffler dishes this year.

The first of these will be a semi-mobile 2.7m² dish. It will be used at events, demonstrations for visiting school groups or even for hire around the CERES site. Eventually (depending on funding) this mobile dish will be trailer-mounted, enabling it to be taken to an even wider audience throughout southern Australia.

The second dish will be a major build, with plans for a 16m² dish driving a Stirling cycle engine. This will be a standing dish, calculated to collect 3.9kW in summer and 5.8kW in winter.

CERES has established a volunteer building group to build the first dish, which is now about eight people strong. These volunteers have a wealth of experience in solar collection dish design, mechanical engineering and hands-on metalwork skills.

At the CERES end of this group are Neil Faragher, formerly of Solar Systems and now a Green Tech manager at CERES and Rhys Freeman, CERES energy and vehicle projects coordinator.

Exciting times are beginning at CERES Green Tech, with the launch of the first solar cooker in July. ✻

Bryce Gaton is Green Technology and Tertiary Liaison Manager at CERES.

Further reading and links:

For more information on the CERES Scheffler working group email neil@ceres.org.au

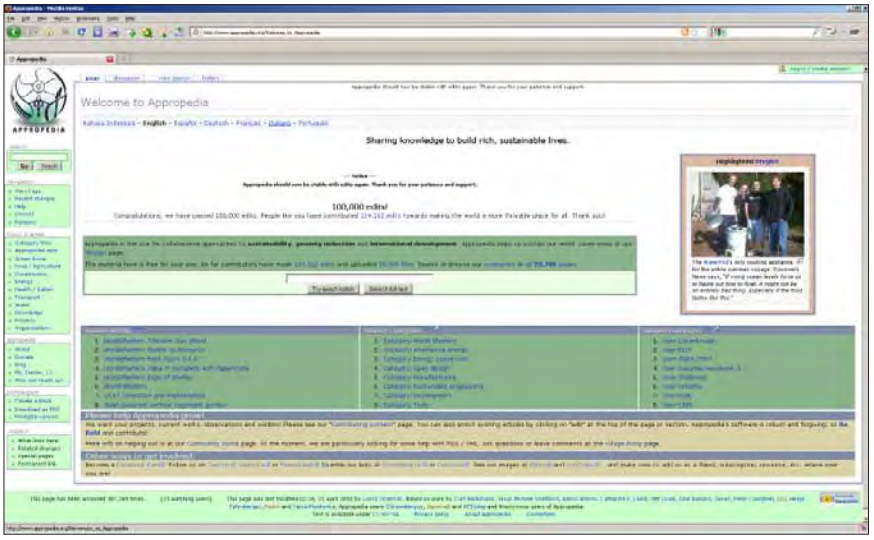
Official website for Scheffler dishes: ww.solare-bruecke.org

Gadhia Solar Energy Systems: solarcooking.wikia.com/wiki/Gadhia_Solar_Energy_Systems

CERES: www.ceres.org.au

Browser

www.appropedia.org



We've all seen and used Wikipedia, well Appropedia is like the wikipedia for sustainable and appropriate technologies and lifestyles.

It looks like most wikis, i.e. it isn't overly pretty, but the important thing about this site is not what it looks like, but what it contains.

The site has a large number of articles on a huge range of subjects. You can search by category, such as appropriate technology, energy, transport, water and numerous others. Each category has various sub-categories and these contain a wealth of articles. Typical articles and subjects include *How to make awesome thermal curtains, Increasing supercapacitor performance* and *How to build a mechanically powered battery charger for LED lighting.*

Some pages contain nothing more than links back to the original article on another website, but even so, they are still a great source of information.

Reading some of the entries, it's clear that a lot of university students are using the site to showcase some of their work, but that's not a bad thing, just be aware that some of the articles are a little naive in their approach or results.

One excellent feature is a complete site dump that you can download in xml format. This is great if you have made contributions and want to be able to access them locally, or just want all that info at your fingertips without needing to be online.

Of course, there's also a help page, a discussion forum and links to the common social networking sites.

www.myelectriccar.com.au

As you might have gathered from the URL, this site is about electric vehicles and, in particular, what's happening around the world and how it relates to what's happening (or not happening) in Australia.

There's regular news updates on new models of EV being released by the major car manufacturers, as well as all the smaller makers like Tesla, Coda and the like. Each model has its own information page where you can read up about the features, production timeline, and even watch a video or two.

The 'New Models' tab lets you find vehicles quickly. There's a 'FAQ' page for the newcomer to EVs, information on the benefits of owning and running an EV, and there's even a 'Conversions' page with several examples of internal combustion engined vehicles that have been converted to electric power.

One interesting page is the 'Incentives' page, which lists what major developed countries are doing to promote electric vehicles. Unfortunately, Australia is only mentioned for what it's not doing.

While not the most extensive EV website out there, the fact that there's enough interest and activity in the Australian EV community to warrant assembling such a site is an encouraging sign. Now, let's hope the federal and state governments start offering some incentives for prospective EV owners.

Products

A rechargeable battery to beat all others?

Rechargeable batteries have improved considerably in eco-friendliness and capacity in recent years, with nickel metal-hydride NiMH cells becoming the most popular in the standard sizes of AAA, AA, C and D. While they perform well, some devices just need the higher voltage available from alkaline and lithium primary (non-rechargeable) cells.

PowerGenix nickel-zinc rechargeable batteries not only produce higher voltage (1.6 volts per cell in fact), but you can recharge them hundreds of times. However, you do need to use the PowerGenix range of chargers—regular NiMH chargers won't work.

According to the manufacturer, the cells also have lower internal resistance than NiMH cells, so not only do they have a higher terminal voltage, they maintain that voltage better under load. They also state that the cells are fully recyclable, and we expect they are less toxic than most cell technologies, considering the main active materials.

The batteries are available in packs of 4 or 8 cells and also bundled with universal voltage fast chargers which will charge the batteries in as little as 1.5 hours and can be used anywhere in the world with appropriate plug adaptors. The cells are currently only available in a 2500mAh AA size, with AAA cells to be released later in 2010.

The cells and chargers are only available in the US, but can be easily purchased online. We bought a charger and 12 cells from DepotEco and it cost around US$58 including postage, comparable to buying good quality NiMH cells locally. We can attest that these cells do indeed make more power available, especially in high drain devices, and have excellent energy capacity, easily outlasting NiMH cells of the same amp-hour rating.

Manufactured by PowerGenix, ph:+1 858 547 7300, info@powergenix.com, www.powergenix.com. Available from DepotEco, www.depoteco.com

Split the logs, not your spine!

Splitting logs is not the easiest of tasks, but if you gather and split your own firewood you don't have to half kill yourself splitting large logs.

The Agma Smart-Splitter is a clever device that allows you to split logs with minimal effort. In effect, it's a slide-hammer for logs. It consists of a metal rod along which the splitting head slides. The splitter is positioned against the log and the slide hammer weight is lifted up and dropped until the hammering effect splits the log. There's no swinging heavy and potentially dangerous axes or log splitters and no back injuries.

The Smart-Splitter is designed in Sweden and is distributed in Australia by Swedex. To complement the splitter there is also a Smart-Holder which can hold logs up to 230mm diameter and any length while you cut it into usable lengths ready for the splitter.

RRP:$196 for either the splitter or holder.

For more information and to buy online contact Swedex Pty Ltd , PO Box 103, Sandown Village VIC 3171, ph:(03) 9570 7075, info@swedex.com.au, www.woodsplitter.com.au

Walking on milk bottles

ModWood, the recycled plastic decking material, has recently had some new colours added to the range. ModWood's Natural Grain Collection now features four colours (from top: Sahara, Black Bean, Jarrah and Silver Gum). The left-hand side of the image shows the smooth finish and the brushed finish is on the right.

ModWood is a wood composite decking board made from recycled milk containers and non-virgin pine products. Each lineal metre of the 137 x 23mm decking board contains approximately 37 recycled plastic milk bottles and around two kilograms of reclaimed pine dust.

For more information, contact ModWood Technologies, 5 Jesica Rd, Campbellfield VIC 3061, ph:(03) 9357 8866, info@modwood.com.au, www.modwood.com.au

Eco fridge range

AC (mains powered) fridges have improved in efficiency in leaps and bounds in recent years. So much so that they are now the best option in many larger solar power systems.

The Electrolux range of two-door fridge/freezers is part of their Eco Range of products and includes several fridges with 3½ star ratings in the new star ratings system (they had 5 to 5½ stars in the previous system). Energy consumption is well under 1kWh per litre of capacity per year, even for units 500+ litres in size, making them some of the most energy efficient on the market. Go to www.energyrating.gov.au and search on two-door fridge/freezers to see the list.

What's more, being made in Australia, they have a lower embodied energy compared to imported units. They also use the more greenhouse friendly R600a (isobutane) refrigerant (rather than R134a), which has an atmosphere life of less than a year, according to Electrolux.

They have stainless steel finishes and are available in several styles, including squarelines, rounded fronts and with freezers on both top and bottom.

For more information and to find your closest supplier, call 1300 363 640 or go to www.electrolux.com.au

Telescoping mini wind turbine

Vertical axis wind turbines like the Savonius rotor are rarely used for electricity generation, mainly due to their lower efficiency and the lack of available low-speed generators. The latter problem no longer exists, thanks in part to rare earth magnets, and so making a direct drive vertical axis machine is now simple.

This small unit from Jaycar Electronics is rated at 12 volts DC and 50 watts at 10m/s and has a digital display in the base to indicate voltage. However, as this is a waste of energy, we recommend disconnecting this display. The unique thing about this turbine is that the blades are telescopic, so the turbine takes less space when put away, although we're not sure why you would do this! Dimensions are 455/655mm H x 280mm W x 150mm D.

This turbine should have uses for small systems where solar panels are not suitable due to shading issues.

RRP: $399

Available from Jaycar Electronics stores. For more information ph:1800 022 888 or go to www.jaycar.com.au

Fluorescent bulbs that never wear out!

Well, almost. Induction bulbs have been around in other countries for years, but it has taken a while for them to reach Australia, at least for domestic uses. Induction lamps are similar to fluorescent lamps, but instead of using heating filaments and an electrical discharge to produce light, they excite the contained gas using a magnetic field. There's no filaments or electrodes to wear out at all, and so they don't suffer from phosphor poisoning like fluoros do (the reason fluoros go black at the ends).

The Eco Living Centre has a range of induction lamps from 15 to 200 watts. There are two units suited to domestic use, the 15 and 23 watt models. They feature 750 and 1400 lumen outputs respectively and have a rated lifetime of 80% output after 80,000 hours!

They are instant starting and have a power factor of >0.9. The 15 watter measures 59 x 57 x 160mm while the 23 watt unit is 78 x 62 x 182mm. Downlight fittings to suit are also available.

RRP: $44.80 for the 15 watt model, $48 for the 23 watt unit.

For more information contact the Eco Living Centre, ph:1300 308 823, www.ecolivingcentre.com.au

Products

Degradeable bags that actually degrade!

There are quite a few 'degradeable' bags around nowadays, you can even get them at Woolworths, but not all degradeable bags will actually degrade in landfill. Some require exposure to UV light in order to degrade. Locked up in landfill, they are not much different to a regular plastic bag.

Because We Care have a range of truly biodegradeable bags that are ideal for replacing regular plastic shopping bags, as well as for use as smaller rubbish bags. Because We Care were the first company to be AS4736 certified by the Australasian Bioplastics Association (ABA) and their bags are suitable for home composting.

There's a 300mm x 500mm x 25um thick 'singlet' style checkout bag, a 465mm x 400mm x 35um thick flat top bag, and a 310mm x 380mm x 15um thick fruit and veg bag. Now there's no excuse for your local supermarket not to supply biodegradeable bags!

The shopping bags are available in packs of 500 while the fruit and veg bags come on rolls of 400. Because We Care also have the biodegradeable resin available for plastics manufacturers to make their own biodegradeable products.

RRP: $89 for 500 checkout bags, $117 for 500 flat top bags and $94 for six rolls of fruit and veg bags. All prices don't include GST and delivery.

Available from Because We Care, 309 Fitzgerald Rd, Derrimut VIC 3030, ph:(03) 9931 6888, www.becausewecare.com.au

Seven star water heater

Rinnai are renowned for their high efficiency instantaneous gas water heaters, but they have just gone one better with the release of the 7 Star Rinnai Infinity 26 Enviro water heater.

The Infinity Enviro is designed and made in Japan and features temperature control for safety and convenience, a compact design and a 12 year warranty on the heat exchanger. The unit has the ability to run at low flow rates, making it compatible with water saving outlets and shower heads.

According to Rinnai, the Infinity Enviro has around a 30% efficiency advantage over a 3 Star storage unit and produces around one-sixth of the CO_2 of an electric storage system.

RRP: around $1799.

For more information contact Rinnai, ph:1300 555 545, www.rinnai.com.au

Low pressure irrigation valve

Controlling irrigation flows from water tanks or other low pressure sources is normally difficult, as most irrigation valves won't work with such low pressure.

The MV75 irrigation valve from HR Products is designed to run from pressures as low as 20kPa (2.9psi) and should be suitable for many low pressure irrigation needs. It is available in three versions—with a 20mm BSP fitting each side, or with the outlet fitted with a 19mm or 13mm hose barb, for use with common polypipe and hose sizes.

The valve is rated at 24 volts AC, 8 watts (holding current of 0.33A). It also features an internal filter and is made in Australia.

RRP: under $20. Available at Bunnings and other hardware and irrigation outlets.

For more information contact HR Products, ph:(03) 9457 7500, infovic@hrproducts.com.au, www.hrproducts.com.au

Dimmable downlight fitting

Most LED fittings that are designed to replace downlights don't have the ability to be dimmed, so they are unsuitable for some installations. If you want dimming capability, the Brightgreen D900 LED downlight could be the solution.

The D900 is available in both warm white and cool white (called the D1000). Power consumption is just 16 watts while producing around 900 lumens of warm white (3000K) light from the Japanese made LED. It is dimmable with both leading and trailing edge dimmers and comes pre-assembled with its associated LED driver and power cord.

Other features include a solid state (no moving parts) fan, a 55 degree beam angle with a gimble adjust of 15 degrees, 'instant on' with no flickering, and a colour rendering index (CRI) of 90 for excellent colour rendering. They are UV and mercury free and come with a five-year warranty. The fittings are available with either silver or white fascias. Mounting hole diameter is 90mm and the mounting depth is 120mm.

RRP: $129

Available from most major electrical wholesalers, including MM electrical, and good quality lighting retailers. For more information contact Brightgreen, ph:1300 672 499, info@brightgreen.net.au, www.brightgreen.net.au

12 volt roof ventilator

Wind-powered roof ventilators may seem like a good idea, but they are often least active when they are needed most—on hot, still days. To vent the hot air from a roof cavity, forced ventilation is usually needed.

The Edmonds Maestro is a 300mm roof-mounted thermostat-controlled powered ventilator. It runs from 12 volt DC power and can be directly connected to a suitable solar panel. Rated power consumption is 11 watts, so a small panel is all that's needed.

It is a relatively quiet ventilator (63 dBA @ 1m) and according to the manufacturer is equivalent to two to three wind-powered whirlybird style vents (when tested to AS4740). It features a malleable base that fits most roof types up to 45° and is also available with solar panel as a complete kit.

RRP:$ 660 for the standard Maestro, $763 for the solar model.

Manufactured by Edmonds, ph:1300 858 674, sales@edmonds.com.au, www.edmonds.com.au. Available from Bunnings stores.

A Bush(light) Baby

Bushlight are known for their robust and reliable prepackaged remote area power systems, which often find favour in remote communities, farms and other properties far from the mains grid.

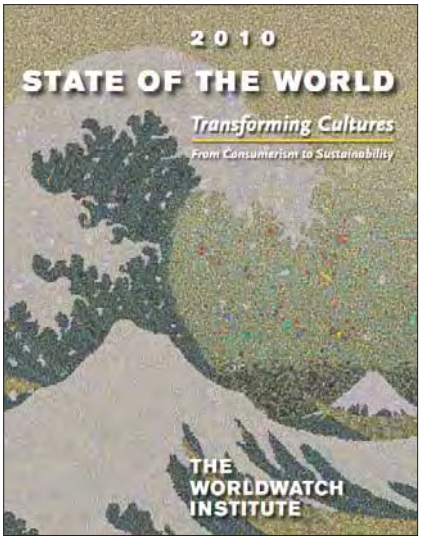
Until now, their systems have been designed to run complete homes through to whole communities, but now there's a smaller version which is ideal for shacks, workers' quarters and seasonally occupied buildings.

Like its larger cousins, the Baby Bushlight contains everything needed to produce a complete working solar power system, including batteries, controller and inverter. The kits include everything needed except a few common tools. No electrician is required, so the end user can purchase and legally install the systems.

There are two sizes available. The smaller system (1.5kWh/day) will run a light and a pedestal fan at night as well as an energy efficient chest fridge 24/7. The larger unit (3kWh/day) can power these appliances plus a small chest freezer. On sunny days, either unit can provide enough extra energy for a load of washing.

RRP: $17,200 for the small unit, $25,200 for the large unit. These prices are before any rebates.

For more information and to purchase a Baby Bushlight system, contact Bushlight, ph:(08) 8959 6142, ben.macdougall@bushlight.org.au, www.bushlight.org.au



State of the World 2010 – Transforming Cultures

Published by Worldwatch Institute, Washington DC, 2010, $19.95

Unless a massive cultural shift that values sustainability over consumerism occurs, government pledges and technological advances will not rescue us from potentially disastrous environmental and climate risks. SOW Project Director, Erik Assadourian, demands that our cultures change so that "sustainability becomes the norm and excessive consumption becomes taboo".

The report's 60 authors present strategies for reorienting cultures that range from "choice editing" such as deliberately striking options from consumer menus, to harnessing the power of religious groups to internalise sustainability values.

Many of the regular sustainability problems are highlighted: bottled water, fast food, disposable paper products, motor vehicles and the pet industry. In the US$300 billion was spent on advertising pet services. Two pet German Shepherds use more resources annually than the average Bangladeshi.

SOW 2010 is not without hope. Big efforts for change have started in government, business and communities. Internationally the 2002 UN Marrakech Process on Sustainable Consumption and Production includes seven task forces: sustainable lifestyles (Sweden); co-operation with Africa (Germany); sustainable public procurement (Switzerland); sustainable products (UK); sustainable tourism (France); sustainable buildings and construction (Finland); and education for sustainable consumption (Italy). As an example, Sweden identifies and compares grassroots social innovations, finds promising examples and diffuses them, including 'train the trainer' tools with projects in 30 countries and 10 languages.

Governments have a key role in 'choice editing' by eliminating offending choices (CFCs, lighting), trimming away the worst products and practices (building practices, appliances), making offending choices less attractive or increasingly difficult, and changing the context for choices. Cuba ripped out all its incandescent globes, banned the import of inefficient appliances and saved 200MW of its maximum peak demand.

Peter Newman's chapter 'Building the Cities of the Future' cites Vauban 'eco-city', where new planning and design, bike paths, wind turbines, solar and farmers' markets make it easier to live sustainably. The ASBEC (Australian Sustainable Built Environment Council) project with the same name highlights the grim alternative—longer, slower commutes with increased emissions.

Many businesses are leading in policy and example. Retailing giant Wal-Mart is greening its centres and supply chain, cutting truck fuel use and increasing profits. They call it 'engagement lifting others'.

Education is crucial. Women with no schooling average 4.5 children each; with some primary schooling they average three and with one year of secondary school, just 1.9.

While the threat of climate change demands urgency, SOW 2010 gives equal importance to the unsustainable use of scarce resources, threats to biodiversity, equity, education and culture.

Worldwatch Institute President Chris Flavin sums it up: "In the end, the human instinct for survival must triumph over the urge to consume at any cost".

Reviewed by Tom Roper

To buy a copy of *State of the World* 2010 go to www.worldwatch.org/sow10

Q&A

Parallel solar arrays

Last year we had a 3kW solar system installed with five SunPower 215 watt solar panels which produce—on a good day—seven to eight kilowatt-hours (kWh).

We have recently fitted another five SunPower 210 watt panels which now produce approximately 10 to 11kWh.

If additional panels are added that are not of the same wattage, does the system select the lower wattage output?

R Honschooten
Gosnells WA

I assume when you state a '3kW solar system' that you mean the inverter was a 3kW unit. Both of your arrays are rated around 1kW each. I'm also assuming that the total output is now 10-11kWh per day, not just for the new array, which wouldn't be possible for a 1kW array.

Providing the arrays are of the same or very similar voltage with similar performance and derating curves, then you should have almost doubled your output. Wattage isn't the important figure for array matching, but rather, the maximum power point voltage. Because both arrays are of the same brand and similar size, I suspect they are a good match, so there's no way to know why you are not seeing the output increase you would expect without having the system tested.

A relatively common problem with systems nowadays is the supplying of an inverter that is too small for the array. Many people have systems that, for the middle part of the day at certain times of the year, will go into power limiting as the inverter reaches its maximum output. When you look at a power curve of such a system you will see the output rise until it hits the limit of the inverter. It will then plateau at that limit until such time as array output falls below inverter capacity.

This is the sort of problem I would expect you were having, but the arrays don't match the '3kW' you mention, so I would need more exact information on your system to be able to work out what's going on.

The '3kW' rating of the system might actually be 3kWh, the average expected output from a 1kW system over the course of a year in a place like Melbourne, but it seems too low for WA. If this were the case, then most likely you had an inverter installed that was rated not much more than 1kW, and so it would regularly go into the power limiting scenario described above.

Lance Turner

Halogen transformers

I've been trying to advise some householders on LED lighting options, especially downlight replacement, but am personally confused about transformers for them.

1. What is the difference between a transformer (like the Redback transformer that is promoted for LEDs) and an LED Driver?

2. If a person buys a Redback transformer, how many LED lights will that supply power to? Just one, or several?

3. I bought up some 5W LED MR16 lights and the package says "Do not connect more than one LED MR16 to a transformer." In a situation where a ceiling has 10 halogen lights already driven by one transformer, does this mean I can replace only one of those 10 lights?

This has probably all been answered many times before, but I thought you may be able to advise me directly on those three questions at least, having your brain cells already saturated with such things.

Chris Harries
Dynnyrne TAS

The terms transformer and driver are often used interchangeably in the industry, which doesn't help as they are two different thngs. A transformer just changes the voltage from one level to another. Whether it is an old style iron-core transformer or one of the more modern electronic types, they still do the same thing. Some electronic transformers can have a DC output, which makes them a bit more than a transformer, in most cases they would be considered by electronics type people as being a power supply, but to the average installer/builder they would still call them transformers.

A LED driver is a different beast. LEDs themselves (as opposed to LED bulbs—the LED is the light generating device inside the LED bulb) require current limiting. Unlike a regular bulb, which you just feed with a fixed voltage and it sets its own current, a LED has to be fed with a controlled current and it sets its own voltage. So, inside a LED bulb, you will have one or more LEDs and a LED driver, which controls the current through the LED. Some LED systems (usually the commercial types, rather than domestic ones) have LED bulbs which are just the LEDs inside a case, with the driver externally. Often the driver runs directly from mains power, converting the 240 volts AC down to a DC voltage suitable for the LEDs, at a controlled current, so they are effectively a powersupply/controller all in one. Another example of this is LED bulbs that screw into regular mains 240 volt sockets. The driver (in this case built intot he bulb) does all the voltage conversion and current control, much like the driver inside a compact fluoro.

So, there are all sorts of drivers and transformers and power supplies, some that only need themselves to drive LED, some that are used in conjunction with another driver.

For the average MR16 (i.e. 12 volt halogen) retrofit, you will have a transformer at each light fitting which then drives the bulb, be it halogen or LED.

The reason they state that one transformer must be used per bulb is one of safety. If you should leave the home and the person moving in reinstalls halogens, you have a serious overload problem. For instance, you might have a 60 watt electronic transformer driving 10 x 5 watt LED bulbs. This will work fine, but if someone then installs halogens in some or all of those sockets, the load will be far more than the transformer's rating and it will be overloaded. Usu-

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ally, this just means the transformer will shut down, but the older iron-core types will simply overheat until their inbuilt thermal fuse operates.

It sounds like your system is one of those as is found in commercial premises and some homes, where multiple bulbs are strung on suspended wires or placed in spotlight fittings and driven from one large transformer. In this case you are fine replacing all of the halogens with LED bulbs running from one transformer, there should be no problems as the total load is decreasing, not increasing, and the system has already been designed to handle the maximum load it is possible to install.

If you are also replacing the old transformer with an electronic one, you need to make sure the electronic transformer you are using has a similar rating to the one it is replacing, just in case the above scenario, where all the fittings end up with halogens again, occurs. If you look at your current old transformer it probably has a 500 or 600 watt rating, so you can't replace it with a 60 or 110 watt electronic unit.

Lance Turner

Solar panel ratings

I am just curious how you can get more than the maximum rated output of the panels plus any tolerance.

I have a 3.15kW system comprising of 18 Suntech 175W panels. They have a ±3% power tolerance. So the maximum I could achieve would be 3150 watts plus the 3%, which is 3244 watts.

My panels are nice and clean now after some recent rain here in Adelaide. Today I was watching the LCD on the inverter and I was seeing peak output of 3900 watts as the sun came out from behind clouds. But what suprised me was I was seeing sustained output of 3650 watts for five minutes or more. I really don't know how that is possible but that is what the display was indicating.

Tracey Williams

When systems are designed they allow for derating (lower output) from panels for heat, dust, shading etc. Cool clean panels often perform better than the panels specs. Panels in Antarctica work way, way over specs because of the low temperatures. Your panels were cool and clean giving higher performance. Also, there may have been reflection from the clouds in the area giving even higher light levels. It may also be a testament to the array of panels, which may be conservatively rated by the manufacturer.

All these factors are likely to have added up to a short term higher output from your panels.

I would be very happy about it. It is a good thing.

Mick Harris

This is a great example of why I dislike the now all too common practice in the industry of specifying inverters that have the same or an even slightly lower output rating as the array they are connected to. On systems like this the extra energy available under the conditions described above is simply wasted, as the inverter limits the output power to its design rating, not to what the panels are actually able to provide.

Lance Turner

A couple of questions

I recently read in *New Scientist* about solid-oxide fuel cells (SOFC) from companies like Bloom Energy in California, Topsoe Fuel Cell in Denmark and Ceres Power in the UK. They look very interesting. Could you publish something about this?

Regarding the CSIRO UltraBattery, is anybody thinking of using these in electric cars? If so, who? If not, is there any reason why not?

Lee Seldon

We have looked at solid-oxide fuel cells in the past, the Australian company Ceramic Fuel Cells Ltd has been working on them for a long time and has recently released a working system.

I'm not a fan of fuel cells to be honest, they are generally complex and expensive devices with high maintenance requirements, and when everything is factored in, not the most efficient way of converting a fuel into electrical energy. We probably will do an update in the future.

The UltraBattery is basically a modified lead-acid battery. There are several other companies working on or already making similar batteries, such as www.axionpower.com and Firefly Energy, but it seems the latter has shut down recently. I tried contacting the company that was listed as being the supplier of the CSIRO battery but got nowhere.

Basically, the CSIRO and similar batteries, while having greater cycle life and power densities than regular lead-acid batteries, have a similar energy density to a regular battery, which is simply too low for most commercial EVs. This is why the larger players in the car industry aren't considering them, although some of the smaller manufacturers are using lead-acid batteries to provide low cost EVs. As far as we can tell, all EVs planned by the larger manufacturers are going to use higher energy density chemistries like lithium ion in order to keep weight down and range as high as possible.

Lance Turner

Notes and errata: Issue 111

The article titled *Monkeying around with solar* failed to explain that technically, setting up a grid interactive system as described in the article goes against electrical regulations and may be illegal. A reader has pointed out that the inverter could pose a shock hazard as it is essentially outside of the RCD and so could cause injury through electric shock. We strongly recommend that anyone installing a small system such as this have it wired to the Australian Standard for such systems and not plug it into a regular power point. While this will add considerably to the cost of the system, it will ensure your home's RCDs will continue to protect you.

6 Stars Queensland

In Upfront 'Build by Stars' we wrote that 6 Star residential ratings commence nationally from May next year. In fact, the 6 Star residential standards came into effect from May 1 this year in Queensland, with all states due to implement the 6 Star standard by 2011.

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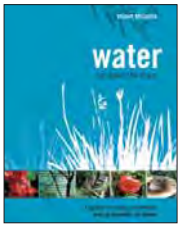

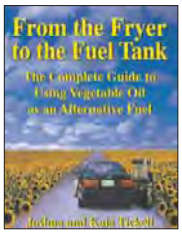

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Kits, LEDs and energy-efficient devices

LED Replacement Bulb: cool white and neutral white

Price: $29.95

This LED lamp has been designed as a direct drop-in replacement for MR16 halogen lamps. Its 5W power rating ensures a high level of brightness that is equivalent to a 20W halogen MR16 lamp. Also, unlike the halogen equivalent that generates high levels of heat, these LED type MR16 lamps generate very little heat and are therefore safer. The body is made of aluminium for good heat dissipation, to keep the LEDs running as cool as possible.

Available in 38 and 60 degree beam angles.

Item code: LEDHAL_5WMR16_XXYYCLR — replace XX with CW (Cool White) or NW (Neutral White). YY is the beam angle (38 or 60)

Non-contact thermometer

Price: $102.50

This non-contact infrared thermometer can measure from -50 to 650 deg C, making it ideal for measuring the surface temperature of your solar panels or checking for thermal leaks in your home.

Item code: THERMO_INFRARED_ED72

Digital lux meter

Price: $51.65

A handy digital light meter which will measure light in three ranges, from 0.1 to 50,000 lux. This meter is ideal for measuring light levels when replacing incandescant lamps with more energy-efficient alternatives, or for checking light levels on solar panels.

Item code: METER_LUX_50K

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Note: not suitable for battery charging use!

Item code: MAXIMISER_6AMP_KIT

12 amp maximiser kit

Price: $70

Drive pumps and other motor-driven devices directly from a solar panel or panels without the need for batteries.

Item code: MAXIMISER_12AMP_KIT

30 amp speed controller kit

Price: $49.95

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

Constant current circuit kit

Price: $9

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

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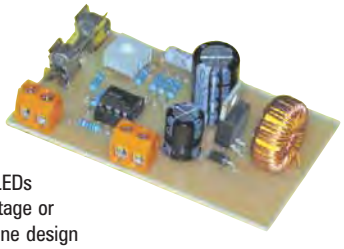

Price: $30

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

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Difficulty rating: ★★☆☆☆

The good parts inside old VCRs

If you're the type of person who sees possibilities when confronted with useable parts, there's plenty to inspire inside a VCR, writes Julian Edgar.

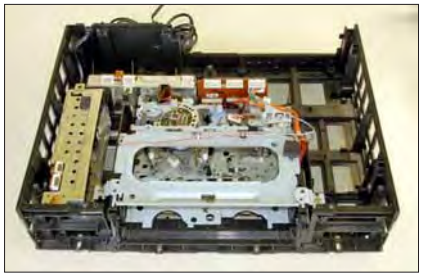
Now is a great time to be salvaging VCRs. With the move to DVD players and, even more significantly, digital video recorders, VCRs are being discarded in huge numbers. You can find them at the tip, at garage sales, even in kerbside rubbish pick-ups. The most you should pay is a few dollars, but more often than not they are free.

So why would you bother salvaging a VCR? And wouldn't it take hours to pull it apart to get the good bits? Well the answers are, respectively: lots of reasons and no. And contrary to what you might expect, the best bits are mechanical rather than electronic. The trick with salvaging VCRs is to quickly pull the thing apart, sort and keep the good bits and then get rid of the rest.

Here's a typical starting point. This is what you might call a medium-age VCR. Older ones are better and heavy older ones are better again!

Why is this? The heavier a VCR, the better the quality of salvageable components inside. In fact, to go to extremes, the ancient U-matic video tape machines weigh an incredible amount (some can barely be lifted) and inside you'll find engineering that is fantastic, including solenoids and switches.

On the other hand, a super lightweight VCR has generally less of everything you might want. However, any VCR is worth picking up for its parts. At the very least you should get a useful motor and a few other goodies.



It takes very little time to remove the cover (keep those screws!) and strip out the main circuit boards. In fact, it's worth stressing that disassembling a VCR is really a quick and easy process. Expect to take perhaps only half an hour to do the first one from start to finish. When you get speedy, you can do it in 10 minutes.

It makes sense to do all the mechanical work in one go, coming back to the electronic parts later in the process. So with the electronic boards put to one side, the next step is to remove the tape transport mechanism and drum. This assembly is almost always found on a sub-chassis which is screwed to the plastic of the inner enclosure.

Here's the inner chassis on its own. As you can see, already the contents of the VCR have been narrowed down to just this and the electronic circuit boards.

Throw the rest away as you take it off: including the top and bottom covers (unless you need sheet metal), front cover and inner plastic chassis. The next steps involve pulling this piece of gear apart.

You'll need a good quality medium point Phillips head screwdriver. Invariably, some of the screws are tight and once you start mangling screw heads, the process rapidly gets all too hard. You may also need a very small Allen key and a Torx bit screwdriver.

The best bit

Here's one of the absolute pearls. I'm happy collecting a whole VCR just to pull this part out, that's how good I think it is.

But what is it?

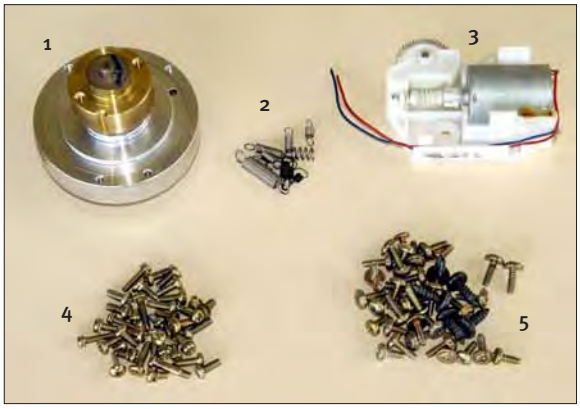
It's the spinning drum that carries the video heads that read and write to the tape. The drum is designed to rotate with great precision many millions of times during the life of the VCR and as a result, it's beautifully made.

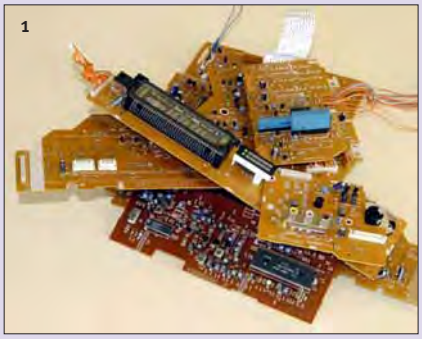
For uses for the video drum see 'the video drum and its uses' box.

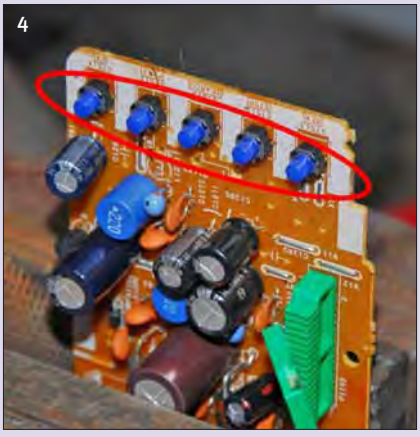
Here's what we have so far: (1) the video drum; (2) 10 springs (nine extension and one compression); (4) 38 machine screws and (5) 44 self-tapping screws.

'He's joking,' you're saying. 'Why bother collecting the screws?' Well, you tell me which local hardware store has small plated Phillips head self-tappers in stock? Or a fine metric thread Phillips head machine screw—just what you need as a replacement in a piece of gear you're working on? Springs? How many times have you said to yourself: 'Hey, all this needs to fix it is a little spring,' and then you've looked in frustration for a spring, *any* spring?

Finally, (3) is a DC brush-type permanent magnet motor that uses a worm reduction drive to turn a slowly rotating output shaft. It would make a perfect winch for a model boat, or a merry-go-round for a model railway layout, or a bespoke kids toy.







Electronic boards

Remember all the electronic boards we put to one side? Well, here they are.

Now I know what you're thinking, he's going to tell us to get out the soldering iron and solder sucker and laboriously unsolder every one of these trivial cost components, and who'd bother wasting their day doing that?

Instead, what I do is identify the bits that I am very likely to have a use for and that cost more than cents to buy, or that are not readily available off the shelf. These include components like colour-coded RCA sockets, which are great for anywhere you need a socket on portable gear. And the high power wire-wound resistors are perfect for dropping fan speed or dimming lights.

Forget using the soldering iron. All you do is hold the PCB in a vice, grasp the component you want with a pair of pliers and aim a normal heat gun at the solder side of the PCB. It takes literally a minute to salvage 10 or 15 components, and that's time worth spending.

In photo 4 I've highlighted the miniature push buttons. And just check the size of the push button in photo 5! It's ideal where you want to add a really unobtrusive momentary switch, whether that's to de-activate an alarm or trigger a function.

From top: 1. Electronic boards; 2. colour-coded RCA sockets; 3. high power wire-wound resistors; 4. miniature push buttons; 5. push buttons close up.

I also collect the power cords. These are invariably twin sheathed cable that's excellent when you want a reasonably heavy duty cable that looks neat and unobtrusive. For example, I've used this cable under the bonnet of cars to power accessories.

These belts (usually one per VCR) are also worth salvaging. I have used them as replacement belts in other machines but my major real-world use has been as gasket rubbers when I've wanted to seal around the top of a box or even inside the front of a bike headlight.

The trick with VCRs is to quickly pull the thing apart, sort and keep the good bits—and then get rid of the rest.

See over for video drum uses

Salvage it!

The video drum and its uses

So what about that video drum again? Here's what a video drum assembly typically looks like. The first step is to undo all the visible screws...

...and that might involve a Torx bit or small Allen key.

The parts like that arrowed here can be broken off with a screwdriver. Note that you should always wear goggles as this material easily shatters and is very sharp.

As you disassemble the video drum, you'll start revealing the good bits, like these precision sealed ball bearings in the alloy housing and the hardened steel shaft that fits through the bearings.

The brass collar is held in place on the shaft with an internal Allen head grub screw. You'll need the right sized Allen key—don't try to drill out the grub screw as the (working) collar is very valuable.

Some elements on the shaft are a press fit. However, the shaft is easily moved if the element is supported on vice jaws and a pin-punch and hammer are used to push the shaft through.

It might not look all that exciting but consider this. You now have a precision-ground, hardened steel axle (at left). You have two precision sealed ball bearings that match the axle perfectly. You have two light alloy housings, one of which is normally a press fit on the axle and the other that houses the two bearings.

Amongst other things, I've used video drum assemblies to make wind vanes and manual anemometers. To assess wind speed you just watch how fast it is turning—the precision bearings make it incredibly sensitive.

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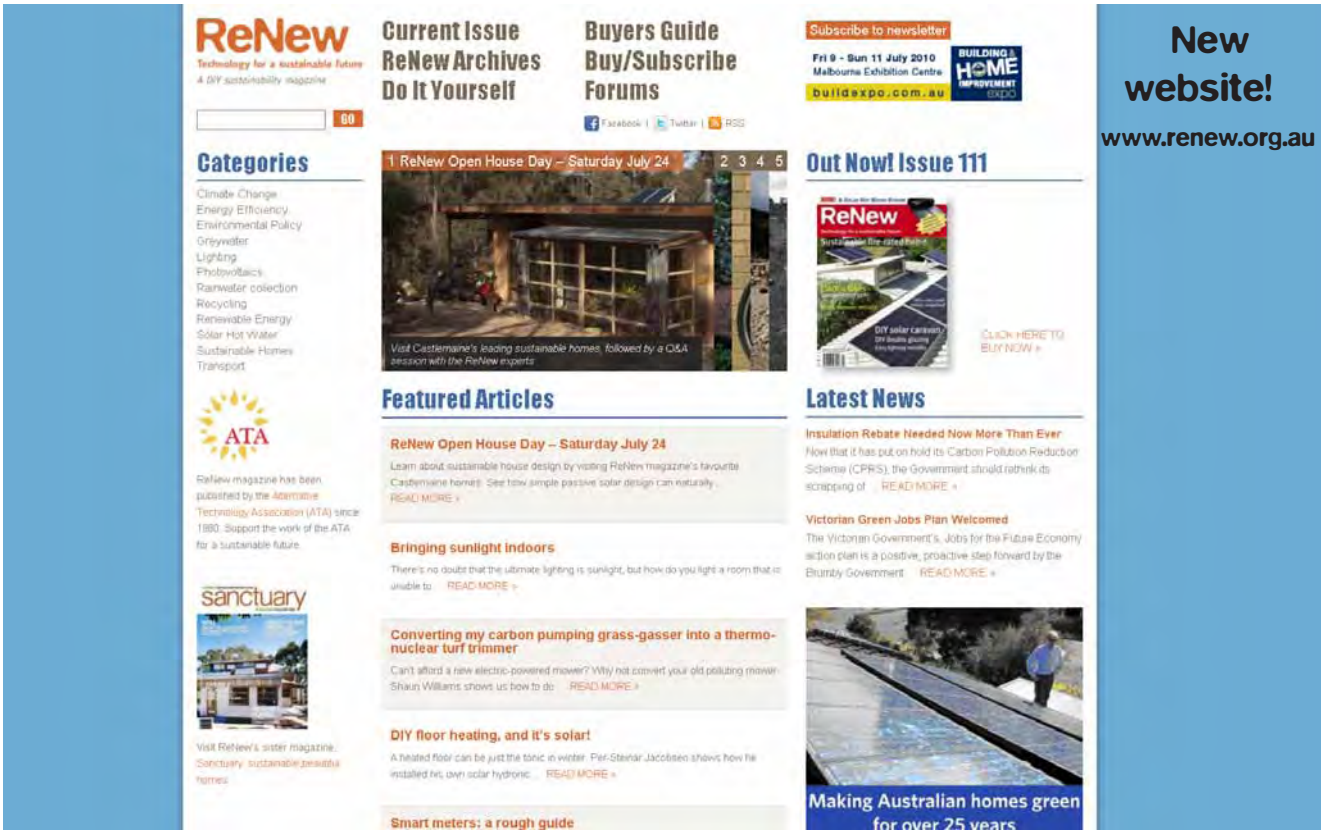

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