ReNew

Technology for a sustainable future

Issue 142

SOLAR PANEL GUIDE *INSIDE*

WIN a Flex PowerPlay smart solar home system valued at up to **$7999**

*Australian residents only; details p83

Solar for all

Solutions for renters, landlords, apartments & more

PLUS

- Solar system upgrade tips
- PV recycling options
- Induction cooktop mini guide
- Getting solar: from research to install

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Scoring your home: efficiency scorecards
Solar monitoring basics: from inverter to app
Beyond solar PV: make use of renewable heat
EV update: more options for Australia

Solar Panel Buyers Guide inside

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← **Cover image: More Australian Solar Homes (MASH).**
Traditionally, solar energy has been hard to access for tenants and apartment dwellers, but happily a range of options are emerging to enable them to join the solar revolution (page 20). Linnet Good (pictured) and her partner Dev Mukherjee successfully negotiated with their landlady to get a 3 kW solar system installed on their rental home in Castlemaine, Victoria, via a solar bulk buy run by local sustainability group More Australian Solar Homes (MASH). Case study on page 26.

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Products

In this section we share info about products that sound interesting, sustainable and useful. Product listings are not an endorsement by *ReNew* or the ATA of any particular product—they are for reader information only. They are not product reviews and we have not tested the products.

01

Ultra-portable solar cooker

We have been following the GoSun range of solar cookers and while they look like nice devices, they can be a little pricey.

The most recent addition to the range, The GoSun Go, has changed that, with a much lower price and a very simple design that gives a high level of portability.

The cooker simply consists of an evacuated tube and a pair of reflectors, all encased in a waterproof case. Just fill the tube with food (a food tray is provided) or fill with water and point the cooker towards the sun. Because the whole unit is waterproof, you can simply dunk the cooker in a clean water source to fill it—perfect for camping.

The Go includes an adjustable stand along the clamshell hinge to make finding the right sun angle easy, and the unit can boil around 400 mL of water in as little as 30 minutes and will cook most meals in 20 to 30 minutes.

The cooker doesn't need full sun to work. GoSun states that any day where a visible shadow is cast is bright enough to use the cooker—cooking times just take a bit longer.

The cooker measures 360 x 178 x 86 mm when closed and weighs less than a kilogram.

Current (on Kickstarter) RRP is US$99, final price TBA. For more information go to www.gosunstove.com. GoSun products are distributed in Australia by Renee Napthali, ph: 1800 787 2787, renee.n@caravanrvcamping.com

02

Simple EVSE

As transport moves to electric power there is a need for simple, adaptable EVSE (electric vehicle supply equipment) units for installations in shopping centres or other "free-to-charge" charging points where metering isn't needed. The eBasic WallBox has been specially designed for unmetered indoor or outdoor locations, and has no access control or networking capability. It's a simple EVSE for circuits that are unmetered or metered at the switchboard. It can be wall or bollard mounted.

The eBasic can be connected to a 15 or 32 amp power supply on a single- or three-phase connection, providing a maximum output of 22 kW. The current limit can be set via an internal switch to match the current capacity of the circuit, from just 6 A to the full 32 A.

Because the eBasic can be wired up to single- or three-phase power, the same model can be installed on sites where there is a mix of single- and three-phase circuits. In addition, charging station providers (or homeowners) can upgrade the power supply from single- to three-phase without having to upgrade the EVSE.

The eBasic features a three-colour LED indicator on the front panel for basic charge monitoring, and the unit is fully compatible with all pure-electric and hybrid cars including the Nissan Leaf, BMW i3 and Teslas.

RRP: $850. For more information and to buy, contact E-Station, ph: 1300 695 774, info@e-station.com.au, www.e-station.com.au/ebasic

03

Natural insulating bricks

We don't normally think of clay building products as being good insulators, but Clinka expanded clay materials are a different matter.

Clinka makes two main products, clinkaBLOKs and clinkaFILL. Both are based on small balls of expanded clay which range in size from 2 mm to 20 mm. The balls are produced by passing 'fat' clay (clay with a high mineral content) through a rotary kiln. The result is small balls full of air pockets and a hard outer shell—an ideal natural insulation material.

ClinkaBLOKs consist of 'Clinka' balls bound together using cement to form blocks of various sizes and shapes, including wall and footing blocks and isoBLOK, which has an inner and outer layer of clinkaBLOK and a core of insulation, giving the block a total R-value of 3.4.

ClinkaFILL is just the loose 'Clinka' balls and is suitable for insulation under slabs, where a 150 mm layer of clinkaFILL provides around R1.77 of insulative value and eliminates the need for a vapour barrier. It can also be used for backfill against retaining walls to reduce hydraulic loading, as a green roof drainage material and as aggregate in concrete to reduce weight.

RRP: POA. For more information contact Clinka, ph: 0411 588 603, ryan@clinka.com.au, www.clinka.com.au

Raising the roof
Solar for renters and apartment dwellers

Tenants and residents of strata complexes have traditionally struggled to access solar. Dr Björn Sturmberg and Anna Cumming look at how these groups can join the solar revolution.

IN AUSTRALIA, we have an 'energy trifecta' of famously abundant sunshine, infamously high electricity prices and efficient solar supply chains. It's no surprise then that Australians have embraced the option of rooftop solar systems at record rates. By September this year we'd collectively installed over 1.7 million solar systems, and in Queensland and South Australia every third house is solar powered. Forecasts all agree that the solar boom is far from over, particularly now that the advent of affordable household battery systems is fuelling the divergent dreams of either becoming a 'gentailer' (generator-retailer) of your excess solar power in a peer-to-peer network, or defecting from the grid entirely.

While the growing ubiquity of solar is a wonderful outcome environmentally, socially it is causing tension between the 'solar haves' and 'solar have nots'. To be clear, the solar haves are in fact saving all Australians money on their electricity bills[1] through their supply of excess solar power to the wholesale market at times of high demand. Still, the cheapest source of electricity for the Australian home is behind-the-meter solar and those who cannot access this are being left behind to bear the full burden of skyrocketing electricity prices.

One main reason for being locked out of solar is not owning your own roof. Renters and apartment dwellers make up more than one in three Australians and have traditionally struggled to access solar; the grid is also missing out, as all those roofs represent significant untapped solar potential. Happily, the demand is there, and options are emerging even for these tricky market sectors.

↑ At Stucco Apartments, a student housing cooperative in Sydney, residents successfully retrofitted an embedded network with solar and batteries to provide locally generated solar electricity to all apartments. Read the full story in *ReNew 139*.

What's the problem?

Renewables are a bit like a bar tab: the free drinks are delightful, but someone first has to hand over a credit card. In the case of solar systems on rental properties, that someone is the owner, and the solar juice flows solely to the tenants. In apartments the drinks are on the body corporate account, and the party involves all the residents.

More formally, this is known as a split-incentive problem: one group bears the cost (the capital cost of the solar system) while the benefits (free solar electricity) are enjoyed by another.

How is solar different to an air conditioner?

The split-incentive isn't unique to solar. Pretty much any investment an owner makes in their rental property will be enjoyed solely by tenants and yet owners frequently invest significant capital into renovations and appliances. Similarly in apartment complexes it is commonplace to share the costs and benefits of common areas and common assets, despite not making precisely equal use of these assets. So what makes investing in solar different to investing in an air conditioner or renovating a shared garage?

While air conditioners and garages have tangible benefits that become apparent immediately on use, the benefits of solar systems are intangible, noticeable only on infrequent electricity bills. This is compounded by the relatively high cost of a solar system (though prices have dropped dramatically in recent years), mistrust of the energy market and the perception that

Sharing the solar benefits
Rentals and apartment case studies

If you don't own your own roof, how can you get solar? We speak to a variety of tenants and apartment owners to see how they went about it.

Doing a deal with the landlady

Originally hailing from Sydney, Dev Mukherjee found winters in his poorly insulated rented sharehouse in Castlemaine, central Victoria, pretty hard to handle. Although from Melbourne, his partner Linnet Good also felt the cold, and she worked from home. The all-electric house also incurred large electricity bills—up to $800 per quarter in winter for the three tenants, as they only had a single reverse-cycle heater in the living area and used plug-in radiators elsewhere.

After living there for a couple of years, and prompted by a bulk-buy solar scheme offered by local sustainability group Mount Alexander Solar Homes (now More Australian Solar Homes), Dev and Linnet approached their landlady about installing solar on the property in an effort to reduce their energy bills as well as the house's environmental impact.

"Our landlady was supportive," says Dev, "though of course she was concerned about the cost. She wanted to ensure she'd recoup the cost while the system was still under warranty. The panels had a ten-year warranty, but the inverter was only warranted for five years." Eventually a suitable agreement was reached, and in spring 2014 a 3kW solar system was installed at a cost of around $5000.

The electricity bill remained in the tenants' names after the solar system was installed, and they retained the feed-in tariff for exported solar generation. They negotiated a $25 per week rental increase with their landlady, calculated to pay back the cost of the solar system over five years. "Our average bill reduction we calculated to be slightly more than $25 per week," he says, helped by changing their behaviour to make best use of the solar, like running the washing machine in the middle of the day.

Image: More Australian Solar Homes

↑ Linnet Good with the solar panels she and her partner Dev Mukherjee approached their landlady to install on their Castlemaine, Vic, sharehouse. In return, they agreed to a small weekly rent increase to help cover the cost of the system.

In addition, they didn't have another rent increase in the time that they lived in the house. (In the end, despite intending to stay long term, they moved out as the landlady wanted to sell the property vacant; Dev believes the solar system was a drawcard for the purchasers.)

Dev and Linnet encourage other renters to start a conversation with their landlords about installing solar. "It helps if you have a good relationship with the owners, and be mindful that, as they put up the capital, they must be able to see a return on that investment."

Individual solar systems for strata—success in Bondi

Edna Ross's unit is one of five in a small strata complex in Sydney's Bondi Beach. A self-confessed "solar nut", Edna recently got the ball rolling to install solar on their building. "If I'd lived in my own freestanding house I would have done it much earlier," she says. An information session on solar options for strata run by her local council got her thinking; she also met energy efficiency consultant Ethan Burns of Sustainability Now, who provided advice.

"I did some research and put the idea of installing solar to my neighbours. The agreement took about an hour," she says, "a testament to my smart neighbours."

DIY pelmets for renters

by one of the ATA's energy efficiency experts, John Knox

WE ALL know we need to get smarter about how we use energy and, in much of Australia, heating is a large part of that energy use. Renters, especially, can have a hard time improving the heating efficiency of their homes.

One thing that many houses lack is pelmets above the curtains/windows. Pelmets help keep warm air in during winter, but also help to reduce heat from getting in during summer.

If you want to know the physics of how pelmets work see www.bit.ly/2Arh6lA. Here are some instructions on how to make inexpensive, lightweight pelmets that can be attached to the wall with tape—good for renters, as they don't require drilling into the walls.

Materials you'll need

Corflute is a cheap plastic board with a corrugated plastic centre which you may associate more with signs for real estate agents, elections and protests! It comes in sheets up to 2400 x 1200 mm and can even be bought in longer lengths off the roll. It comes in a variety of thicknesses but we will be using the standard 3 mm. It's easy to cut and eminently foldable.

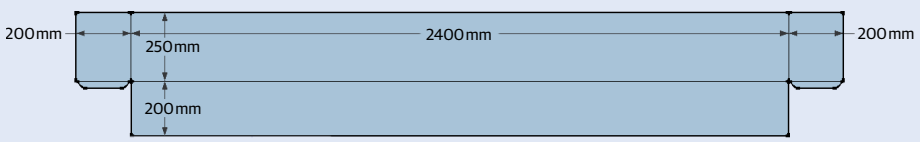
You'll also need something to attach the pelmet to the wall. Use tape or blu-tack that won't leave a mark if you take the pelmets down when you leave.

Image: iStock: AlexeyVS

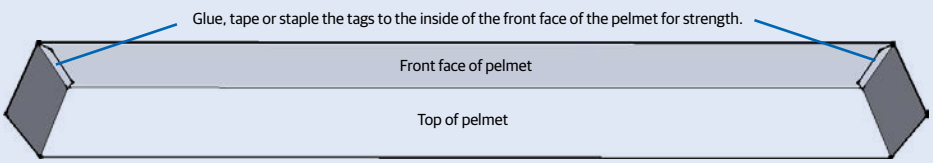
↑ Pelmets should be enclosed on the top and sides for greatest effectiveness. Pelmets open on the top are simply decorative and do nothing to improve energy efficiency.

Instructions

1. First, measure up! Measure the width of the curtains and depth out from the wall around your curtains when they are both open and closed; you need to know how far out from the walls the pelmet will need to extend. As they are drawn back they tend to push out from the wall. I add 50 mm to each end and to the distance out from the wall to give some clearance. I find a height of 200 mm is adequate; this gives a 50 mm clearance above the curtains and 150 mm in front of them.
2. On a piece of paper, sketch out the unfolded pelmet. This lets you see the design to make sure it is correct before transferring it to the corflute. This will be a rectangle of the required width x depth + height. I add tabs on each side to assist with holding the whole thing together. See Figure 1 for an example.
3. Transfer the design to the corflute and carefully cut it out.
4. Now comes the tricky bit. You want to score through the outer layer of corflute along the fold lines (where the tabs are and the fold at the front) without cutting completely through. A bit of practice should make you an expert!
5. Bend the pelmet into shape and either tape or staple it together. Using a white broad (50 mm) gaffer tape will make this easier without making the end result unsightly, or strong double-sided tape between the tabs and the inside of the front face will work well too.
6. You should now have something similar to Figure 2!
7. Place your finished pelmet over the curtain, with 50 mm clearance all around, and tape or blu-tack onto the wall.
8. Voila!



↑ Figure 1. A simple design for DIY pelmets made from corflute or a similar material. In this example, the window is 2300 mm wide and the curtain sits 200 mm out from the wall. This makes the pelmet 2400 mm wide and 250 mm deep.



↑ Figure 2. The completed pelmet, shown upside-down and looking at the inside.

Scoring your home
Energy efficiency scorecards

Energy efficiency scorecards promise a way to compare homes and kickstart energy efficiency and liveability improvements, for both renters and homeowners. The ATA's Katy Daily looks at how the Victorian government's Australian-first scorecard scheme could help her draughty rental home.

SINCE moving from the USA to Melbourne six years ago, my family of four has been renting a tastefully restored 1926 art deco weatherboard. And, in the typical refrain you hear from almost every immigrant from a colder climate, I've never felt as cold as I did that first spring in Australia.

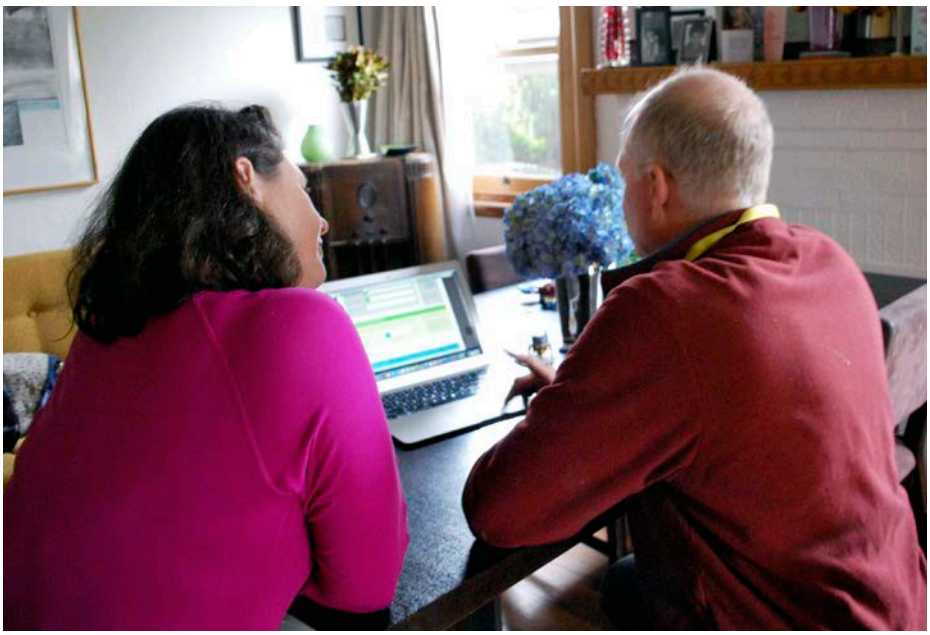
Working at the ATA armed me with plenty of ideas for things I could do as a renter (and that we can take with us when we move) to make our draughty home more energy-efficient: we've replaced almost all the lights with LEDs, installed a Methven Kiri showerhead, added a Valvecosy to our hot water system and started insulating the hot water piping, and bought an energy-efficient refrigerator and washing machine.

We've done a good job of getting our electricity usage down to a respectable 4 kWh/day on average, but the house leaks like a sieve and my partner and I are both loathe to turn the heat on just to heat up the neighbourhood! As a result, our house is very uncomfortable in the winter and can be oppressive on very hot, still days and nights. We've been wanting to approach our landlord about draughtproofing, solar and other improvements to help make the home more comfortable while maintaining the low running costs, but didn't know how to start the conversation.

Enter the Victorian government's new Residential Efficiency Scorecard which rolled out in 2017. The scorecard is an Australian-first home energy rating program that gives (yet another) star rating, this time for your home, on a scale from 1 to 10, similar to the energy use star rating on a fridge or washing machine. Not to be confused with the NatHERS Star rating which describes the thermal performance of a home, the scorecard rating represents the running cost of the fixed appliances in a home (heating, cooling, lighting, hot water and pools/spas) and is intended to be used as a guide to make home improvements efficiently and cost-effectively.

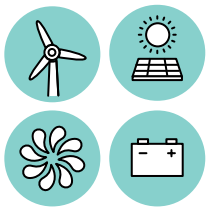
In the first phase of the program, until April 2018, six selected not-for-profit organisations are deploying independent, accredited assessors to deliver free scorecard assessments for health-care and pensioner concession cardholders, those on a retailer hardship program, those who are culturally and linguistically diverse, community housing residents and renters. Anyone else can access the service for a fee. In April 2018 this will be expanded to for-profit companies who can perform the assessment and may also be able to perform the necessary improvements to raise the house's score.

The assessor comes to your home for an on-site assessment. They use the government-supported Scorecard webtool to rate the energy efficiency of the home's construction and fixed appliances like heaters, air conditioners, hot water systems, spas and pools, and renewable energy features such as solar PV. At the conclusion of the hour-long assessment householders receive a two-page scorecard certificate which provides an overview of the energy efficiency of the



↑ Data collected during a scorecard visit is entered into the scorecard software and a score generated on the spot. The assessor will discuss this and any specific questions with the householder, and send them a report within a couple of days.

100% renewable by 2030
How are we progressing?



In late 2016, we reported on ATA analysis that showed a 100% renewable grid is feasible and economic in the long-term. Here, Andrew Reddaway follows up to see how we're progressing towards that goal.

THE last year has seen much action in the electricity grid, both announced and commenced. It's become clear that the electricity grid's transition is well underway, as coal-fired power stations are being replaced by renewables. However, poor planning and coordination has caused problems such as curtailment of wind generation in SA (see box).

Transition planning needed

As the grid transitions to a high level of renewables, good long-term planning is required. If the grid's current planning arrangements continue unchanged, decisions and investments will be uncoordinated. They may make sense for the short-term profits of individual companies, but may not lead to a well-designed overall system. The Chief Scientist considered this, and recommended an "integrated grid plan" by the Australian Energy Market Operator (AEMO).

In the current system, generators compete against each other, may close without notice and have a business incentive to conceal their future intentions.

There is no guarantee that new power stations will be built—the system expects that investors will foresee a shortfall, identify a profit and construct the needed infrastructure. To assist investors, AEMO annually produces the Electricity Statement Of Opportunities report attempting to identify future shortfalls. This document only looks ahead 10 years, and doesn't consider scenarios such as 100% renewables. AEMO also produces a transmission report, which looks ahead 20 years but has a relatively narrow focus on transmission lines and related assets.

In hindsight this system has a clear flaw.

Image: © The University of Queensland

↑ Solar farms can coexist well with sheep, as space is normally left between rows to avoid self-shading. Solar farms totalling 23,000 MW for the ANU plan would require about 70 million panels: a large number, but clearly achievable as by December 2015 Aussies had already installed more than 23 million panels on rooftops. The farms would cover about 230 km², about 1.8 times as large as Australia's largest irrigated area, Cubbie station. Agriculture can also continue unimpeded under the proposed wind farms.

If investors fail to act in time, generating capacity may be insufficient to meet demand. It takes several years to build a new power station, but an old one can be closed very quickly—Hazelwood's owners provided only five months notice. Individual asset owners have no responsibility for overall system reliability.

This is why interventions in the market have been required in 2017, including the SA government's Energy Plan.

The current system also relies heavily on clear, long-term government policy to guide investors. Without such policy, investors face the risk that their newly-built asset might have to contend with unexpected new incentives, rules and regulations.

The best plan so far

In the absence of long-range planning by authorities for a high-renewable grid, the best studies have come from universities. In February 2017, the ANU published a clear vision for our future grid. Its researchers found the most economic combination for a fully renewable grid comprises:

- wind farms (45,000 MW)
- solar farms (23,000 MW)
- rooftop solar (17,000 MW)
- existing hydroelectric and biomass generators (10,800 MW)
- pumped hydro energy storage
- extra transmission lines.

Total generation capacity in the plan is 93,300 MW, nearly double our grid's

PV recycling
Where do all the panels go?

The solar revolution has brought many environmental and, increasingly, economic benefits. But each photovoltaic panel is also a future item of waste. So what do you do when a panel comes to the end of its useful life? Moreover, what do you do with billions of them? Eva Matthews investigates.

FROM its infancy in the 1980s, solar as a source of renewable energy has finally become mainstream. In Australia, installed solar capacity has grown from 0.13 GW in 2010 to 6.2 GW as at mid-2017—a 4500% increase. Globally, in the same timeframe, capacity has grown from 50 GW to 305 GW. Fantastic!

Assuming that today's panels are typically 270 W to 300 W, this equates to a current global total of at least 1.1 billion panels—and given the early panels were just 60 W, this number is likely to be higher in reality. That's a mind-boggling figure! And it's only going to get bigger, with global installed capacity projected to reach 4500 GW by 2050.

At some point (let's assume 25 years, the standard warranty period), all of these panels will come to the end of their useful lives … and then what? Given a standard panel weight of 18 kg, that's roughly 20 million tonnes of potential waste to manage.

Panels may also be retired before the 25 years is up. Leaps in technology may lead to systems being upgraded early and a significant number of panels (roughly 10%) fail early due to damage during manufacture, transport or handling.

Trash and treasure

Unless properly managed, all this potential waste becomes a monumental problem. To date, unusable solar panels have often ended up in landfill, along with many thousands of tonnes of electronic waste (e-waste) despite programs to divert the waste for recycling.

PV panels contain small amounts of hazardous substances. These will only leach out if the panels are broken up—unfortunately, this is pretty much guaranteed to happen when they are deposited in landfill. In small amounts, the toxicity may be negligible, but when you're talking millions of tonnes of panels, the danger of contamination is a significant concern. Silver, tin and lead (particularly in older panels) are the hazardous components of mono- and polycrystalline silicon panels (estimated at 50% to 60% of the market); indium, gallium, selenium, cadmium, tellurium and also lead are found in thin-film panels.

Currently 85% to 95% of a panel can be reclaimed and recycled. Some damaged or early-fail panels can be repaired and resold on the secondhand market or to developing countries at reduced prices, allowing access to solar technology to those who might otherwise not be able to afford it. Glass, copper, lead, aluminium and the hazardous semiconductor materials can be reclaimed through a mix of mechanical and chemical processes that have relatively low environmental impact, and either melted down for recycling or sold on as raw materials to be used in the creation of new solar panels and other electronics, reducing the embodied energy going into their manufacture.

Not only does the reclaiming/recycling

↑ Piles of PV panels waiting to be recycled.

Image courtesy Reclaim PV

Soak up the sun
A solar panel buyers guide

We've contacted photovoltaics manufacturers for details on warranties, cell types, size and price to help you decide which solar panels are best for you.

SOLAR photovoltaic (PV) panels have become a common sight in the Australian urban landscape. From powering domestic dwellings to providing power for camping or even hot water, PV panels are everywhere. In Australia there are around 1.7 million rooftop solar installations, totalling over 5.6 GW of installed capacity.

However, there are still many homes without solar. This article aims to provide guidance for those looking at purchasing a solar installation, whether a new system or an upgrade. It includes types of solar panels and factors to consider when buying them. The guide focuses on PV panels only. For information on other components that may be used in a solar installation (e.g. inverters), system sizing and economic returns, see 'More info' at the end of the article.

↑ Over time, the average size of solar panels has increased to the point where panels over 250 watts are common, along with larger systems!

Solar panel types: monocrystalline, polycrystalline and thin film

Solar panels are made from many solar cells connected together, with each solar cell producing DC (direct current) electricity when sunlight hits it. There are three common types of solar cell: monocrystalline, polycrystalline and thin film. There are very few thin-film panels on the residential PV market—most panels are of the crystalline type.

Both monocrystalline and polycrystalline cells are made from slices, or wafers, cut from blocks of silicon (one of the most common elements on Earth). Monocrystalline cells start life as a single large crystal known as a boule, which is 'grown' in a slow and energy-intensive process. Polycrystalline cells are cut from blocks of cast silicon rather than single large crystals.

Thin-film technology uses a different technique that involves the deposit of layers of semiconducting and conducting materials directly onto metal, glass or even plastic. The most common thin-film panels use amorphous (non-crystalline) silicon and are found everywhere from watches and calculators right through to large grid-connected PV arrays. Other types of thin-film materials include CIGS (copper indium gallium di-selenide) and CdTe (cadmium telluride). These tend to have higher efficiencies than amorphous silicon cells, with CIGS cells rivalling crystalline cells for efficiency. However, the materials used in some of these alternatives are more toxic than silicon—cadmium, particularly, is a quite toxic metal.

Each cell type has some advantages and disadvantages, but all in all, modern solar panels do pretty much what they are designed to do. There are no moving parts to wear out, just solid state cells that have very long lifespans.

Crystalline cells are a very mature technology and have a long history of reliability, so a good quality crystalline PV panel will very likely perform close to specifications for its rated lifespan, which is 25 years or more for most panels. Crystalline panels are usually cheaper than thin-film types, with the cheapest being polycrystalline panels, although the pricing gap between cell types has diminished in recent years.

Solar steps
From research to install

How our "no good for solar" roof was actually just fine. By Stephen Zuluaga.

UNTIL recently, I'd thought solar wouldn't work well on our house. With little north-facing roof to speak of, I just assumed that solar wouldn't be worth it. But then I began to read about some of the good outcomes possible with an east/west array—our roof has lots of east/west space and shading issues only at the extreme ends of the day.

Although an east/west array will produce less overall than a north-facing one, it can extend generation hours, both earlier in the morning with an east-facing array and later in the day with a west-facing system. Long generation hours are important if you don't have battery storage and the gravy train of premium feed-in tariffs has left the station. It means you can match more of your generation to usage, particularly before and after work usage, and hence increase your 'self-consumption' of solar—this will mean lower grid imports and a shorter payback period.

Modelling the economics

Before committing to a solar purchase, I was interested to more fully understand the financials. I found ATA's free Sunulator tool (www.ata.org.au/ata-research/sunulator) which helped me model a scenario based on my actual electricity consumption and the combined north/east/west PV configuration I was contemplating. Sunulator is a great tool—if you're planning solar you should use it [*Ed note:* ATA also has a simpler tool available to give you an indication of the financials without the full modelling of Sunulator, see www.ata.org.au/ata-solar-advice.] The energy analysts at the ATA helped with understanding the Sunulator results as one of the ATA member benefits.

Using a few PV system sizes, our location and orientation, Sunulator provided an estimate of generation over a year for these different sizing scenarios. We ultimately went with 9.72kW but also modelled 10.2kW and 10.8kW. It then matched generation with our household's actual electricity consumption over the past year and our electricity and feed-in tariff rates (allowing for forecast increases), to provide an expected payback period of seven years. The expected payback is based on the real quote prices you put into it. In my case, this represents a 16% ROI. I wonder how many people think about that when they consider solar—they should! I'll be interested to track the estimated generation and payback against the actual results over the next few years.

Choosing the technology

As well as looking at the financials, I also investigated different panel options. There are a wide range of panels available, with varying price tags and panel wattages, and options such as DC optimisers and microinverters to consider. I looked at both DC optimisers and microinverters as I was concerned to maximise generation (these maximise generation for shaded arrays and also if there's dirt on a panel), but in the end I decided the additional cost per watt was too high; Sunulator helped a lot with that conclusion.

One thing with solar is that different installers will work with particular panels and inverters, so you can't just choose any

↑ East- and west-facing roofs are still fine for solar installations, if shading is at a minimum.

No longer cooking with gas
Induction cooktop mini guide

Induction cooktops can make converts, with power and performance as good as or better than gas. We look at the features to consider when buying one.

IF YOU'RE planning to go all-electric—to reduce your bills and carbon footprint as suggested by ATA analysis (see www.bit.ly/RENTSTAE)—you're going to need an electric cooktop. Not so long ago, that meant an element-style cooktop with all the downsides that went with that: slow response to turning the heat up or down and the consequent risk of burnt fingers (or melted implements) as the elements stayed hot for a long time after being turned off. Many keen cooks favoured gas cooking for these reasons—but induction cooktops are changing that.

Should I go induction?

In *ReNew*, we've recently covered several stories about readers' satisfaction with the switch to induction; in fact, many would call themselves induction converts who would never go back to gas.

Fans of induction cooktops cite many advantages—fast performance, excellent temperature control from low to high, increased safety as the cooktop doesn't get as hot, ease of cleaning of the flat surface and, last but not least, energy efficiency.

There are a couple of disadvantages which can make the switch more costly for some. One is that you may need to replace your saucepans and frypans. Most new cookware is induction-compatible, but some older cookware fails the 'magnet' test. See 'Cookware requirements' for more on this.

Another potential cost is that you may need an upgrade of your electrical switchboard or the wiring to your kitchen. Induction cooktops have varying power requirements, but all are likely to require 20 amps or higher, up to 42 amps. See 'Installation and power requirements' below for more on this.

Image: Samsung

↑ Samsung's magnetic control knob can simply be moved between control zones on the cooktop. It makes the controls feel more intuitive for those used to older knob-style controls. Note the LED 'flames' used to simulate a gas flame—they vary in intensity depending on the heat setting.

Cooking with science

The speedy performance of induction cooktops can seem like magic, particularly if you've experienced the slow response of electric element cooktops. But it all comes down to science.

They work by producing an oscillating magnetic field. Because the magnetic field is constantly changing, it induces a matching flux into any magnetic cookware on the cooktop. This induces very high currents in the cookware, causing the cookware to get hot due to the metal's electrical resistance.

Because the pot is heated directly by the magnetic field, the amount of power being fed to the pot, and hence the running temperature of the pot, can be varied almost instantly, giving induction cooktops heat control capabilities as good as or better than gas.

Features and considerations

When you're buying an induction cooktop, there are a few considerations to make sure that the cooktop you buy will suit your needs and will be easy to use.

COUNTERTOP, OVEN UNIT OR PORTABLE?

The first consideration is what type of cooktop you want. Do you want it as part of a freestanding oven or built-in to a countertop—or are you looking for a plug-in portable option? You'll have the most choice if choosing a countertop option.

If you have an existing freestanding oven with gas or electric cooktop, you will need to replace the whole unit, either with a separate oven and cooktop or with a new oven/induction cooktop combo (though there are fewer models like this available). For the best

More EVs for Oz?
Australians getting new options

There has been a dearth of electric vehicle options here in Australia, despite dozens of models being available overseas. Bryce Gaton looks at what's happening in our EV market.

IN 2016, Norway and Holland became the first countries to set a year—2025—for ending sales of new internal combustion engine (ICE) vehicles. This could be discounted as something that's easy to do in countries with no auto industry to protect, but 2017 has seen something of a sea change: countries with significant automotive manufacturing industries are now following suit. France and the UK have set 2040 to end ICE sales; China is setting aggressive year-on-year percentage targets for EV sales versus ICE (such as 20% by 2025) and is reported to be moving towards setting an overall ICE sales end date; India has set 2030; and California in the USA is proposing legislation to set 2040 as the end date.

Existing ICE vehicles are not covered by the above-mentioned laws, but this too is about to change. Holland is the first country to set a year—2030—for having all petrol and diesel cars off the road, together with closure of all coal-fired power plants . Meanwhile, at a recent meeting in Paris, the mayors of 10 of the world's larger cities (including Paris, London, Los Angeles and Mexico City) pledged to remove petrol and diesel cars from large parts of their cities by 2030.

Sadly, here in Australia we can't even get our politicians to agree on a plan to move our energy supply off fossil fuels, let alone one to shift transport to more renewable sources of energy.

However, some state and local governments are starting the legwork. Byron and Tweed shire councils in northern NSW recently released a report that looks at ways the region can encourage the uptake of EVs to reduce the region's carbon emissions. The full report, 'Power Up—the Northern Rivers Electric Vehicle Strategy', can be found at: www.bit.ly/2iH8zQD.

The Victorian Government has asked for input to a new report which seeks to understand "the benefits and barriers to the wider uptake of electric vehicles in the state of Victoria"; public submission hearings are being held in November 2017.

In the meantime, do consumers in Australia have any new options if they want their personal transport to be less polluting? The answer is: yes, but not many.

Now

Excitingly, two new EVs have just been announced for sale in Australia! In late September Renault Australia announced the Kangoo ZE van and Zoe electric sedan were available for order. Disappointingly, the release is being done in stages, with the first being to commercial and government buyers only. Purchasers must hold an ABN (sole traders are included) and orders can only be made direct from Renault Australia, not through the dealer network. This is in line with the staged introduction they had in Europe, so it's hoped they will become more readily available in the not-too-distant future. For more info on purchasing, see www.bit.ly/2zuVjc1.

Near future

A new model Nissan Leaf was announced a couple of months ago. While still using the previous model's body and floorplan, it has all-new front and rear treatments and a new interior, plus a 33% larger (40 kWh) battery with a 320 km real-world range. Charging is also now up to 7 kW at 240 V AC (giving a recharge time of around 5.5 hours). Starting price in the USA is around US$31,000, which is marginally less than the just superseded model. Already on sale in Japan, it has been mooted for release in Australia sometime in 2018. We can only hope!

Image: Nissan

↑ The 2018 Nissan Leaf looks a whole lot better than the bubble-eyed previous version and has much greater range as well.

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