SOLARISING CHURCHES

A PRACTICAL RESOURCE FOR UNITING CHURCHES IN NSW

"This church is powered by divine energy"
Solar panels on the roof of Caloundra Uniting Church, Qld
www.caloundra.unitingchurch.org.au/SJGroup.htm

Produced by the Uniting Earthweb Group
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Uniting Earthweb

www.unitingearthweb.org.au

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1 INTRODUCTION

1.1 Why Go Solar?

Fossil fuel resources (coal, oil and natural gas) are being depleted at an increasing rate. At the same time, climate change from human activity is already severely impacting on vulnerable communities across the globe. If left unabated, climate change threatens catastrophic changes that cannot be reversed. Now more than ever, Christians have a calling to witness to a more hopeful future. We have an opportunity to be part of God's healing and renewal of all creation.

Ever since its formation, the Uniting Church has seen caring for God's creation as an essential part of our discipleship. In November 2008, the Standing Committee of the NSW Synod resolved to request all congregations to consider how they can reduce their carbon footprint and integrate creation care into all aspects of their worship, witness and service.

Our church buildings require electricity for their day to day operations. One way that we can directly reduce our reliance on fossil fuels and our contribution to climate change is to generate our own solar electricity. A number of recent developments in government policy have now put this within the financial reach of more churches in NSW. At the beginning of this year, the State Government introduced a gross feed-in tariff. Small renewable electricity generators – such as homes, small businesses, churches and community organisations with solar photovoltaic systems on their rooves – receive a premium for all of the renewable electricity that they produce. This, coupled with an Australia-wide subsidy on the installation cost in the form of renewable energy certificates, means that there has never been a better time for churches in NSW to go solar.

Solar photovoltaic systems on church rooves:

- Are a concrete, practical expression of churches' environmental responsibility and concern.
- Provide an opportunity for churches to engage with congregants and their local communities on environmental issues.
- Protect churches from inevitable increases in electricity costs in the coming years and decades.
- Make financial sense. Our calculations suggest that systems up to 10 kilowatts in size pay for themselves in less than seven years. After this time, they earn an income for the church.

1.2 About This Resource

This resource provides guidance for church congregations in NSW who are interested in installing a solar photovoltaic system to produce electricity. It also includes information for churches considering solar hot water heating for their residential properties e.g. manses. Most of the material is relevant to households as well, and the booklet provides some specific guidance for homeowners.

The resource has been prepared by the Uniting Earthweb Group (UEG). Uniting Earthweb is a network of Uniting Church people within NSW and the ACT who work for a greater connection between ecology and Christian faith and practice. The UEG is a small group of Uniting Church members who meet regularly to help support the development of Uniting Earthweb, and includes staff from UnitingCare and the Board of Mission. The UEG has taken all due care in the development of this resource. However, we stress that the material is provided for guidance only, and should not be substituted for your own research. **Prices are constantly changing as are government programs. You are responsible for ensuring your eligibility for rebates, schemes and incentives, for obtaining pricings, and for identifying and choosing (a) suitable solar installer(s).**

The UEG aims to provide ongoing help to churches who are installing solar systems. If you are making use of this resource, please contact us (details on the contents page) – we may be able to provide phone support. We would also appreciate being able to use your learnings from researching and installing a solar system to assist other churches.

2 ABOUT SOLAR PV SYSTEMS

2.1 How Do Solar Systems Work?

Solar photovoltaic (PV) systems convert energy from sunlight into electricity. They are usually found on the rooves of buildings. A solar system is made up of several components, including:

- Solar panels or modules, which consist of specially fabricated crystals that convert light energy to electricity. There are three main types of solar panels (monocrystalline, polycrystalline and thin film/amorphous), each with their own benefits,
- A frame which holds the array of solar panels together, and
- An inverter which changes the solar direct current (DC) power into 240V alternating current (AC) power suitable for appliances and for feeding into the electricity grid.

Having a solar PV system is like having a mini power station on your roof. When it is sunny, the system produces electricity, which is consumed by appliances (lights, computers etc) operating in the building. If your system is connected to the electricity grid (a "grid-connected" system), any extra power the solar panels produce is fed into the grid. At night, when your solar system is not producing any power, electricity comes to you from the grid. A meter reads how much electricity your system produces and how much you consume.

Further information:
To read more about solar PV systems, see the Clean Energy Council factsheet:
http://www.cleanenergycouncil.org.au/cec/resourcecentre/factsheets.html

3 PLANNING FOR A SOLAR PV SYSTEM

3.1 Minimise Your Electricity Consumption

Whether or not your church is considering installing a solar PV system, you should do what you can to save electricity. The less electricity we consume in Australia, the less we have to generate, and the lower our environmental impact. Lowering your electricity consumption also lowers your church's electricity bill. Heating and air conditioning typically consume particularly large amounts of electricity in church buildings, so any gains made here can have some very significant results.

In order to identify how your church can save electricity, it is a good idea to conduct an energy audit or energy assessment.

A simple and cost-effective way for your church to conduct an energy assessment is to take advantage of the NSW Department of the Environment, Climate Change and Water (DECCW) "Energy Efficiency for Small Business Program". Small businesses (entities with an ABN) who pay up to $20,000 for their electricity in a year or who employ up to 10 people qualify for the program. This includes many churches. Program participants:

- Pay $50 for an energy assessment, which identifies potential energy saving measures (DECCW subsidises the assessment by up to $250).
- Can receive a 50% rebate of up to $5,000 for costs incurred in implementing energy efficiency improvements (e.g. lighting, heating, insulation, hot water).

Further information:
For an energy audit resource, see "Energy Audit Handbook: How to reduce energy use in your church", produced by the Uniting Church Synod of Victoria and Tasmania:
http://wr.victas.uca.org.au/assets/1084/Energy_Audit_Handbook_2nd_edition.pdf

For more information about the DECCW Energy Efficiency for Small Business Program, see:
http://www.environment.nsw.gov.au/sustainbus/smallbusenergy.htm

3.2 Is Our Church Roof Suitable for Solar Panels?

Not every church will have a roof suitable for installing solar panels. Whether or not to install a solar PV system and where to locate the panels depends on considerations such as:

- *Orientation and angle of inclination* – Ideally, to maximise the amount of electricity your solar panels generate, they should face true north, and be angled at the latitude of where you live minus 10 degrees (e.g. Sydney, 22 degrees). However, high efficiencies can still be achieved at a wide range of orientations, and installers can mount the panels at somewhat different angle to that of your roof. However, very steep rooves may be a problem in terms of safety for installers.
- *Solar access* – Solar panels should be installed in a spot that receives full sunlight all year round. Partial shading reduces the output dramatically, so you need to avoid shading sources such as trees or tall buildings.
- *Roof strength and materials* – You need to check that the roof is able to support the weight of the panels. Also, slate rooves are not suitable for solar panels.
- *Visibility* – It is a bonus if your panels have high visibility, so your congregation and local community are reminded of the action that the church is taking.
- *Heritage* – In some council areas, heritage status may place some limits, e.g. how much roof space you can cover with solar panels, panels must be flush with roof, etc. Many solar PV installers are now familiar with heritage issues, or you can call your council for advice.

Many churches will have several buildings to choose from, for example, the church building itself or the church hall. If neither of these are suitable, you may be able to consider the manse.

3.3 What Size Solar PV System Should We Go for?

There are a number of factors to take into account in deciding on the size of your solar PV system:

- *The church's electricity consumption* – The higher the consumption, the larger the system needed if the church is aiming to produce enough power to cover its needs.
- *Your roof* – The potential size of your system may be affected by the size, orientation and strength of your roof, as discussed in the preceding section. A 10 kilowatt (kW) system could require up to about 80 square metres of roof space.
- *The installation cost of the system* – Ultimately, you will be limited by the funds your church has available to install a system.
- *Eligibility for the NSW gross feed-in tariff* – Only systems up to 10 kW in size are eligible, and only electricity customers who consume up to 160 megawatt-hours (MWh) annually.

3.4 How Do We Connect to the Grid?

To receive the gross feed-in tariff, your church needs to be connected to the electricity grid via a "gross metered connection" so that the total amount of electricity you are generating can be measured. You need to fulfil requirements specified by your *electricity network provider* in order to be connected. Your network provider is the company that owns the power poles and meters in your area. In NSW, there are three network providers: Energy Australia, Integral Energy and Country Energy.

Ideally, your solar PV installer will look after the connection of your solar PV system to the grid, including the necessary paperwork required by your network provider. If your installer doesn't do this, you will need to organise the paperwork as well as find and pay an electrician to complete the connection.

Your *electricity retailer,* which is the company to whom you pay your electricity bill (and from whom you will receive your payments under the gross feed-in tariff), may or may not be the same company as your network provider. You should contact your electricity retailer and tell them you are installing a solar PV system.

Further information:
To find the network provider in your locality, see:
http://www.industry.nsw.gov.au/energy/electricity

To find out about your network provider's requirements and processes for connecting your solar PV system to the grid, see their respective websites:
Energy Australia (http://www.energyaustralia.com.au)
Integral Energy (http://www.integral.com.au)
Country Energy (http://www.countryenergy.com.au)

For more details about planning considerations for solar PV systems, see the Clean Energy Council publication "Consumer Guide to Buying Household Solar Panels (Photovoltaic Panels)":
http://www.cleanenergycouncil.org.au/cec/resourcecentre/Consumer-Info/solarPV-guide.html

3.5 Are There Other Planning Matters Our Church Should Be Aware about?

You should contact the planning department of your local council to see their requirements for solar PV systems. For example, you may or may not be required to submit a development application. The requirements are likely to be more stringent if your church is heritage listed.

4 SOLAR PV SYSTEM FINANCES

Several government programs reduce the costs and increase the rewards for installing solar PV systems. However, as the recent suspension of the Australian Government's insulation and green loans programs has shown, such programs are not always stable.

4.1 Is There Any Government Assistance for Reducing Up-Front Costs?

Owners of solar PV systems are able to get assistance with the upfront cost of installing their system by means of Renewable Energy Certificates (RECs). RECs are a form of electronic currency that corresponds to renewable energy generation.

The Australian Government has mandated a Renewable Energy Target (RET), requiring electricity retailers to source a proportion of their total electricity sales from renewable energy sources. The target is set at 20% of electricity by the year 2020. Under the RET, renewable energy generators are able to create one REC for each MWh of renewable energy they generate. These generators can earn money by selling their RECs to other entities who need to buy them to prove compliance with the RET. As RECs are traded on markets, their price varies, from about $30 to about $50 per REC.

As a generator of renewable electricity, your church would be able to participate in the RECs market and offset the cost of installing your solar PV system. However, it is important to note that if you do sell your RECs, you will not be generating any extra renewable energy than what would have happened under the renewable energy target – you are simply contributing to achieving that target.

Small renewable energy generators are actually given preferential treatment in the operation of the RECs market, under an arrangement known as the "Solar Credits" scheme. For the first 1.5 kilowatts (kW) of system capacity, generators are able to apply a multiplier of five when they create RECs – thus creating five times the number of RECs for the first 1.5 kW of power they produce. This has stimulated the small scale renewable energy industry, but has also had some problematic effects. Interested readers can see the Appendix for details of these problems, as well as an outline of modifications to the RET arrangements which will come into force in January 2011.

Your church has several options to consider in relation to what you do with your RECs:

- You can sell all of your RECs, or
- You can sell your RECs for the power your solar system is actually producing, but choose not to participate in the Solar Credits scheme, or
- You can choose not to sell your RECs at all, but rather to surrender them voluntarily

Most people who decide to sell their RECs find it easiest to sell them through an agent (typically their solar PV installer), and receive the money in the form of a discount on the installation cost. If you choose not to generate all of the RECs for which you are eligible, your system will cost more.

Further information:
To read more about the RET, see:
http://www.climatechange.gov.au/en/government/initiatives/renewable-target.aspx

To read more about RECs, see the Office of the Renewable Energy Regulator website:
http://www.orer.gov.au/publications/ret-overview.html
http://www.orer.gov.au/sgu/index.html

4.2 What Income Can We Earn from Our Solar PV System?

At the beginning of this year, the NSW Government introduced the "Solar Bonus Scheme". Under this scheme, small electricity users who are also generators of renewable electricity receive a premium of $0.60/kWh for all of the renewable electricity that they produce until January 2017. This arrangement is known as a gross feed-in tariff.

Eligibility for the scheme is restricted to:

- Electricity customers with an annual electricity consumption of up to 160 MWh, and
- A solar PV system or wind turbine up to 10 kW capacity, which is connected to the electricity grid and with an inverter up to 10 kW capacity.

All electricity providers are required to provide eligible customers with either a Solar Bonus Scheme credit on their electricity bill or a cash payment representing this amount.

Under the legislation, the NSW State Government will "review the Solar Bonus Scheme against its objectives and assess whether the levers of the Scheme require adjustment" in 2012 or when total installed capacity of generators participating in the scheme reaches 50 MW, whichever occurs first. On the 24th August, the Minister for Energy Paul Lynch announced that there had been a rapid uptake of the Scheme and the latter milestone had already been reached, triggering the review. Public submissions are due before 30 September, with the review to be tabled in Parliament towards the end of the Spring Session (the session finishes in December). Terms of the Scheme, such as its length and the tariff rate, are locked into legislation. The Minister confirmed that "if any changes are to be proposed, the legislation would need to be amended and we are on the record stating that any changes would not be applied retrospectively". There is no guarantee that the current premium will remain in place after the review – however, this should not affect existing Solar Bonus Scheme participants.

Further information:
To read more about the Solar Bonus Scheme, see
http://www.industry.nsw.gov.au/energy/sustainable/renewable/solar/solar-scheme

4.3 When Will Our System Pay for Itself?

See Table 1 below for payback times for several system sizes. Three cases are given for each size – depending on what your church chooses to do with its RECs. If you choose to sell all the RECs for which you are eligible, payback time is less than seven years. **Please note that these calculations date from March 2010, and they are conservative and indicative only.** Since that time, the Uniting Earthweb Group has seen installation prices 15% or more lower, with predicted payback times of less than five years. Also, many systems would operate at greater than 90% efficiency in the early years.

4.4 How Can We Finance Our Solar PV System?

Here are some suggestions for possible additional sources of money for financing your system:

- Uniting Resources has advised that the costs associated with solar PV system purchase and installation would be considered as a capital upgrade to the church's property. Such costs are thus eligible for sales proceeds funding. To apply for approval to use sales proceeds, church councils need to fill in a "build application form" available from Uniting Resources, and submit the form to the Presbytery Property Committee and Uniting Resources Property Services.
- Consider approaching the members of your congregation for their financial support. For example, 25 congregants at St John's Anglican Church in Dee Why contributed a total of $5,000 towards the church's 2 kW system.

- Consider approaching Uniting Financial Services for a loan – emphasising the good financial return and the strong ethical reasons for installing a system.

Table 1: Solar System Finances

System Size (kW)	RECs sold	Capital Cost[1]	Electricity produced[2] (MWh/yr)	Annual income (gross FIT)	Payback time (yrs)	Investment comparison[3] (yrs)
3	All sold	$ 14,000	3.9	$ 2,400	6	8
	No solar credits	$ 19,000	3.9	$ 2,400	10	12
	None sold	$ 21,000	3.9	$ 2,400	11	15
5	All sold	$ 25,000	6.6	$ 3,900	7	9
	No solar credits	$ 29,000	6.6	$ 3,900	9	12
	None sold	$ 33,000	6.6	$ 3,900	11	14
8	All sold	$ 40,000	10.5	$ 6,300	7	9
	No solar credits	$ 44,000	10.5	$ 6,300	8	11
	None sold	$ 50,000	10.5	$ 6,300	10	13
10	All sold	$ 51,000	13.1	$ 7,900	7	9
	No solar credits	$ 56,000	13.1	$ 7,900	8	11
	None sold	$ 63,000	13.1	$ 7,900	10	13

1 Assumes REC price of $35.
2 Calculations are for systems installed in Sydney, and panels operating at 90% efficiency.
3 Years for solar system investment to equal a term deposit of the same amount invested at 3.9% interest. Assumes the system is installed by 1 July 2010. After the life of the gross feed-in tariff (6.5 years), assumes a scenario of feed-in tariff equal to the peak electricity cost, and an electricity price increase of 50% by mid 2013 and 5% per annum thereafter.

Further information:
Uniting Resources: http://www.unitingresources.org.au

Uniting Financial Services: http://www.unitingfinancial.com.au/

5 CHOOSING AN INSTALLER

5.1 What Should We Consider When Choosing an Installer?

We recommend that you approach several installation companies for visits and quotes.

Key things you should ensure when choosing an installer:

- Check that your installer has a Grid-Connect Design & Install accreditation from the Clean Energy Council, ask for their accreditation number, and check the Clean Energy Council website to confirm. If they are not accredited, you will not be able to access the feed-in tariff, RECs, insurance etc.
- Check that there is a warranty on all components and labour – including the panels, inverter, frame and workmanship. Solar panels should have an output warranty of 25 years. Small inverters should have a warranty of at least five years, and 10 kW inverters should have a ten year warranty. Given the length of time involved in these warranties, you should check how you would go about making a warranty claim, and consider the risk that component manufacturers may go out of business in the interim.
- Solar panels must be approved by the Clean Energy Council, and inverters by the network provider responsible for approving inverters used in its area.

Further questions that you should ask a potential installer:

- How long has the installer been in business?
- How many systems has the installer installed? Ask the installer for details of recent installations and contact details of clients for reference checks.
- What particular components (e.g. type of solar panels and configuration) does the installer recommend/use, and why has the installer chosen these?
- Has the installer completed installations similar to your church's? If so, ask for examples and contact details of clients for reference checks.
- Will the installer connect the solar PV system to the grid (preferable), or does the church need to organise that?
- How long will it take to provide a quote?
- What electricity output (in kWh per year) is the solar system quoted for your particular site expected to produce, and what assumptions are used in this calculation?
- How long will it take to complete the work, including installation of the gross meter?
- Does the installer actually complete all the work itself, or does it hire subcontractors?
- Are all costs associated with installing the system covered by the quotation?
- Ask the installer to provide guarantees that the work will be completed within the agreed time, including any work to be done by subcontractors.

You should also ensure that:

- You submit the contract offered to you by your preferred installer to Uniting Resources (Property Services) for inspection/advice.
- The gross meter to be installed is available when you sign up for your solar PV system, in order to avoid delays between system installation and grid connection.
- If your installer is completing the grid connection (as well as installing your system), you only make the final payment once: 1) the grid connection has been completed, 2) the necessary paperwork has been sent to your electricity network provider, and 3) the system has been approved by the provider.

5.2 List of Installers

The following is a list of installers that the Uniting Earthweb Group has investigated and believes to be reliable. They use quality components, have considerable experience installing solar panels,

including for non-profit organisations and groups, and have an interest in installing systems on church rooves. Please note that this list is not exhaustive, and that our listing of these particular installers does not substitute for your own research.

Aussie Solar, http://www.aussiesolar.com.au
Aussie Solar is based in the Blue Mountains. For 10 kW solar PV systems or larger, they will install across NSW. For smaller systems, they will not travel as far.

Green Solar Group, http://www.greensolargroup.com
Green Solar Group in based in Sydney and installs systems in the Greater Sydney area (bounded by and including the Central Coast, Wollongong and the Blue Mountains).

Ingenero, http://www.ingenero.com.au
Ingenero has offices in Sydney and several other cities across Australia. They will install solar PV systems within 100km of Sydney city and in major regional centres in NSW. Installations elsewhere are negotiable at an additional cost.

Nu Energy, http://www.nuenergy.com.au
Nu Energy has offices in Sydney and several other capital cities and installs solar PV systems and solar hot water heaters across NSW and Australia.

Pyramid Power, http://www.pyramidpower.com.au
Pyramid Power is based on the NSW south coast and installs solar PV systems and solar hot water systems across NSW.

Solar Shop, http://www.solarshop.com.au
Solar Shop has offices in Sydney, the Central Coast, the South Coast, the North Coast, and a western inland office.

SolarSwitch
http://solarswitchaustralia.com.au
SolarSwitch is based in Sydney, and installs throughout NSW and the ACT, as well as South East Queensland and Victoria.

Sydney Energy Cooperative, http://www.energycoop.com.au
The Sydney Energy Cooperative is a non-profit environmental organisation that aims to involve the general community in energy-related activities. The cooperative installs solar PV systems in Greater Sydney, the Central Coast, Newcastle, the Blue Mountains and Canberra. Due to heavy bookings, the Cooperative is not currently marketing their installation activities.

If you would rather not approach installers yourself, you may be able to take advantage of one of the following initiatives:

1. Uniting Resources (Property Services) is engaging a consultant to look into options for a bulk installation of solar photovoltaic (PV) systems on a number of churches in Greater Sydney (bounded by Newcastle, the Blue Mountains, and Wollongong). This will provide support to participating churches in terms of research and project coordination, and it is also expected to help secure a better installation price. For more information, please contact the Uniting Earthweb Group (contact details below the table of contents).
2. Church Resources runs a "Greening Communities" program for non-profit organisations. Your church can register your interest in solar systems (and a number of other products) on the Greening Communities demand register. (See http://www.churchresources.com.au, and select

"greening communities" under the "strategic initiatives" tab.) The demand register works such that when there are ten organisations in a given locality that have registered on the demand register, Church Resources' consulting partner Eco Community will come and visit those organisations and provide advice on their options. Therefore there is no guarantee that you will receive a fast response, or perhaps any response. In addition to registering online, we therefore recommend that you also phone Church Resources.

Further information:
To find Clean Energy Council accredited installers and equipment, see
http://www.cleanenergycouncil.org.au/cec/accreditation.html

For a more detailed list of questions to ask installers, see the Clean Energy Council publication "Consumer Guide to Buying Household Solar Panels (Photovoltaic Panels)":
http://www.cleanenergycouncil.org.au/cec/resourcecentre/Consumer-Info/solarPV-guide.html

6 INFORMATION FOR HOUSEHOLDS

The majority of information in the preceding sections is relevant to households as well as to churches. The major difference is that most households will look to install small systems. An Australian home with an average electricity consumption would need to install a 4 kW system to meet its energy needs. However, many households consume much less. For example, the Clark family in Hurstville, Sydney, produce at least twice as much electricity with their 3 kW system as they consume. (You can read about their journey with solar power on the Uniting Earthweb website.)

The payback time on small systems is lower than on larger systems, if a household sells all of the RECs for which it is eligible. For example, we have seen prices for fully installed systems of $5,000 or less, representing a payback time of less than five years.

Here are some additional tips for householders to identify installers of solar PV systems:

- Your local council may have identified a preferred installer for homes in their area. Contact their sustainability/environment unit to find out.
- Some local environment groups or climate action groups have organised bulk purchase schemes and/or have knowledge about local installers. It would be worth approaching them for their advice.
- Some electricity retailers install solar PV systems on homes and have special offers to reduce upfront costs. For example, Origin Energy is offering 1.5 kW systems fully installed from $5,000 with an upfront payment of $1,000, and Sanctuary Energy is offering 1.5 kW systems with zero upfront cost.

Further information:
For government information for households about installing solar panels, including a step-by-step guide and a more detailed manual, see: http://www.livinggreener.gov.au/take-action/save-energy/install-solar-power.

To access the Clean Energy Council publication "Consumer Guide to Buying Household Solar Panels (Photovoltaic Panels)" see: http://www.cleanenergycouncil.org.au/cec/resourcecentre/Consumer-Info/solarPV-guide.html

To read about the Clark family's journey with solar power, see:
http://www.unitingearthweb.org.au/explore/the-clark-familys-solar-power-story

For tips on how to reduce your electricity consumption in your home, see:

- Federal government resources on saving energy in your home: http://www.livinggreener.gov.au/take-action/save-energy
- The Australian Conservation's GreenHome materials (look in the "campaigns" section of the website): http://www.acfonline.org.au

7 SOLAR HOT WATER SYSTEMS AND HEAT PUMPS

Another way that churches can reduce the fossil fuel reliance and climate change impacts associated with their buildings is to install solar hot water systems or heat pumps at their residential properties e.g. manses. Water heating accounts for about a quarter of the energy used in and greenhouse gas emissions produced by an average home. A solar hot water system can provide up to 90% of a household's hot water needs. For a household of 3-4 people in Sydney, a gas-boosted solar hot water system can have as little as one fifth of the greenhouse gas emissions of a gas storage system, and less than one tenth of the emissions of an electric storage system. Heat pumps are also very efficient. In much of Australia, emissions from heat pumps are similar to or less than those from electric-boosted solar hot water systems. So if your church's manse is in a cloudy area or doesn't have a north-facing roof, you can still make use of an energy efficient option.

In fact, the federal and state/territory governments are working to phase out greenhouse gas intensive electric hot water systems across Australia. From 2012, installation of electric hot water systems on existing homes will no longer be allowed. Only gas hot water systems, solar hot water systems, and heat pumps may be installed.

Some churches may also like to consider installing solar hot water at their actual church premises. However, unlike solar electricity which can be exported to the grid, solar hot water can only be used on site. The pattern of hot water use varies so much across non-residential church buildings that it is difficult for us to provide advice. For example, some church buildings might only use hot water for washing up couple of times a week, whereas others might have shower facilities that are regularly used. Therefore we restrict our guidance to residential buildings. We recommend that for non-residential buildings, churches consult the "Energy Audit Handbook" in the first instance (see section 3 for a link to the handbook) and conduct an audit of their hot water usage.

7.1 About Solar Hot Water Systems and Heat Pumps

Solar hot water systems use solar collectors or panels to absorb energy from the sun. Water is heated by the sun as it passes through the collectors. It then flows into an insulated storage tank for

later use. The storage tank is usually fitted with an electric or gas booster that heats the water when there is not enough sunlight. A system with a gas booster is around five times more energy efficient than a system with an electric booster.

There are two main types of solar collectors:

- *Flat-plate solar collectors* – this type consists of a flat panel which is coated with a heat-absorbing substance, and which contains water pipes through which the water flows.
- *Evacuated tube solar collectors* – this type consists of concentric sets of tubes. Water runs through the inner pipes, which are coated with a heat- absorbing substance. Outer glass tubes are separated from the inner pipes by a vacuum, which reduces heat loss.

Flat-plate solar collectors are the more common of the two types of collectors and cost significantly less. However, a disadvantage is that they only operate at maximum efficiency when the sun's rays are perpendicular to the flat plate. In comparison, the curved surface of evacuator tubes allows sunlight to strike perpendicular to the water for longer. As well as being more efficient than flat-plate collectors, evacuated tube collectors also weigh much less.

Solar hot water systems are also classified according to the configuration of the storage tank:

- *Thermosiphon systems* – the storage tank is located on the roof above the solar collectors. The cold water sinks into the collectors. Once heated, the density of the water decreases and it rises into the tank. This is known as the thermosiphon effect.
- *Pumped or split systems* – the storage tank is on the ground or in another convenient location, at ground level or in elsewhere in the house. Water is pumped through the solar collectors.

In cases where rooves are unsuitable for a solar collector or where there is no access to gas, a heat pump may be an option. Heat pumps don't use sunlight directly and don't need solar collectors. Instead, they work like an air conditioner or refrigerator in reverse – transferring heat from the air to the water via a refrigerant. Heat pumps are very efficient so they are classified with solar hot water systems for rebate purposes. Installation-wise, a heat pump is similar to an electric hot water system.

Further information:
To read more about solar hot water systems and heat pumps, see the Clean Energy Council factsheet: http://www.cleanenergycouncil.org.au/cec/resourcecentre/factsheets.html

To read about the phase-out of greenhouse intensive hot water systems, see: http://www.environment.gov.au/sustainability/energyefficiency/appliances/hotwatersystems/phase-out.html

7.2 Planning for Solar Hot Water Systems and Heat Pumps

As for solar PV systems, north-facing orientation, a suitable angle of inclination, good solar access, and sufficient roof strength are needed to install a solar hot water system. If you are planning to install both solar hot water and a solar PV system on the roof of the same building (e.g. manse), you should be particularly careful about where you are going to situate them, so that installing one doesn't preclude installing the other. If the roof of the manse is unsuitable for solar hot water, a heat pump may well be an option. You should also check any planning requirements for solar hot water systems with your local council.

The ideal size of the hot water system will depend on how much hot water the residents of the manse require. This is strongly dependent on household size. The church should also ensure that

the manse is fitted with devices that save hot water, such as energy- and water-saving shower heads and taps.

Further information:
For government information for households about installing solar hot water systems and heat pumps, including a step-by-step guide and a more detailed manual, see:
http://www.livinggreener.gov.au/take-action/save-energy/install-solar-hot-water

7.3 Solar Hot Water System and Heat Pump Finances

Owners of solar hot water systems and heat pumps have the ability to generate Renewable Energy Certificates (RECs). (See Section 4.1 of this document to find out more about RECs.) However, unlike for solar photovoltaic systems, the Solar Credits scheme does not apply. Solar hot water systems that are 300L in size (suitable for a household of four people) are eligible for about 30 RECs (at a price of $35 per REC, this equates to about $1,000). To be eligible for RECs, the system being installed must be listed on the register of the Australian Government Office of the Renewable Energy Regulator. Your church should be aware that, if you choose to sell your RECs, the hot water you are producing is counted as a part of the mandated Renewable Energy Target.

State and Federal Government rebates are also available for the installation of household solar hot water systems and heat pumps that are eligible for at least 20 RECs and that replace electric systems. Particular care needs to be taken to ensure that your church meets the eligibility requirement for these rebates:

- The NSW Government offers a rebate of $300 under its NSW Home Saver Rebates program. Either the owner of the residential property or the tenant (with written permission from the owner) is able to apply for the rebate, provided they have proof that they have paid for the hot water system or heat pump. However, the NSW Department of Environment, Climate Change and Water has advised us that tenants in church properties may only be eligible for the rebate in some circumstances. It is therefore safest for the church to pay for the system and to claim the rebate. You should also check your church's eligibility by contacting the Department.
- Under the new Federal Government Renewable Energy Bonus Scheme, a $1,000 rebate is available for solar hot water systems and a $600 rebate is available for heat pumps. However, the eligibility criteria exclude owners of residential properties who are not individuals. It therefore appears that churches are not eligible for the rebate, however, the resident/tenant occupying the property may be eligible.

Installation costs for solar hot water systems vary widely. In mid 2008, Choice Magazine reported full installation costs for a hypothetical home of two adults and two children ranging from $4,000 to $10,000, including the RECs discount (but not rebates). Solahart, a supplier of flat-plate systems and heat pumps (and which installed two flat-plate systems at Maroubra Junction Uniting Church's student accommodation in 2006), say on their website that a fully installed Solahart system can cost between $2,600 and $4,600, depending on the rebates and incentives which may be applicable to the installation.

Government websites advise that, if replacing an electric hot water system, a solar hot water system can save a household $300 in electricity costs and pay for itself in five to ten years. Cost savings will depend on hot water usage, the type of system the solar hot water system is replacing, and electricity prices.

An issue for churches may occur if their residents/tenants pay their own electricity bills. In this case, it is the residents who benefit financially from solar hot water, rather than the church. If your

church wishes to recoup the cost of the solar hot water system or heat pump, you will need to work out a suitable arrangement with your residents/tenants.

Further information:
To read more about RECs for solar hot water and heat pumps, see the Office of the Renewable Energy Regulator website: http://www.orer.gov.au/swh/index.html

To read about the Federal Government Solar Hot Water Rebate, see: http://www.environment.gov.au/energyefficiency/solarhotwater/

To read about the NSW Government Hot Water System rebate, see: http://www.environment.nsw.gov.au/rebates/ccfhws.htm

7.4 Choosing an Installer

Solar hot water systems have been available in Australia for decades, and there are many suppliers and installers. For example, CHOICE magazine has listed the websites of 17 suppliers. Your local environment group may also be able to give advice on installers.

Further information:
To read CHOICE Magazine's buying guide for solar hot water systems and heat pumps, see http://www.choice.com.au/Reviews-and-Tests/Household/Energy-and-water/Solar/Solar-hot-water-systems. However, please note that information about rebates and incentives is now out of date.

APPENDIX: PROBLEMS WITH THE SOLAR CREDITS SCHEME

Under the Solar Credits scheme, renewable energy generators are able to provide a multiple of five to the first 1.5 kilowatts (kW) of system capacity when they create RECs. This scheme has had the effect of stimulating the small scale renewable energy industry. However, it has had the adverse effects of:

- Creating "phantom" RECs, that correspond to no actual renewable energy generation.
- Bringing the price of RECs down, which has impeded the development of the large scale renewable energy industry, such as large wind farms.

On 26th February, in response to these and other problems, the Australian Government announced changes to the Renewable Energy Target (RET). After a period of consultation, the enhanced RET legislation was passed by the Commonwealth Parliament on 24th June (Renewable Energy (Electricity) Amendment Bill 2010. As of January 2011, the RET will be separated into two parts – one for large scale renewable energy generation, and the other for small scale renewable energy. Small renewable energy generators will receive a fixed price of $40 per REC.

Further information:
To read some concerns that have been expressed about the Solar Bonus Scheme, see:
http://www.ata.org.au/projects-and-advocacy/advocacy-on-the-renewable-energy-target
http://www.energycoop.com.au/content/en/expert-opinion
http://www.crikey.com.au/2010/01/29/government-needs-to-think-carefully-about-recs/

For a factsheet on the enhanced RET see:
http://www.climatechange.gov.au/en/government/initiatives/~/media/publications/renewable-energy/06072010-enhanced-ret-fact-sheet.ashx