

*The Australian PV
Association*



Solar Panels & Hot Water Workshop

Going solar – what it all means

Manly Council, Jan 27th 2011

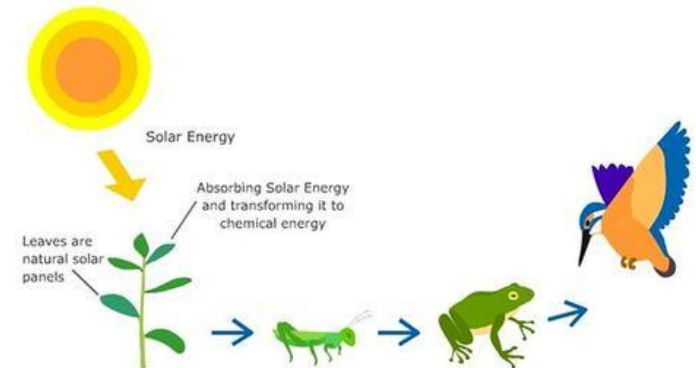
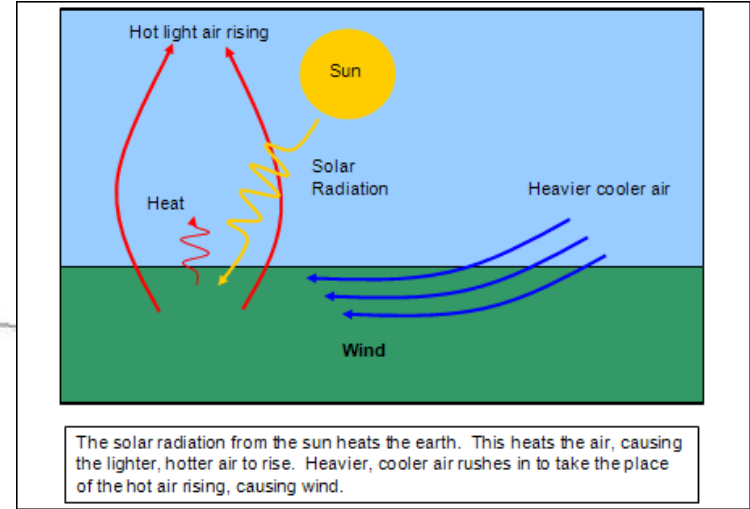
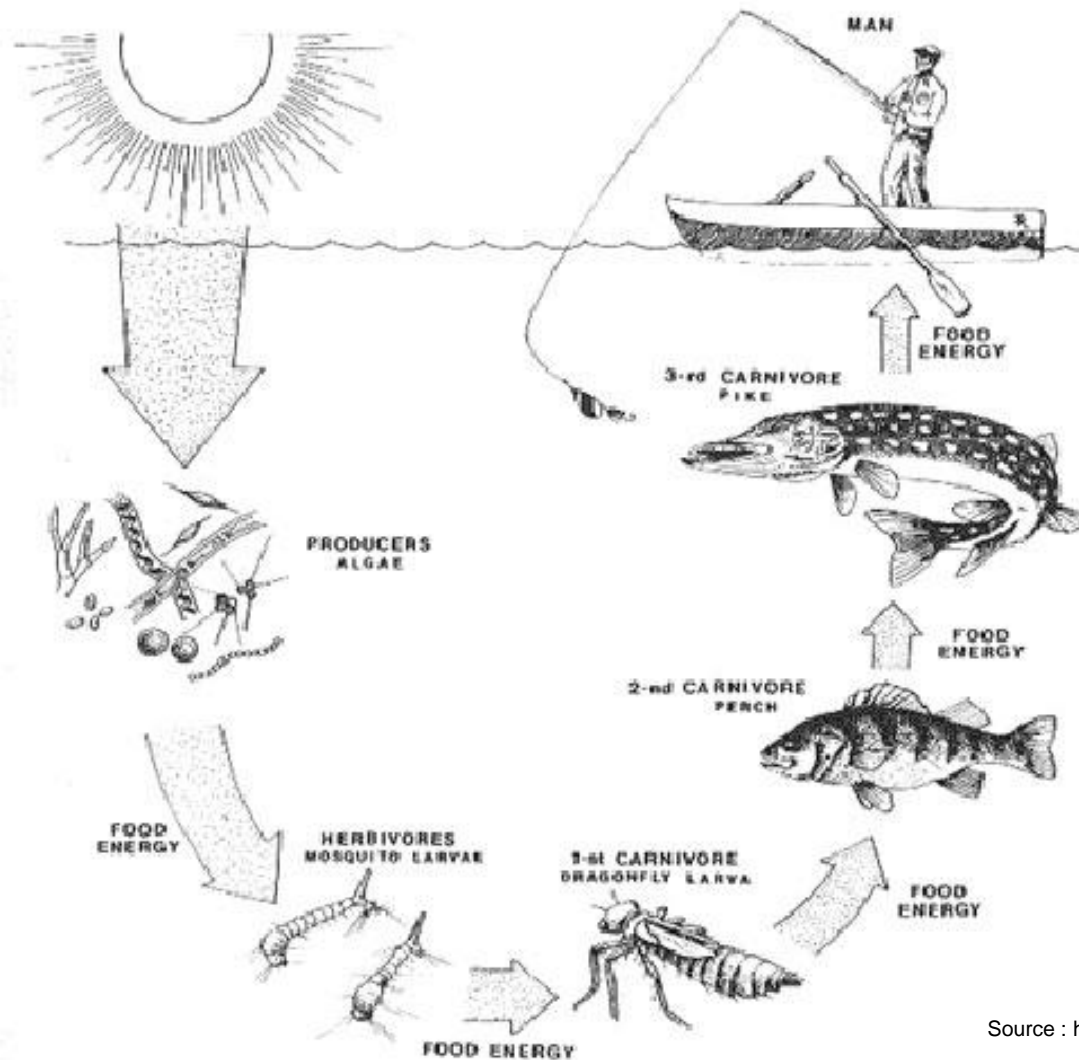
Presenter : Mark Twidell – Australian Solar Institute
Contributions from Dr Muriel Watt, Chair Australian PV Association
+ the internet

Workshop Plan

- Solar Energy – Introduction
- Solar Energy Applications – what is happening
- Why consider Solar energy – economics, environment etc
- What are your options – different technology types
 - Solar Hot Water
 - Solar Electricity - Photovoltaic's
- What Government & Council support is available
- What to look for when making decisions
- Installation and Maintenance



Solar Energy keeps us alive!



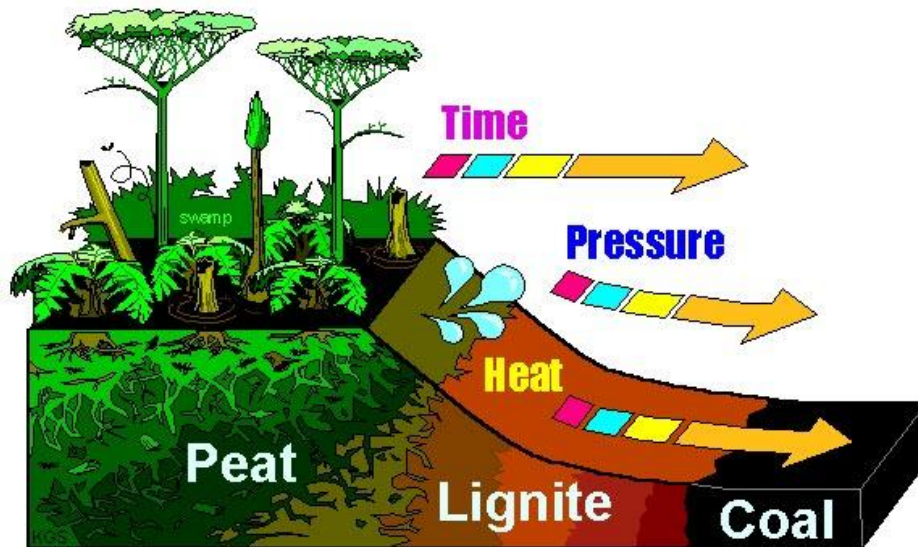
Plant is eaten by grasshopper is eaten by frog is eaten by bird. Stored chemical energy is transferred from the plant to the grasshopper, to the frog, to the bird, enabling each in turn to function as a living organism.

© 2007-2010 The University of Waikato | www.sciencelearn.org.nz

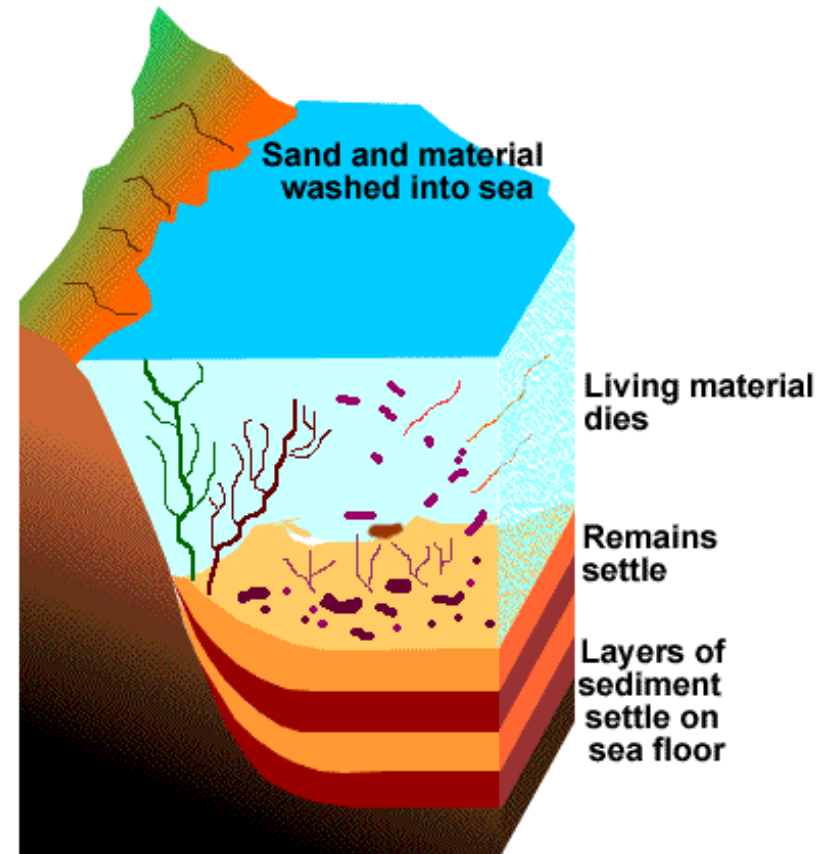


Most of energy sources today are stored Solar Energy!

- Coal and oil formed 260-300 million years ago



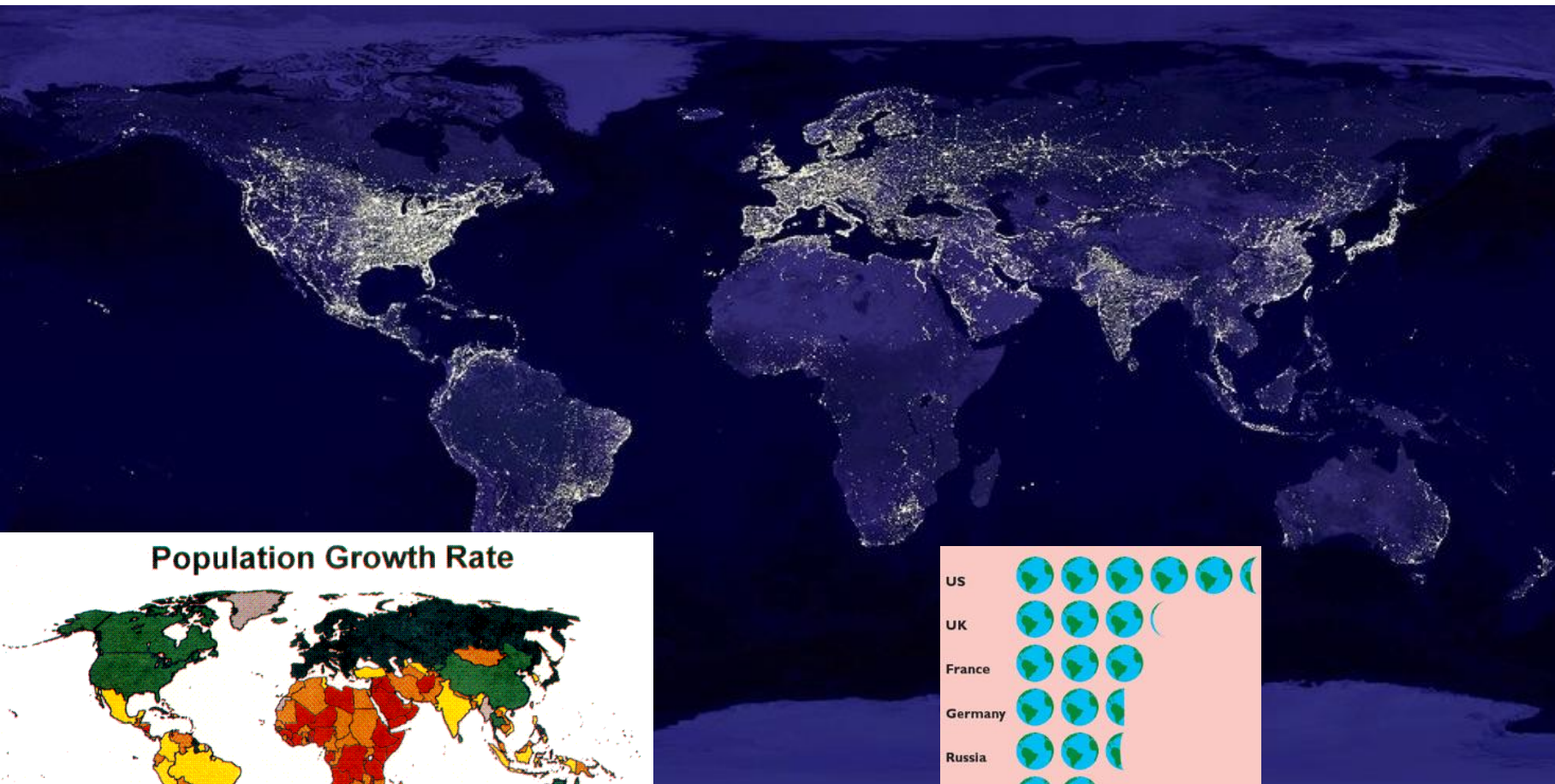
Source : <http://reich-chemistry.wikispaces.com/>



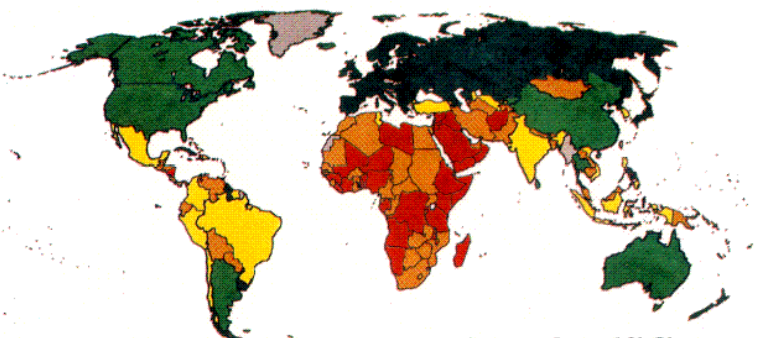
OIL



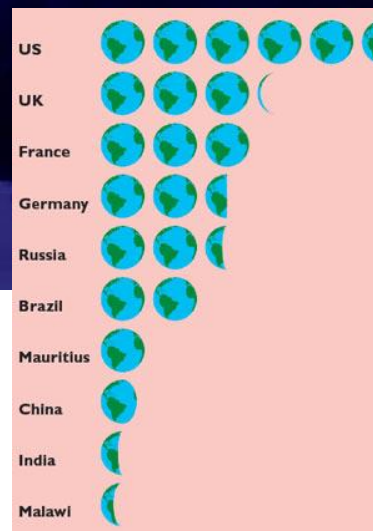
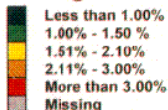
Population & Economic Growth demands change to a sustainable path



Population Growth Rate



Average Annual % Change

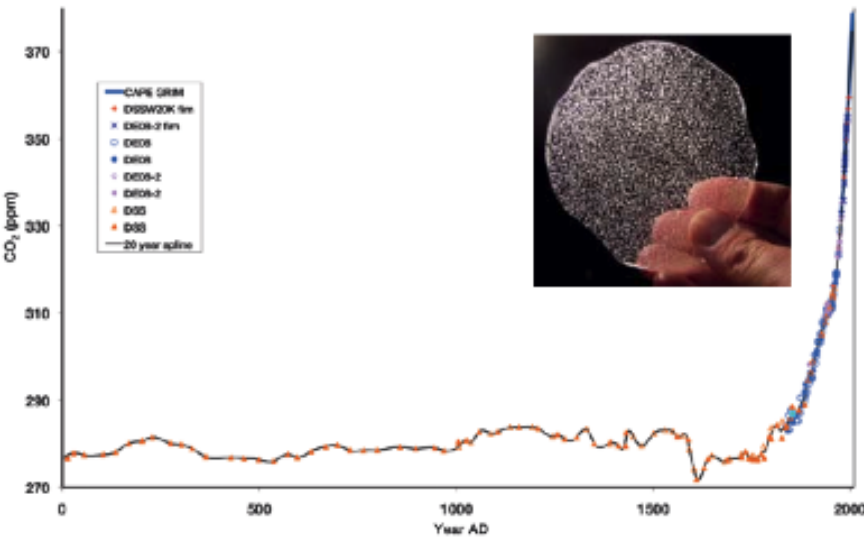


Source
<http://earthobservatory.nasa.gov/IOTD/view.php?id=896>

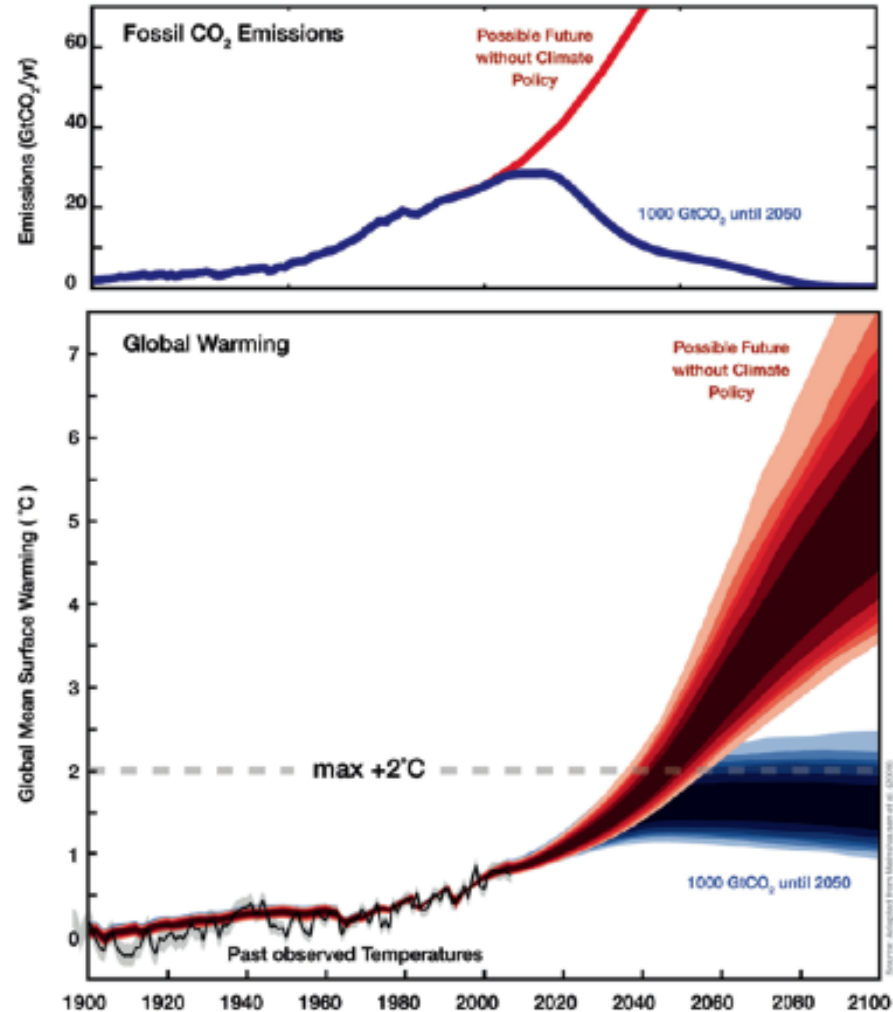


Climate Science supports the need to move to low CO2 Emissions

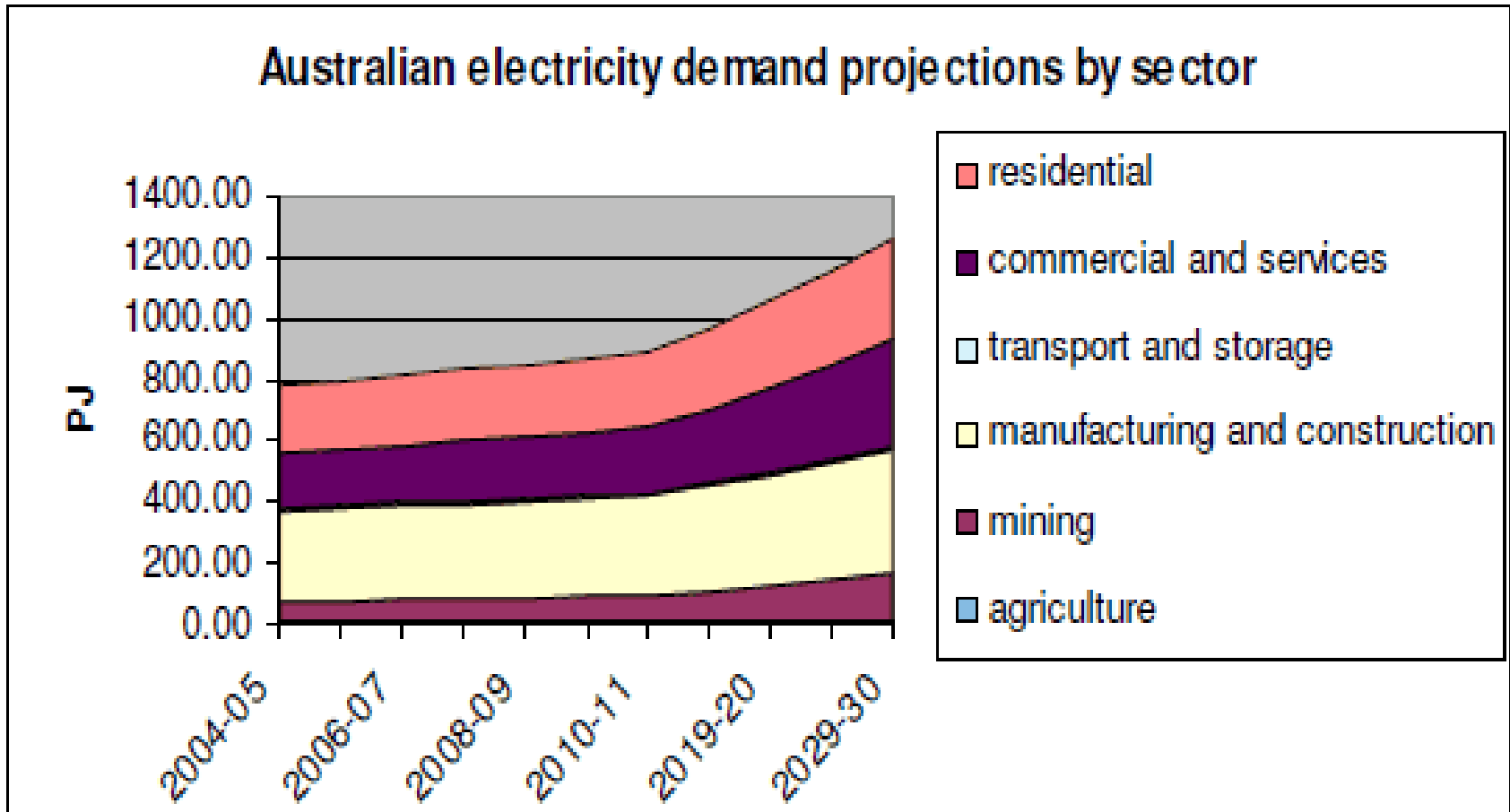
Figure 4.1 Atmospheric CO₂ over the last 2000 years, based on direct measurements in the atmosphere at Cape Grim, Tasmania, older air extracted from Antarctic snow (firn) and from air bubbles trapped in various ice cores (various symbols). The inset shows the air bubbles in Antarctic ice. Image: Australian Antarctic Division. Data: CSIRO



Source : Australian Academy of Science – Climate Change 2010



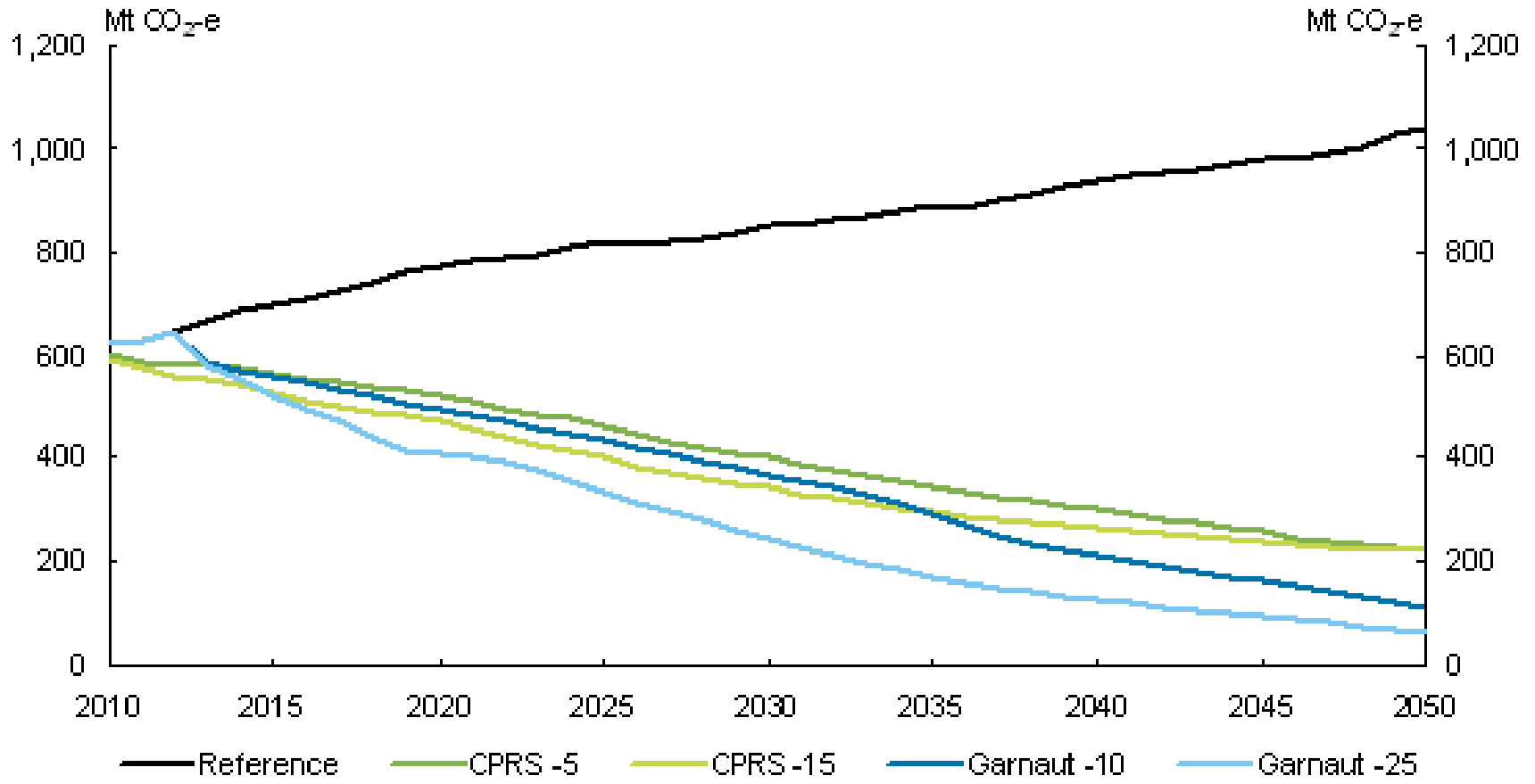
Australia's Electricity Demand is Growing



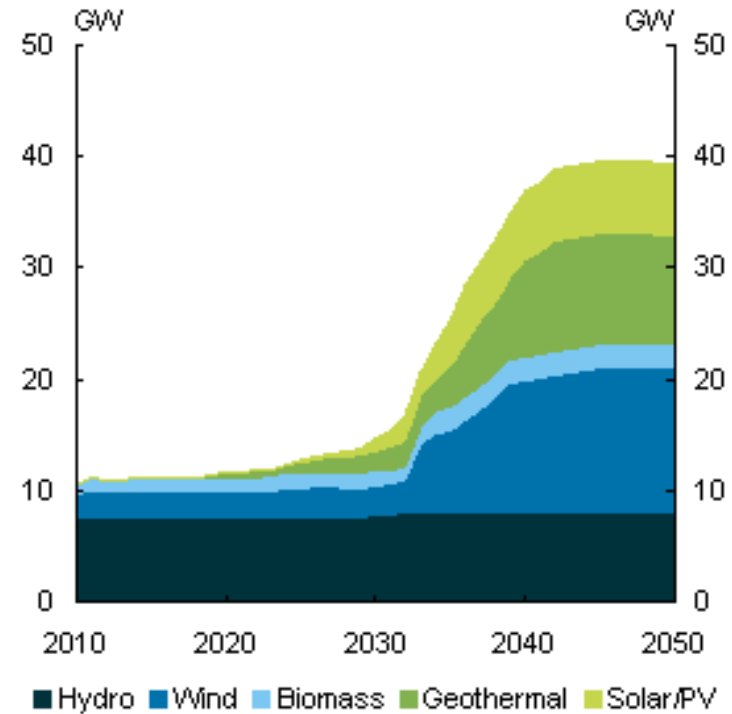
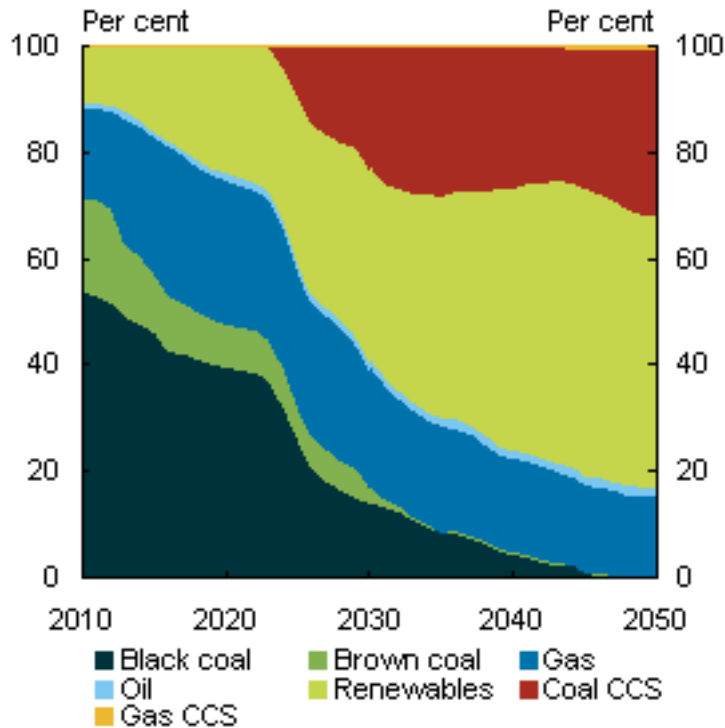
Source: Australian Bureau of Agricultural and Resource Economics (ABARE)



Australia's Emissions project targets



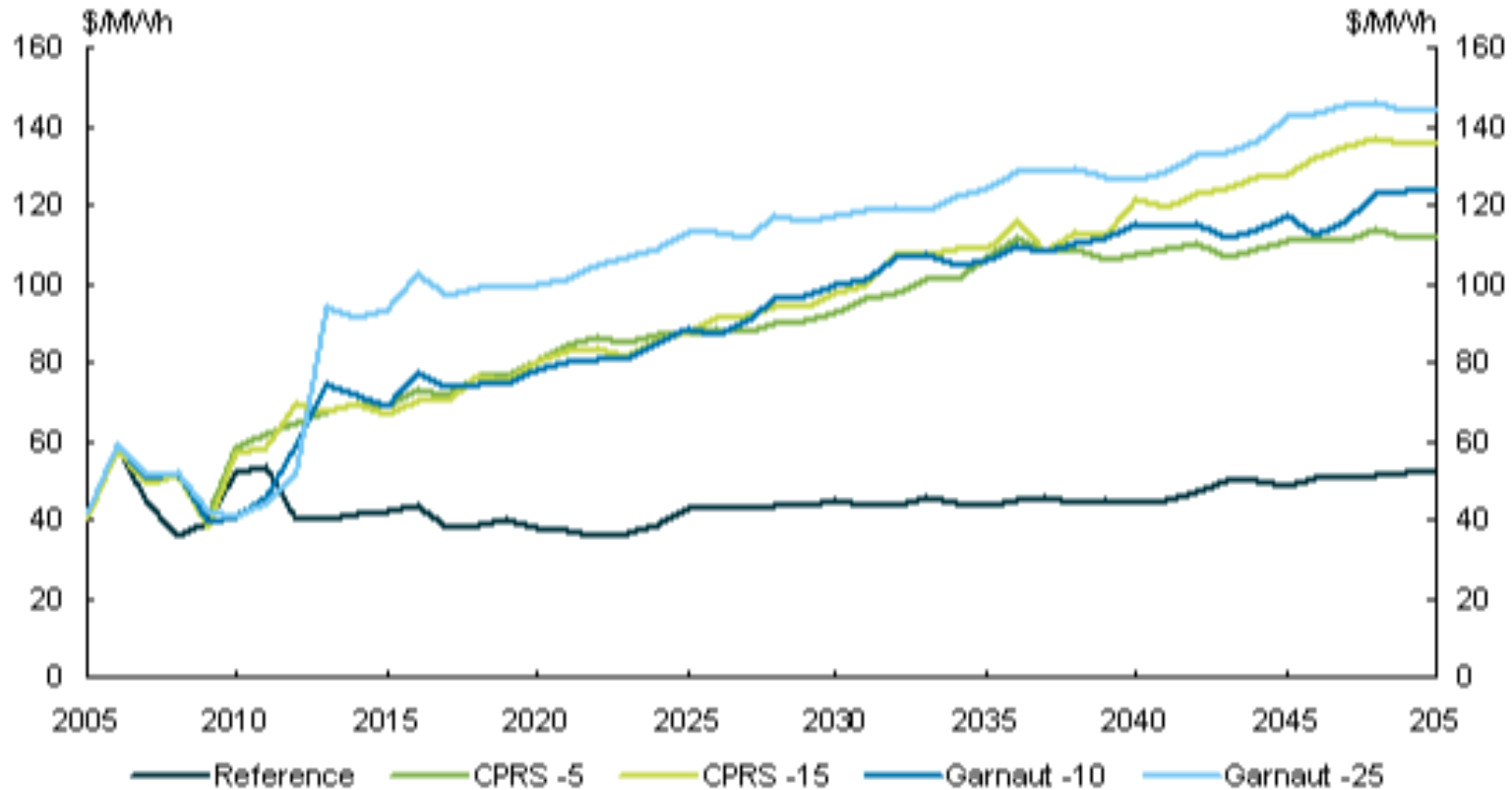
Energy Mix will have to change



Source : Australian Treasury http://www.treasury.gov.au/lowpollutionfuture/report/html/06_Chapter6.asp



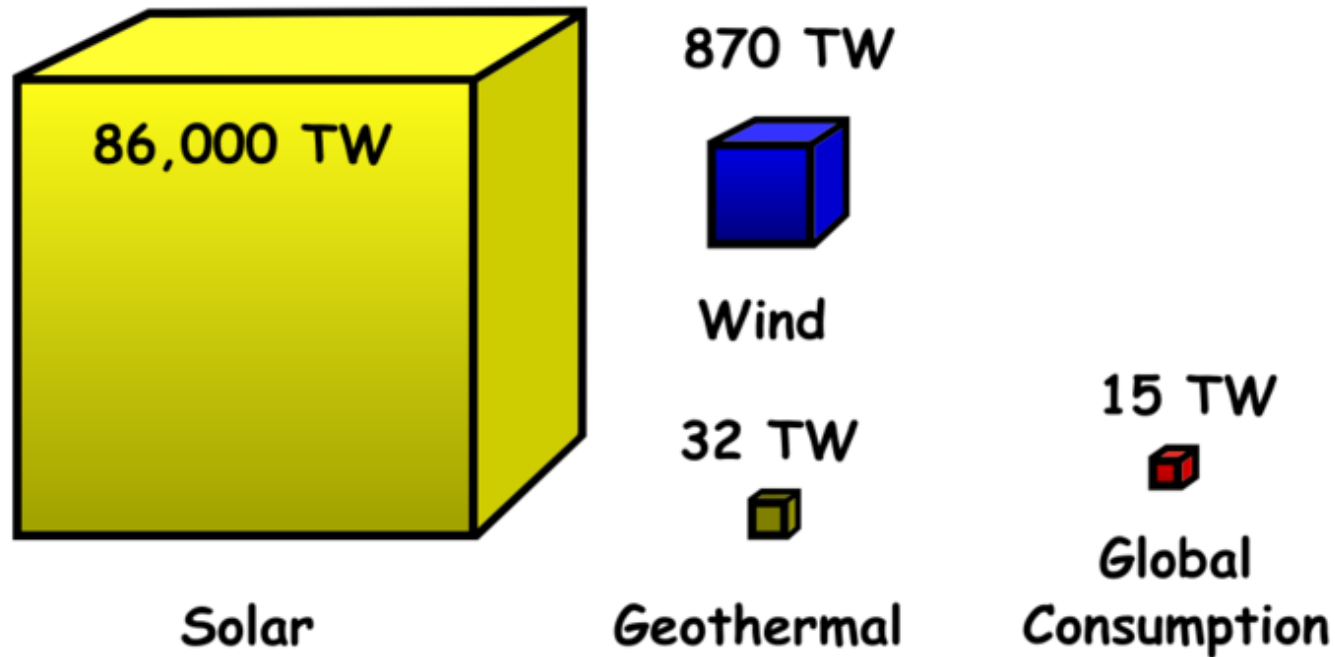
Low Emission Electricity will Cost More



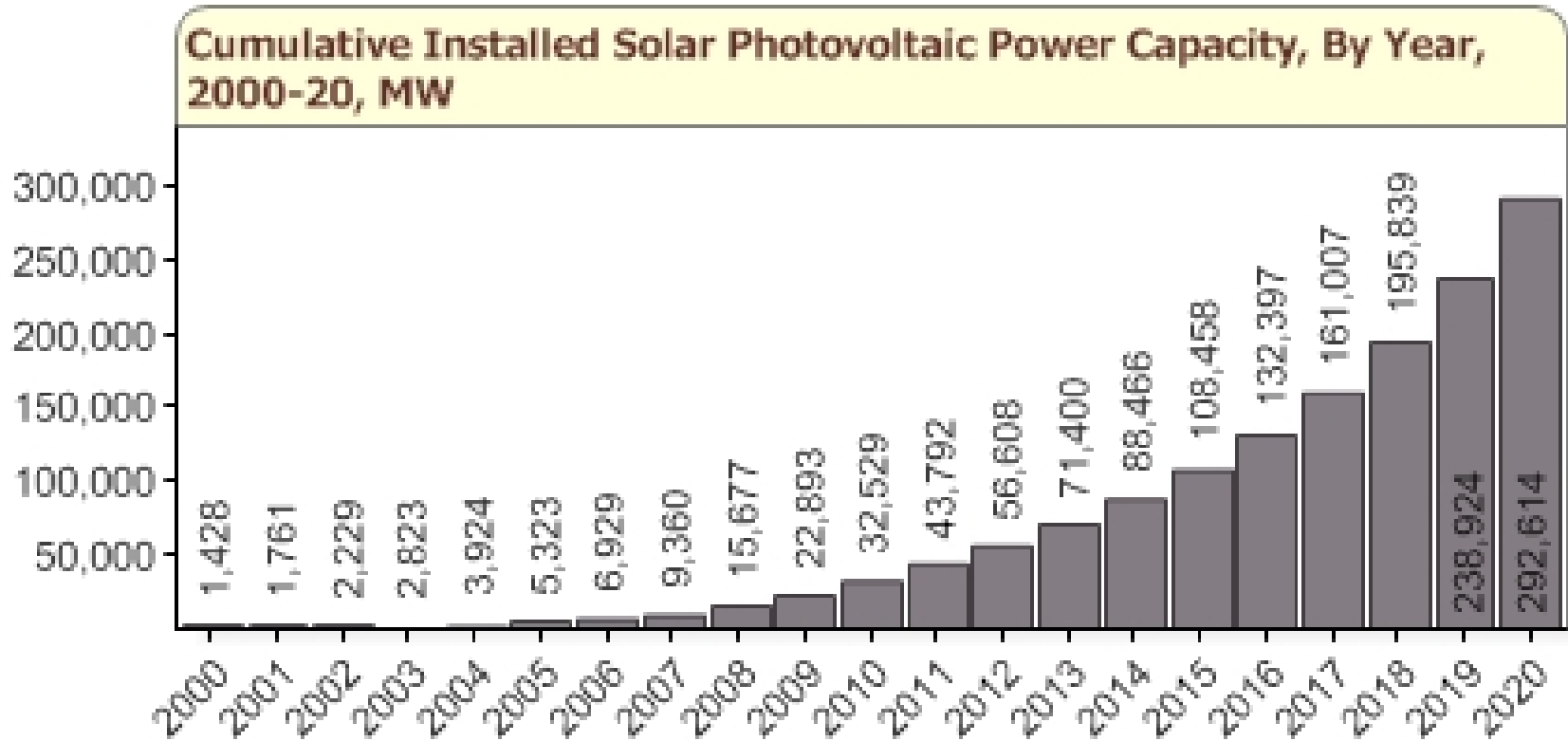
Source : Australian Treasury http://www.treasury.gov.au/lowpollutionfuture/report/html/06_Chapter6.asp



Solar Energy – The world is not short!



Demand For Solar Energy is Growing Globally

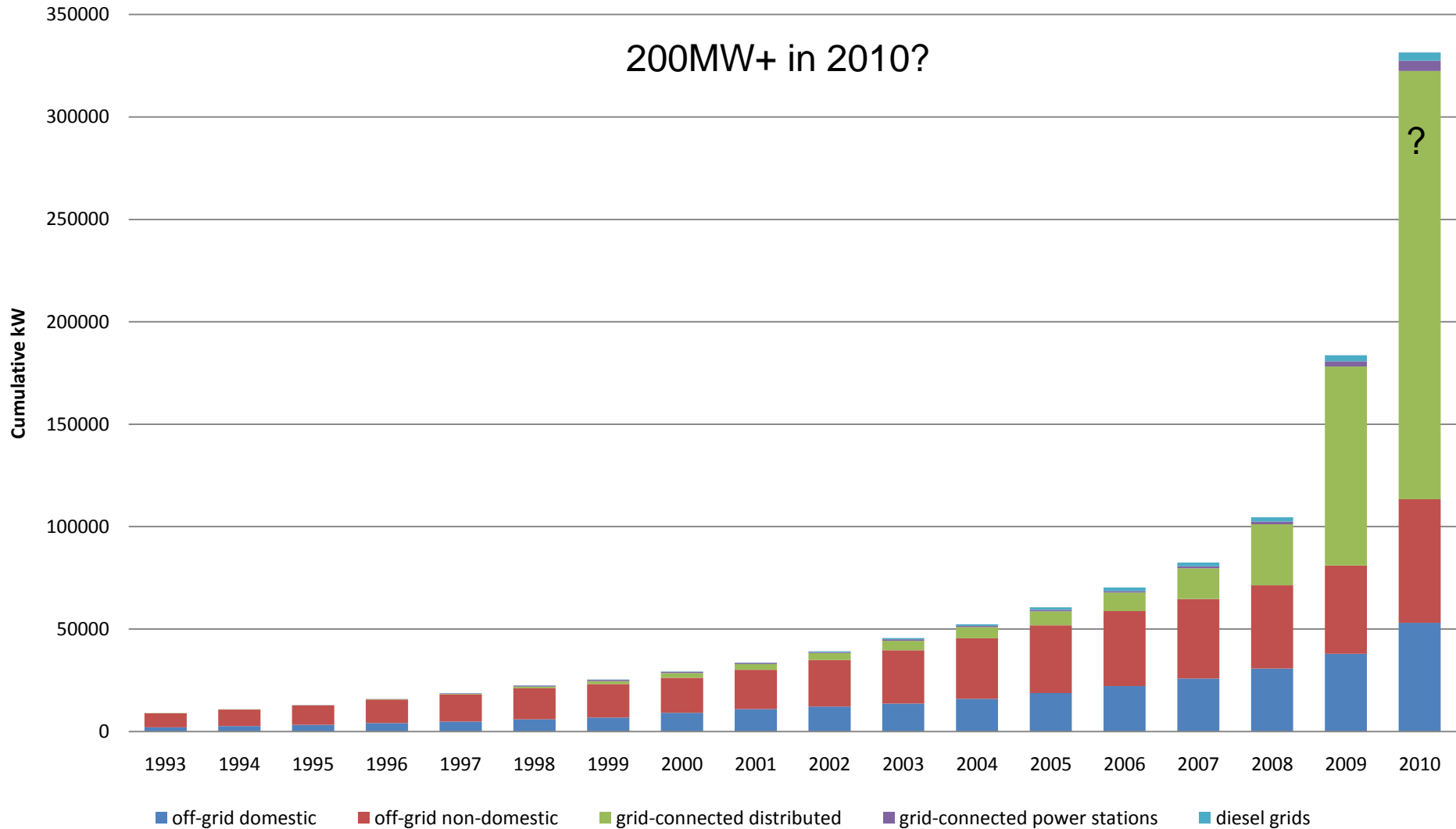


Source <http://seekingalpha.com/article/207119-solar-wind-time-to-buy-into-fear>

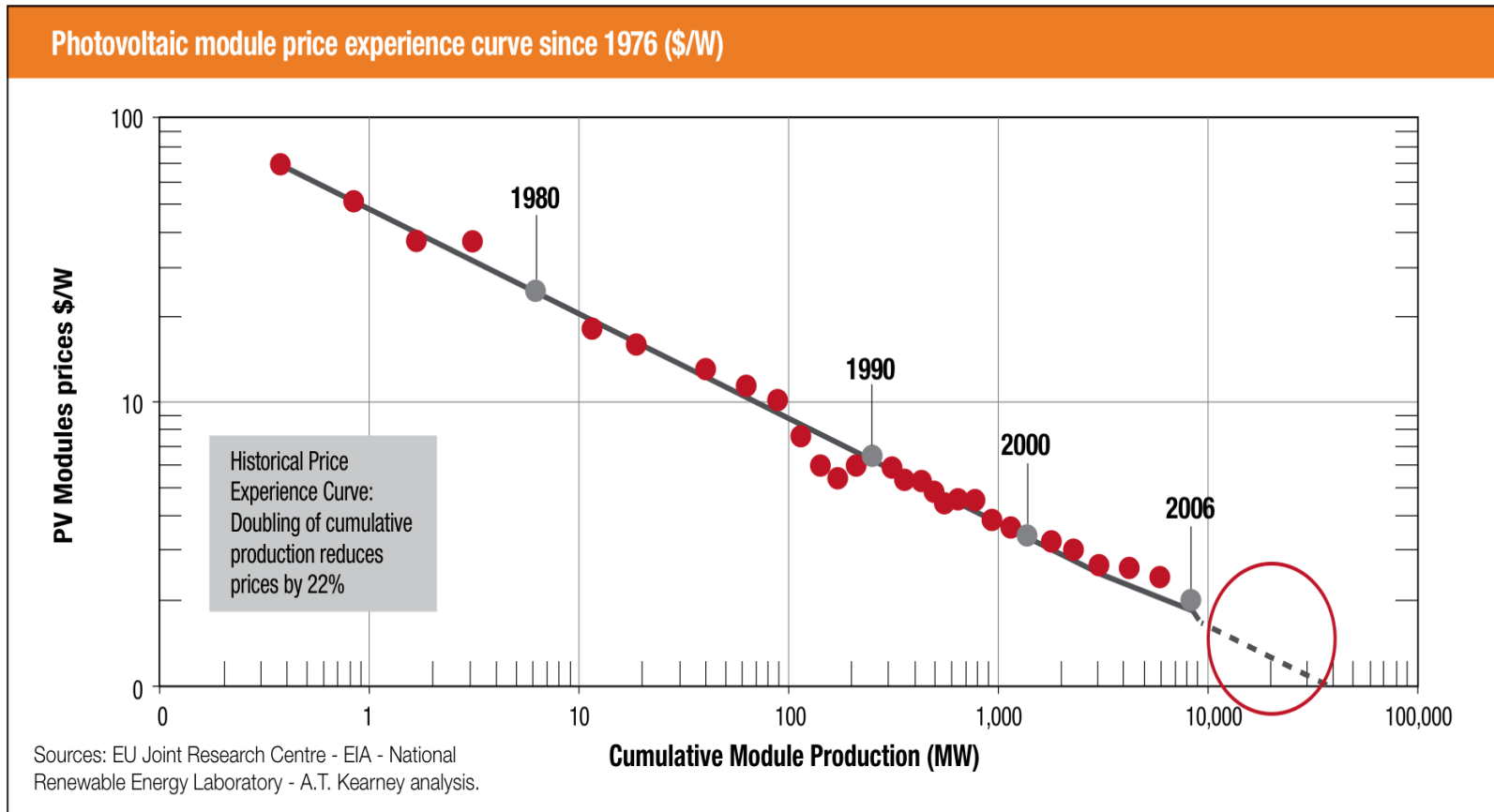


Australian PV Market

(APVA, 2010 and projections)

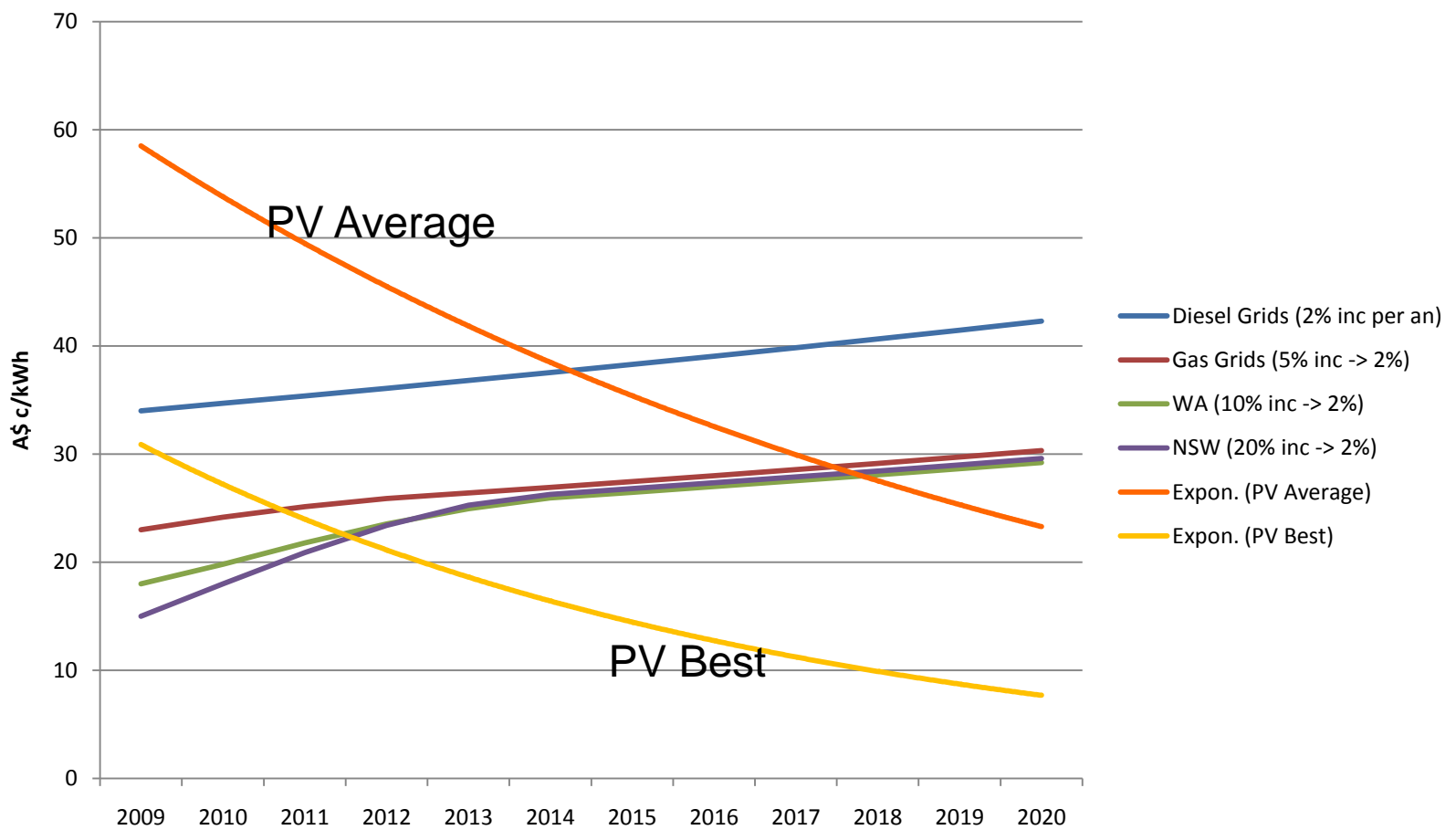


Solar PV Panel Costs and Prices are Falling



Technological progress will enable further substantial PV cost reductions, while fossil fuel-based electricity prices are expected to continue their long-term increase.

Solar Electricity will be competitive



Source APVA



SURFACE AREA REQUIRED TO POWER THE WORLD WITH ZERO CARBON EMISSIONS AND WITH SOLAR ALONE

➔ www.landartgenerator.org



BOXES TO SCALE WITH MAP

- 1980 (based on actual use)
207,368 SQUARE KILOMETERS
- 2008 (based on actual use)
366,375 SQUARE KILOMETERS
- 2030 (projection)
496,805 SQUARE KILOMETERS

Required area that would be needed in the year 2030 is shown as one large square in the key above and also as distributed around the world relative to use and available sunlight.

- ➔ Areas are calculated based on an assumption of 20% operating efficiency of collection devices and a 2000 hour per year natural solar input of 1000 watts per square meter striking the surface.
- ➔ These 19 areas distributed on the map show roughly what would be a reasonable responsibility for various parts of the world based on 2009 usage. They would be further divided many times, the more the better to reach a diversified infrastructure that localizes use as much as possible.
- ➔ The large square in the Saharan Desert (1/4 of the overall 2030 required area) would power all of Europe and North Africa. Though very large, it is 18 times less than the total area of that desert.
- ➔ The definition of "power" covers the fuel required to run all electrical consumption, all machinery, and all forms of transportation. It is based on the US Department of Energy statistics of worldwide Btu consumption and estimates the 2030 usage (678 quadrillion Btu) to be 44% greater than that of 2008.
- ➔ Area calculations do not include magenta border lines.

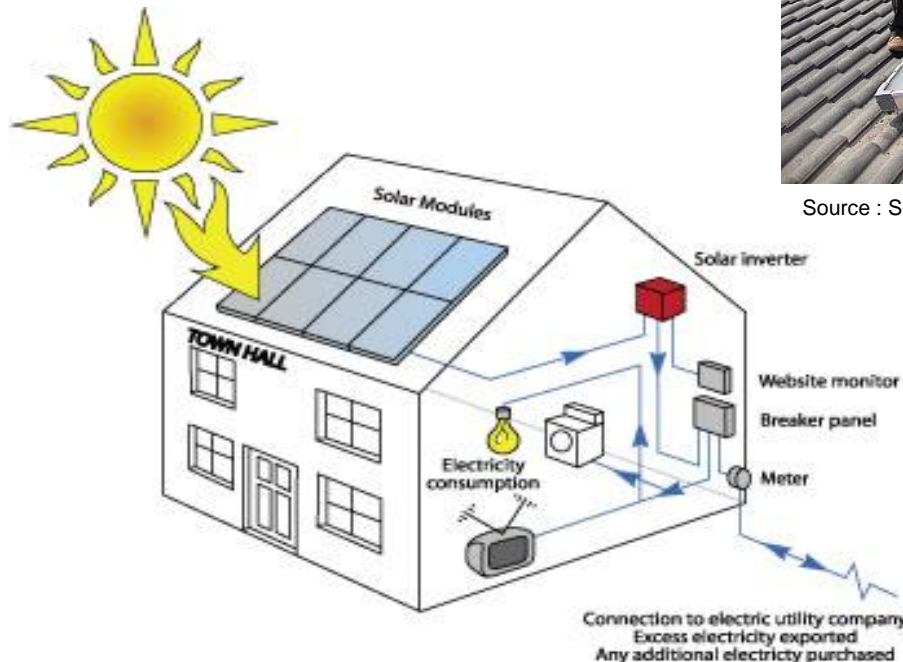
Solar Energy – Direct from the Sun

Main Technologies today

- Solar Thermal – Hot Water
- Solar Photovoltaic – Electricity
- Concentrated Solar Power



Source : <http://thegreenasia.com/blog/?p=69>



SOURCE : <http://www.givemesolar.com/solarpv.html>

APVA

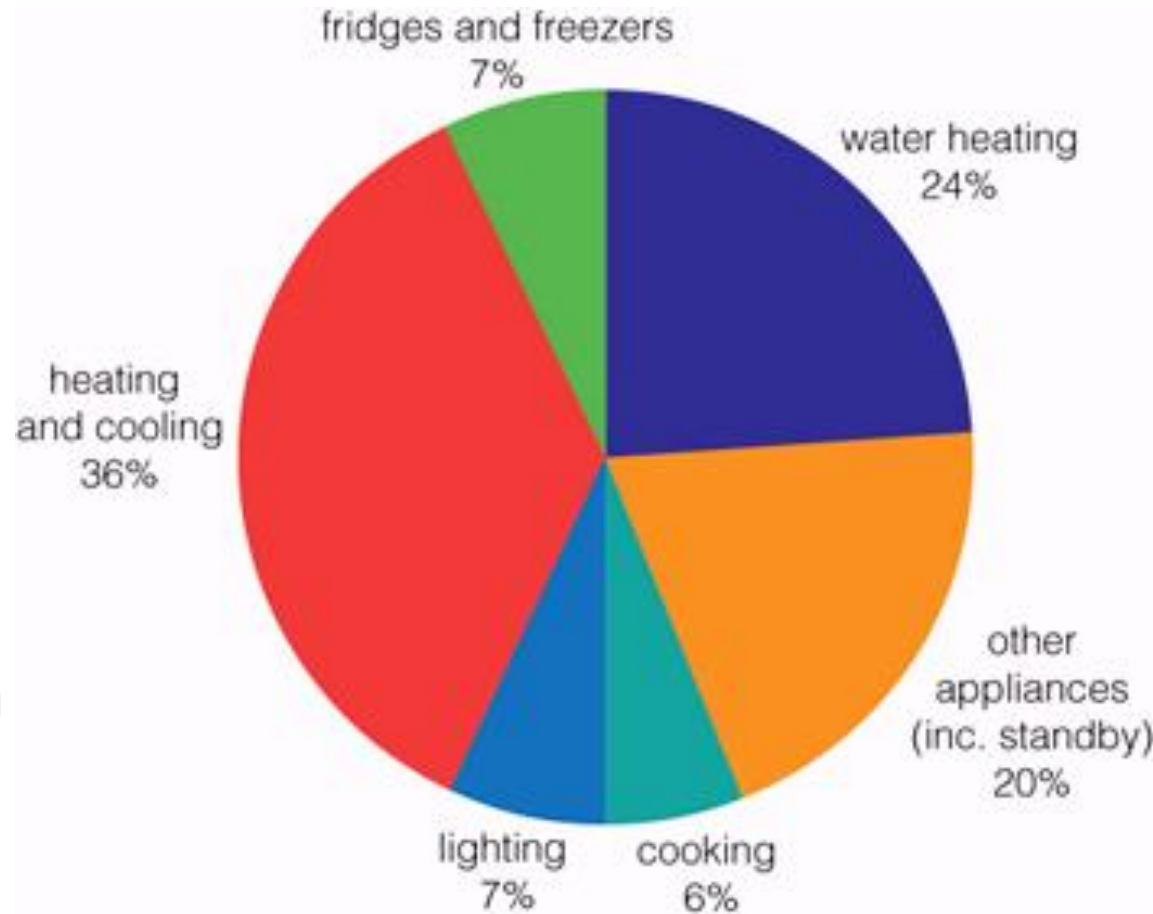


Source : Solarhart



Typical Household Energy Consumption

- Water and space heating dominate
- Reducing your energy use lowest cost way to reduce bills!
- Do an energy audit – plenty of tools on the web



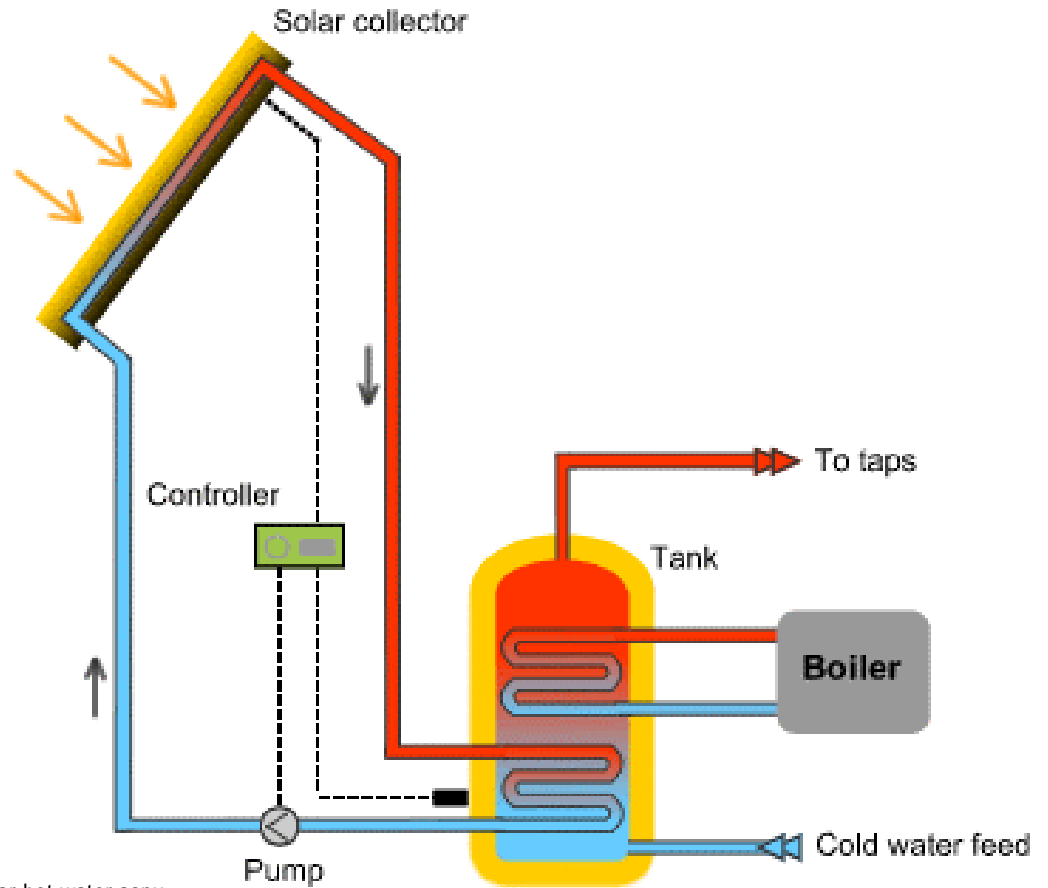
Source http://www.energy.sa.gov.au/be_energy_smart/home_energy_audit



Solar – Hot Water

- Simple and proven
- Economics mature
- Payback proven

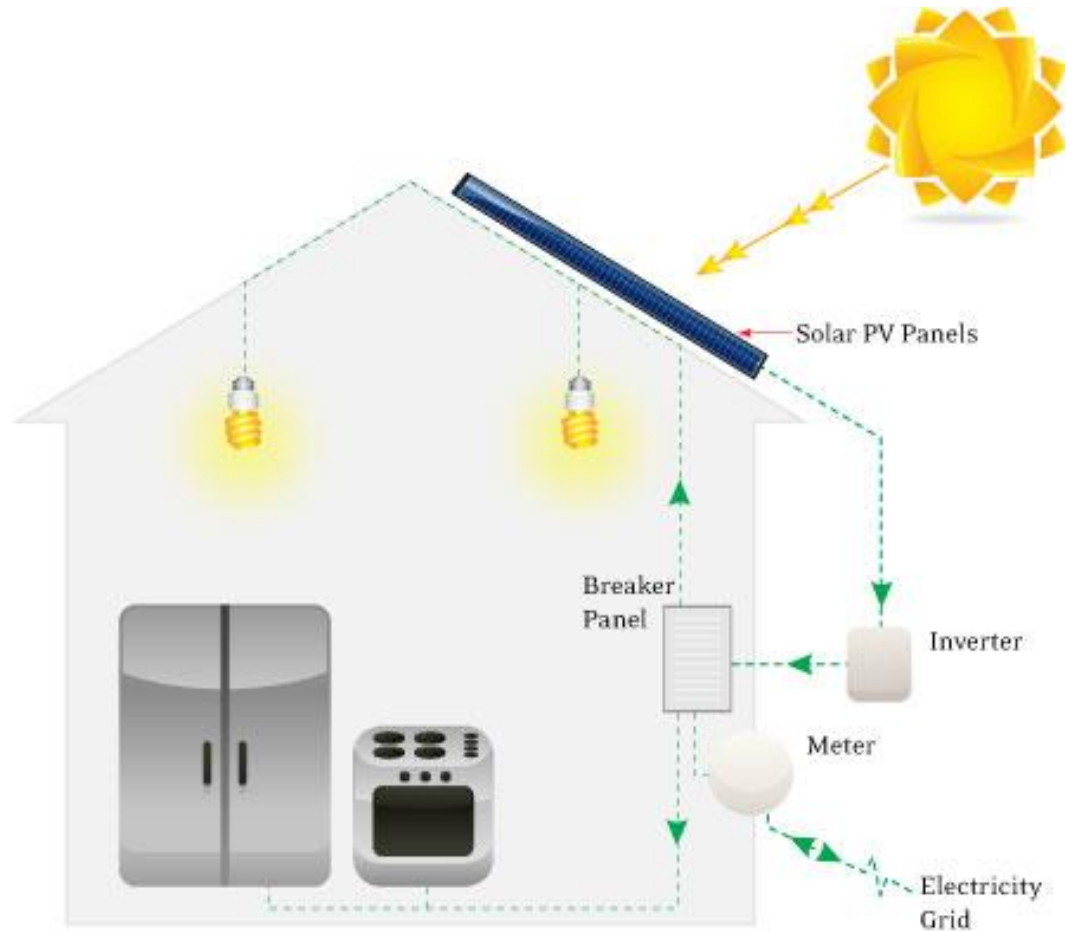
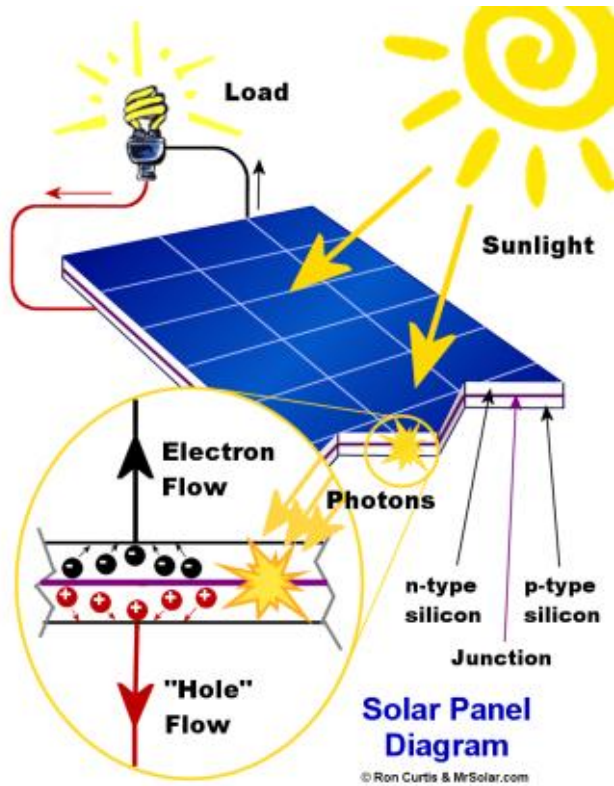
Water heating is the largest single source of greenhouse gas emissions from the average Australian home, accounting for around 23 per cent of household emissions.



Source <http://www.climatechange.gov.au/government/programs-and-rebates/solar-hot-water.aspx>



Solar – Electricity (PV)



Source <http://www.enmax.com/Energy/Res/Greenmax/Technology/SolarPhotovoltaic.htm>



Different types of Solar Hot Water

- Roof mounted tank
- Split System
- Heat pump



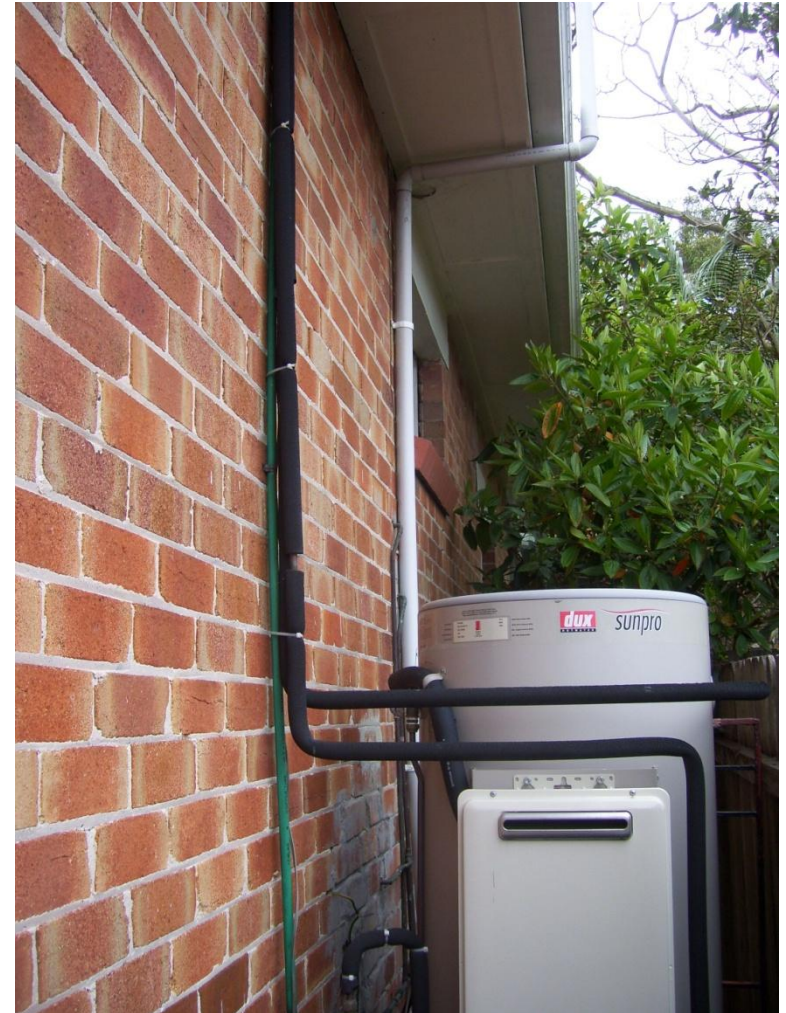
Source : <http://www.climatechange.gov.au/en/what-you-need-to-know/appliances-and-equipment/hot-water-systems/solar.aspx>



Roof Mounted Tank System



Split Gas Boosted Hot Water



AP VA

Pros and Cons of Different Solar Hot Water Systems

Type	Advantages	Disadvantages
Roof mounted tank	Simple and reliable. No pump or electricity required to move the water.	Your roof needs to be strong enough. Some people think it is ugly. The tank is exposed to the elements and harder to maintain
Split System	Easy access to tank. Easier to super-insulate the tank. More flexible boosting. Don't need to worry about roof strength	Needs electricity to pump the water. Longer pipe runs can mean more heat loss (make sure the hot pipes are super well insulated!) More things to go wrong than thermosiphon.
Heat Pump	Nothing on the roof. Easy change-over Does not require direct sunlight	While producing hot water, it makes a noise (similar to an air conditioning unit) Electricity is necessary to power the fan that draws in air. This is minimal compared to an electric hot water system.

All will save up to 90% of a typical domestic solar hot water energy

Source : <http://www.solarhotwaterquotes.com.au/thermosiphon-or-split-solar.html>
<http://www.solarpay.com.au/heat-pump.html>



Different Solar Hot Water Collectors

- Evacuated Tubes vs Flat Plate

- Make more efficient use of the sun's energy
- Are lightweight and can be easily installed on the roof
- Are low maintenance and cleaned by falling rainwater
- Can withstand very low temperatures without the need for an anti-freeze fluid
- Are generally more expensive than flat plate panels
- Individual tubes can be replaced if damaged.

Source

<http://www.metaefficient.com/renewable-power/solar-evacuated-tubes-free-hot-water.html>
<http://www.climatechange.gov.au/en/what-you-need-to-know/appliances-and-equipment/hot-water-systems/solar.aspx>

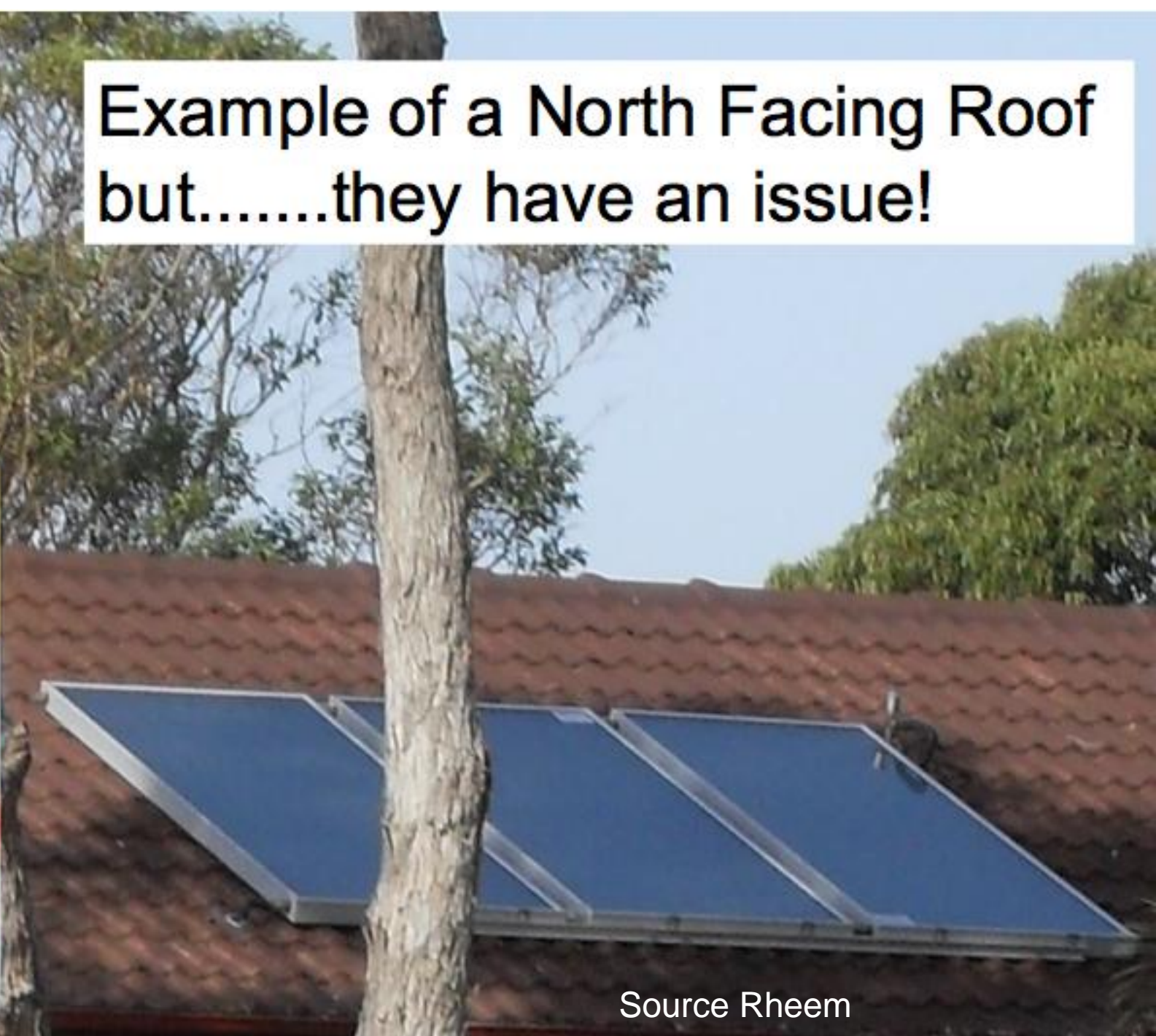


Things to think about – Solar Hot Water

- Gas or electric boost (on demand or in the tank)
- How much hot water do you use – how much do you need?
- Insulate the pipes!
- Access for maintenance
- Shading – now and the future



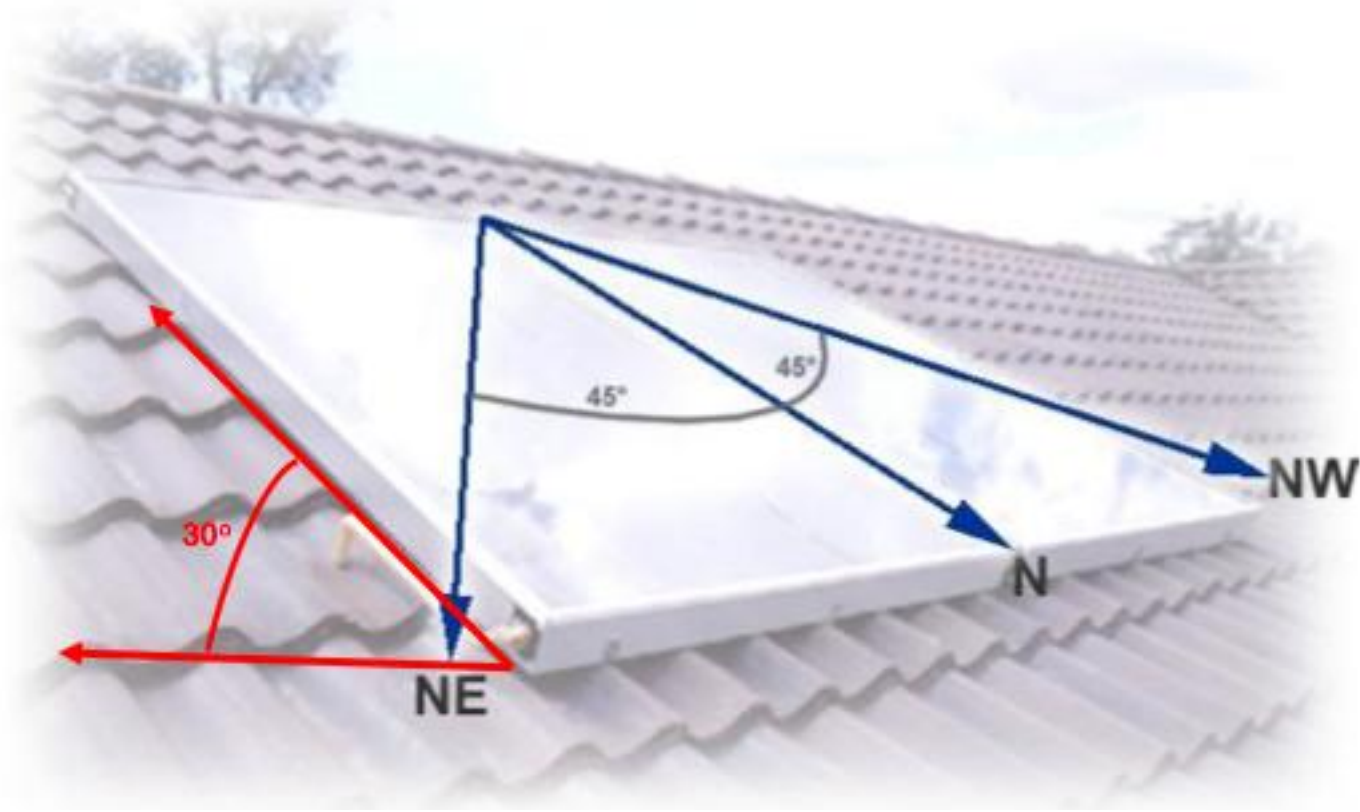
Example of a North Facing Roof
but.....they have an issue!



Source Rheem

Installation Tips

Collector Installation



Source Rheem





Source Rheem

Solar Hot Water – Rebates etc

Support to replace an electric hot water system

- Federal Govt - \$1000 (\$600 heat pump) *May have changed in Jan 2011*
- NSW Govt - \$300
- Renewable Energy Certificates – depends on type of system but typically 20-30 RECs - \$800-1200
- Plus the money you save on electricity bills!

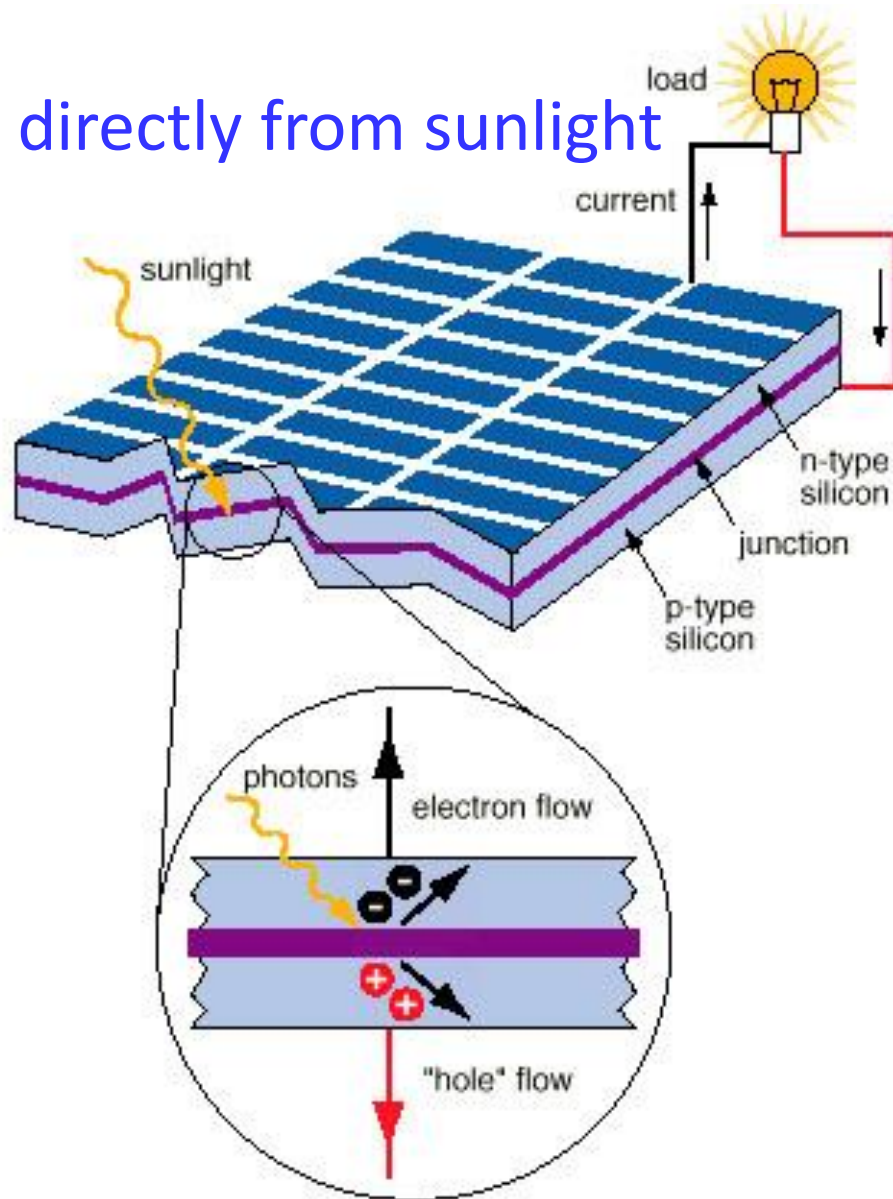
Typical Solar Hot Systems will cost \$5-6,000 before rebates – so about \$2,500 to \$4,000 after rebates.

Payback will be around 5-7 years - >20% rate of return

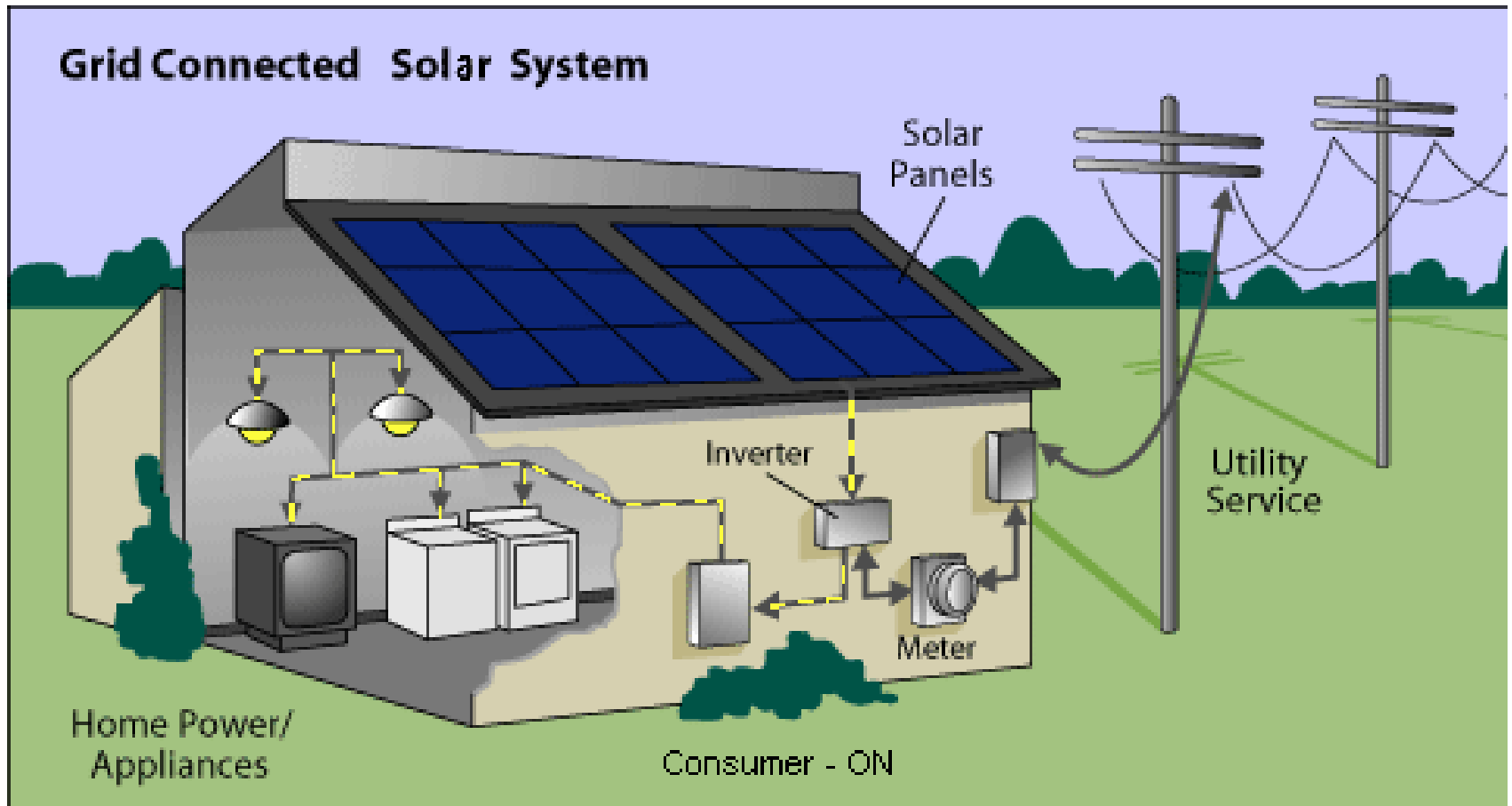


How Solar PV Works

Electricity directly from sunlight



Solar PV Systems Feed directly to the Grid through an Inverter



Source : <http://www.solarsa.com.au/how-solar-works>



Types of Solar PV Systems

- Solar PV panels – 2 main types
 - Crystalline (Mono or multi)
 - Thin Film (Amorphous, CdTe)
- Thin Film generally lower efficiency than crystalline but lower cost
- Crystalline panels power drops at higher temperatures

ALL TECHNOLOGIES WORK WELL
IN THE FIELD



APVA



Source Solarshop





Source Solarshop and Solar Rangers



Source
http://cr4.globalspec.com/PostImages/200807/21ce_solar_roof_tile_FD7EA8BB-C410-3E1B-4FD2FB5777D80F74.bmp



Solar Hot Water & PV

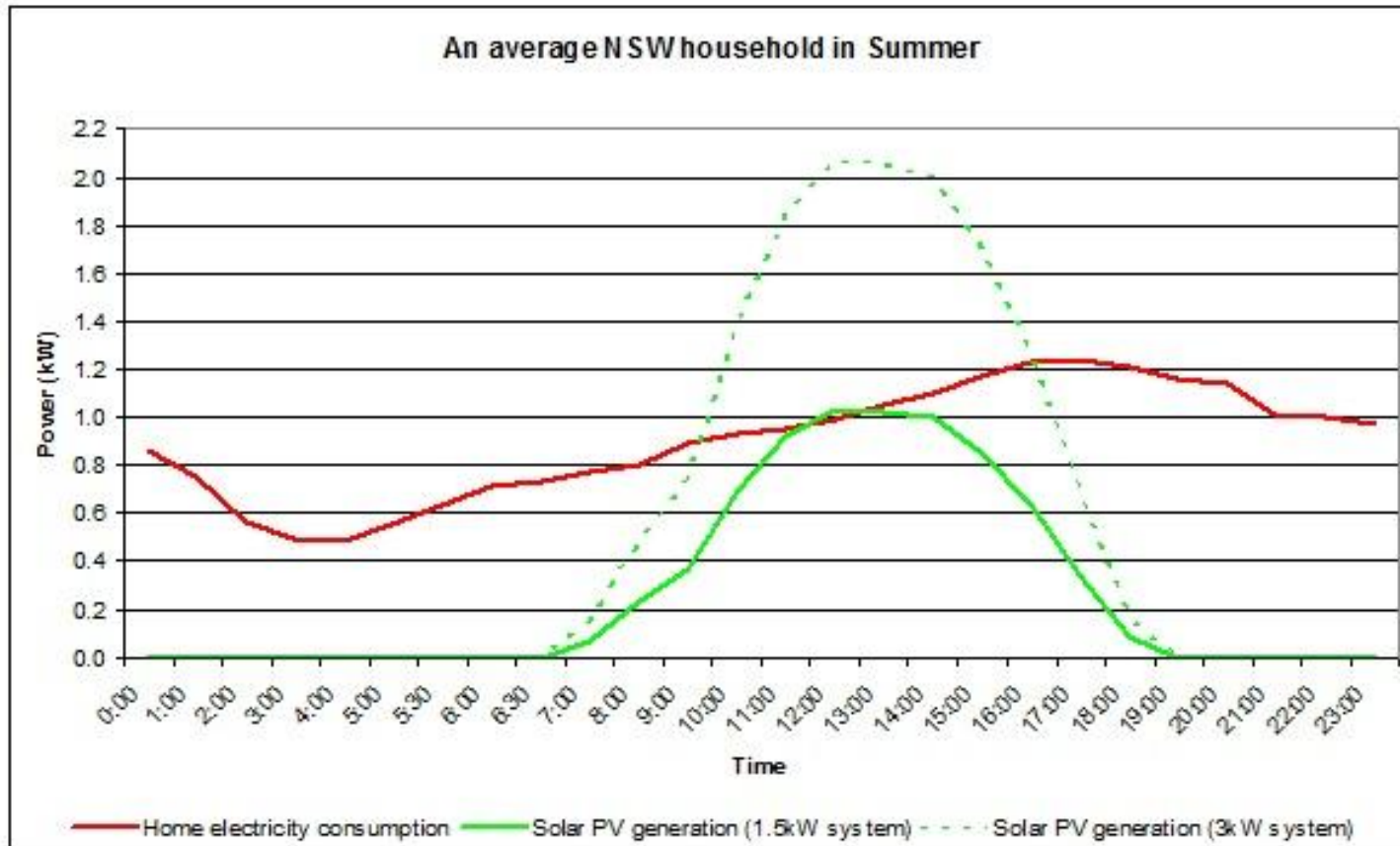




Inverter and Meter Installation



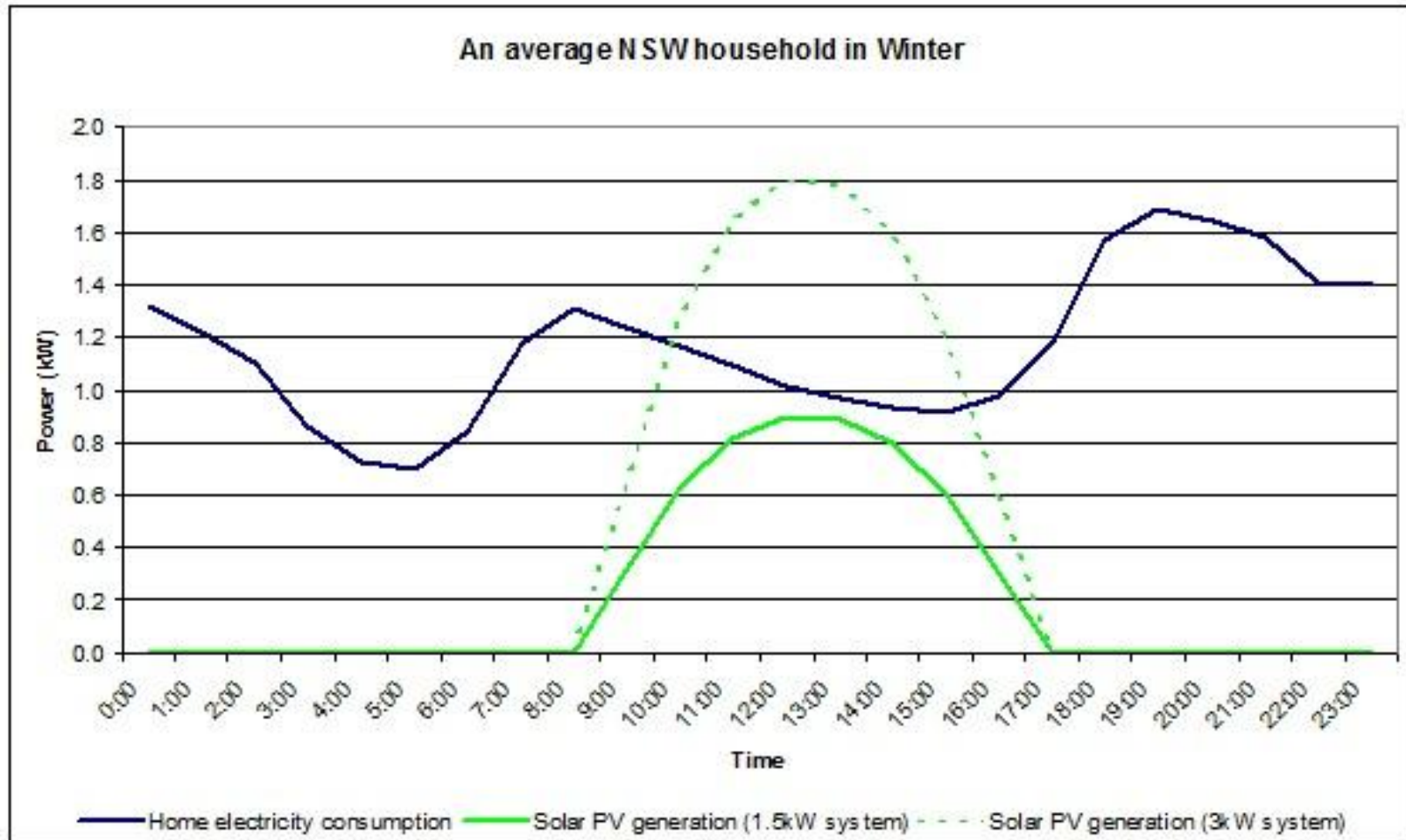
PV Generation vs Home Electricity Use



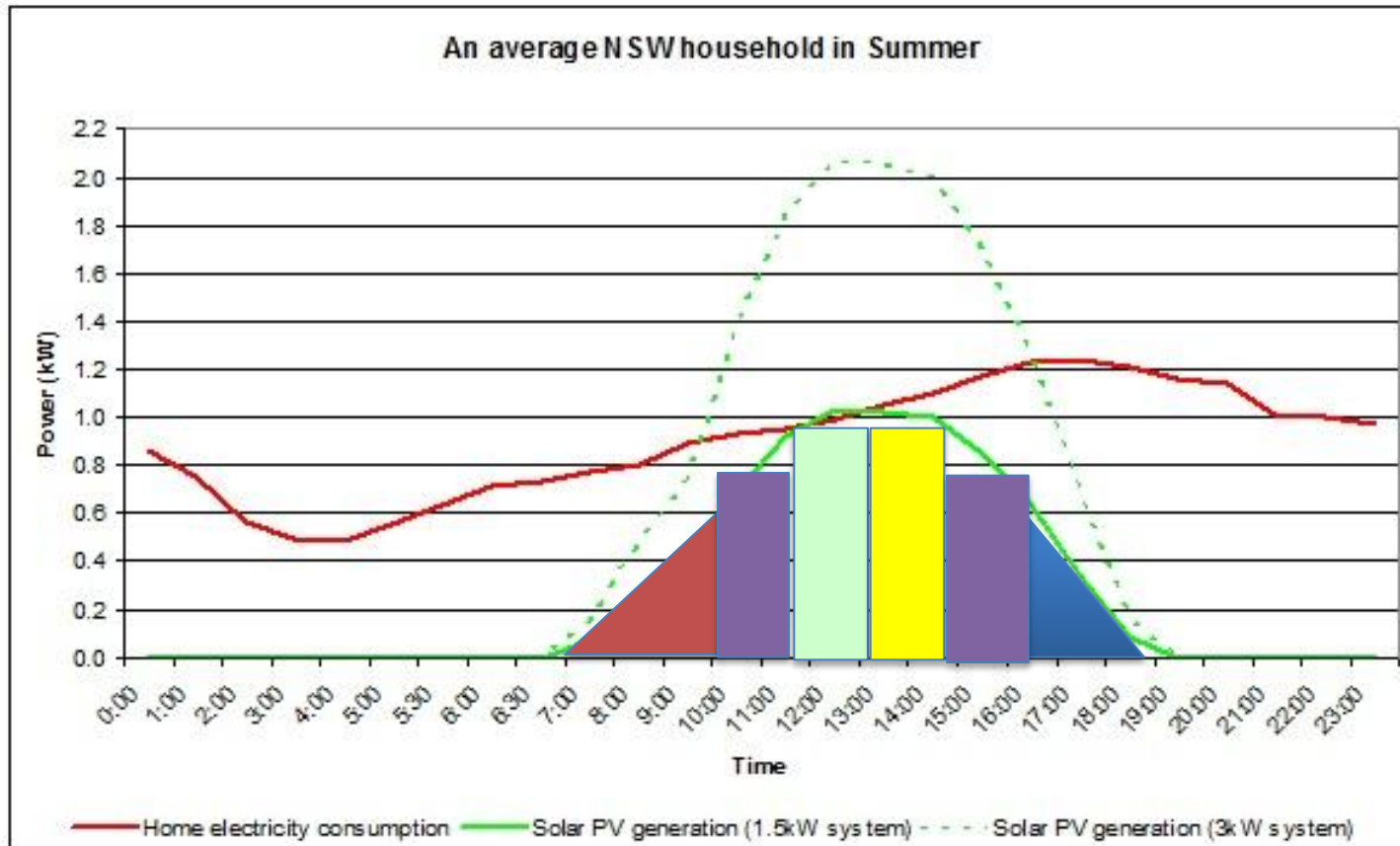
Why solar homes like gross feed in tariffs



PV Generation vs Home Electricity Use



PV Generation – How Govt support works



1.5kW System

Average

5.666kWHrs

2066kWHrs/y

1REC =

1000kWHrs

So 1.5kW sys

2.06 RECs per

year

Why solar homes like gross feed in tariffs

Source : <http://www.solarchoice.net.au/blog/home-energy-consumption-versus-solar-pv-generation.html>



RECS Continued

1.5kW system - 2066kWHrs/year = 2.06 RECs

- But Government allow you to trade the next 15 years up front and get a 5*multiplier for the first 1.5 kW

1.5kW System = 2.066 RECs * 15 years * 5 = 155 RECs

Thereafter each 1 kW gets 20 RECs

- REC = floating around \$32 now but will be fixed at \$40? next year
- So 1.5kW REC rebate worth \$5000 to \$6200



What does this mean to price

- Market advertises the price net of RECs
- Supplier is taking the REC price risk
- So \$2,990 is really a \$7,990 price less \$5000 REC rebate

Solar panel system for \$2,990* fully installed!

Right now pay only \$2,990 for a fully installed 1.5kW solar electricity system! After an upfront payment of \$299 that's just \$112.12* a month on our payment plan.

Origin now makes it more affordable than ever to go solar with our interest free payment plan^.

The Solar Credits Scheme puts solar within reach of more Australians. There is no means testing so your household will be eligible no matter what your income.

Solar panel systems generate clean electricity using the sun's light, cutting your energy bills and reducing your impact on our environment. Installing a solar panel system is not only an investment for the future, you'll also be doing your bit to reduce your



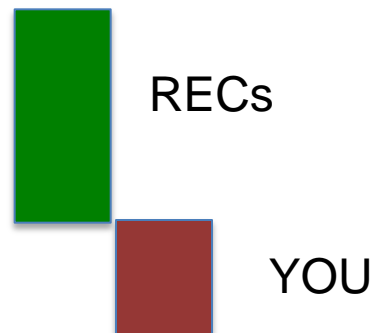
Solar electricity from \$2990*.

Pay \$299 now then \$112.12^ a month.

Go solar

Emergency hot water
Order online or call for fast service

ORDER NOW!



NSW Government – Feed in Tariff

- The Solar Bonus Scheme - will pay 20 cents per kilowatt hour for energy generated from rooftop solar panels up to 10 kilowatts in size. It is available to small electricity customers, including households and some small businesses, schools and community organisations. The Scheme commenced on 1 January, 2010 and is proposed to run for 7 years.
- A 1.5kW system costing \$3000 after the Federal REC rebate will generate in region of 2000 KWHrs per annum - @ 20c/kWHr = \$400 credit
- Currently results in breakeven over 7 years
- But you will be able to sell the electricity for the lifetime of the system (20+ years)



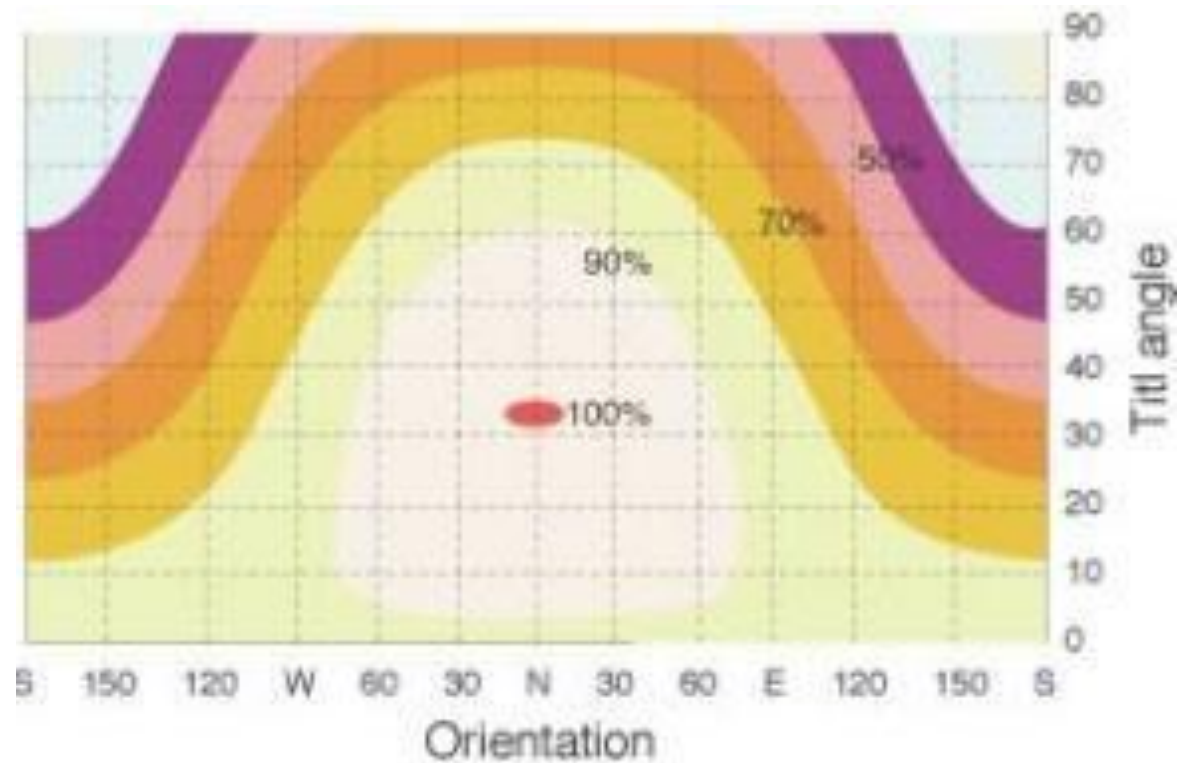
Shading – To be avoided

- If part of a solar array or panel is shaded it will not generate – like a blocked pipe
- Must have clear view of sun from 9am to 4pm



Effect of Tilt & Orientation

North facing roof with a 30-40 degree pitch is ideal but much more important to be free of shade



Installation Safety – Fall Protection



Source Solar Rangers



Installed with safety in mind



Source Solar Rangers



Not so safe!



Always use Accredited Designers and Installers



Clean Energy Council

The screenshot shows a Windows Internet Explorer browser window displaying the Clean Energy Council website. The address bar shows the URL: <http://www.cleanenergycouncil.org.au/cec/accreditation/Solar-PV-accreditation/findaninstaller.html>. The browser's search bar contains 'CEC'. The website header includes the Clean Energy Council logo, navigation links (Home, Technologies, Policy & Advocacy, Accreditation, Resource Centre, Media & Events), and a search bar. The main content area is titled 'Solar PV Accreditation' and features a 'Find an Installer' section. This section includes a sub-heading 'Current Lists of Accredited Designers / Installers of Solar PV Systems', a disclaimer: 'Please note, Accreditation is awarded to the individual Designer/Installer, not the company. If you are unable to find the Company in our list, please ask them to provide you with the name of the Designer/Installer who will be completing the work.', and a link: 'Search for installers by suburb: [Click here](#)'. Below this, it states 'Last updated 1 October 2010'. There is also a section for 'AIBS - SA Certification for roof safety' with the text: 'The following accreditedites have attended the AIBS - SA course on roof safety and are certified to work on roofs in South Australia to see the list [click here](#).' and 'Last updated October 2010'. A 'Useful links' box contains a link to 'Consumer guide to Solar PV'. A sidebar on the left lists 'Solar PV Accreditation' topics, with 'Find an Installer' highlighted.



Insist on Accredited Installers

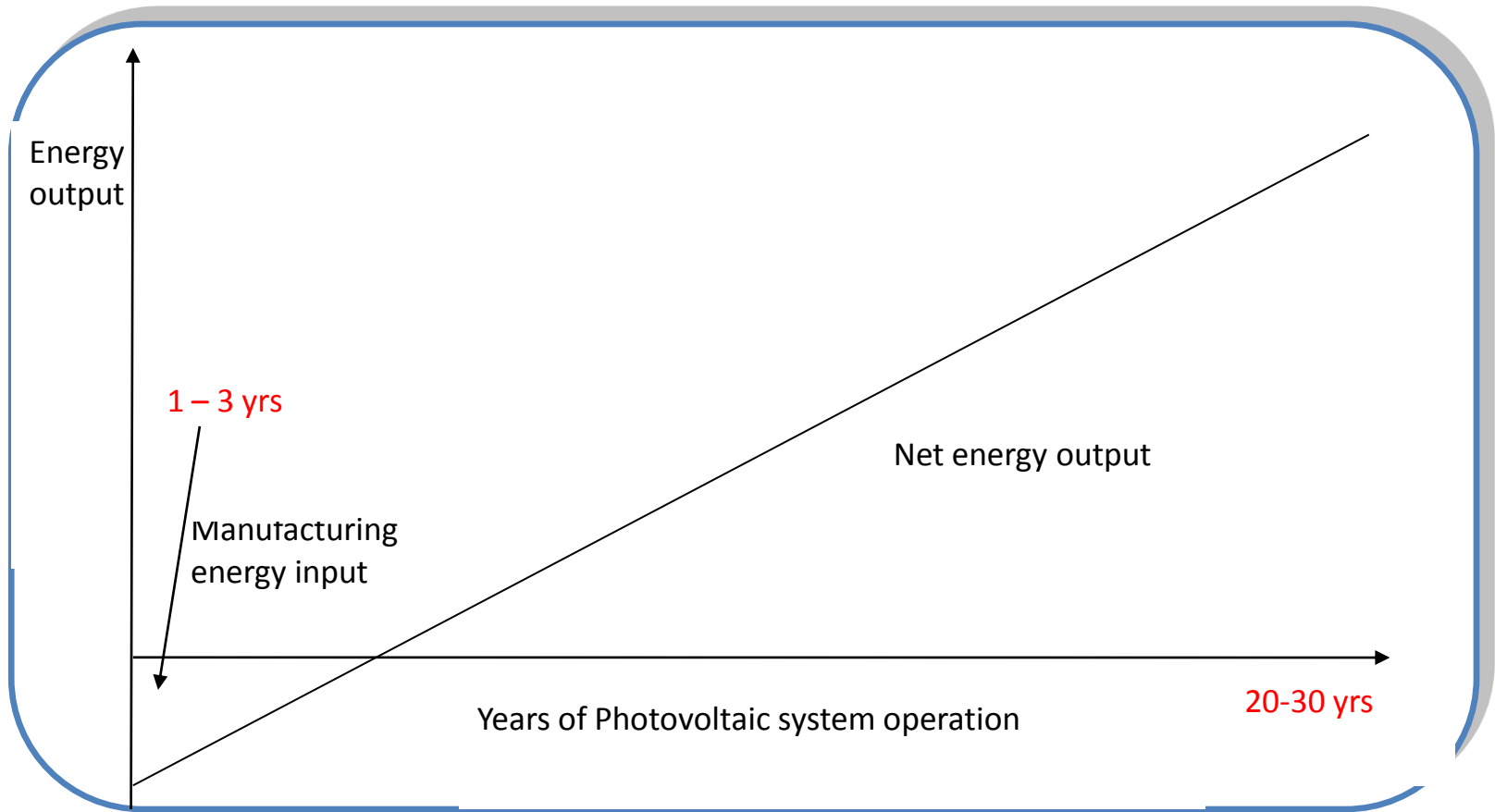
- Solar PV generates electricity
- Like any electrical work on your home if installed incorrectly it could be a fire risk
- Check your installers references – ask to see CEC certification



Clean Energy Council



Common Myths – Energy Payback



Solar in Apartments

- The whole building could elect to install a commercial scale solar hot water (or PV) system. Issue will always be getting agreement!
- You can install a PV System into your own meter – just need agreement



Things to think about when choosing a Solar PV supplier

- The REC rebate is worth about \$5000 on the first kW – will not be available if the system fails and supplier cannot provide backup and warranty
- Warranty terms – who is providing the warranty on the key items – Solar panels and inverter – if the terms are back to back – have you heard of the supplier- what type of financial strength do they have to back up warranty.
- After sales support capability - make sure you are happy
- References – go and look at some systems they have installed in the area and ask questions



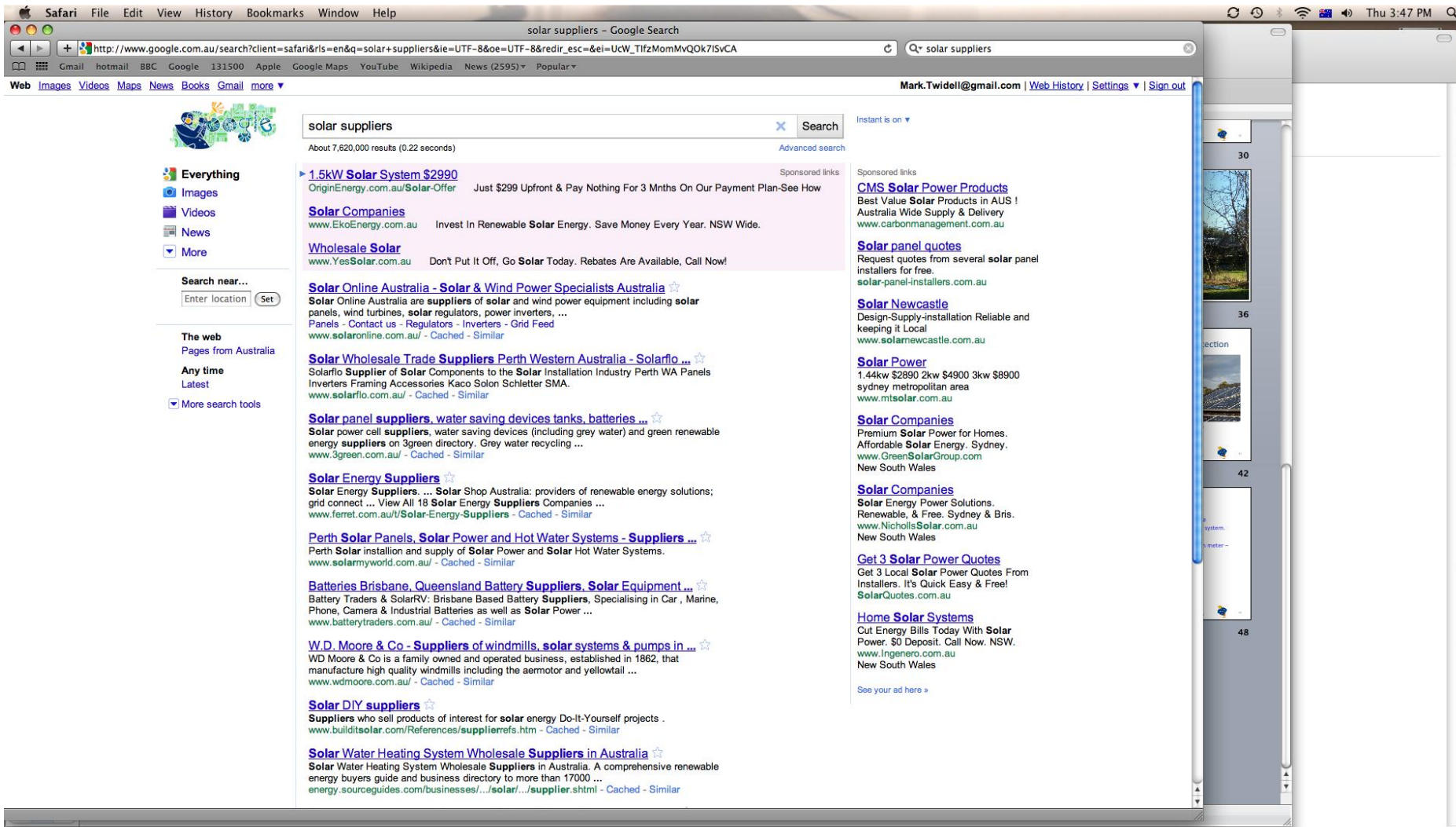
Solar Where to Get Information

Manly Council



The Australian PV Association





Solar Suppliers
About 7,620,000 results!



Summary

- Solar Hot Water - pick the type of system that best suits your home and needs. Gas boosting is the most energy efficient way to ensure 24/7 hot water
- Solar PV – A very good deal currently with Federal and State support. Technology will evolve and get lower in cost but Govt support will also reduce – an investment with greater than 20% is a good one!
- Pick your installer carefully – references, ability to provide warranty – is warranty with the main supplier? (panels and inverters) - ask the questions!

