COONAMBLE HOUSEHOLD ENERGY WORKSHOP

Introduction

- Welcome (Slide 1)
- Amenities
- This workshop has been arranged byas part of.....to show householders more about energy bills and energy efficiency.
- About trying to understand energy bills one participant said "I've got a university degree but I still don't know what it means"
- While many people have done some things to reduce energy use (eg switching off, etc) many are unaware how they could do more to reduce consumption.
- About taking action, one participant said "People just think, 'I'll get around to it' and they don't"
- Among all participants, the biggest motivation to reduce energy use was cost savings.
- Winton's background and experience with actual stories of extreme consumption and extreme efficiency.
- What the initiative wants householders to get out of the workshop:
 - 1. Learn how to read your energy bills,
 - 2. Be aware of ways of saving energy without costing you money all the time,
 - 3. What's using the energy in your home, and
 - 4. Ways to reduce that consumption.

Discuss the evaluation. In addition to evaluation of this session we are asking them to write down what additional information they need and how they would like to get it.

Also if people are interested in finding more about solar we will arrange workshops to cover this if numbers are sufficient. Reinsure householders of after-workshop support. Mention USB sticks to hand out which have more information about energy efficiency including all the free download stuff available from our website.

Electricity bills explained

The two basic types of residential meters (*dumb* and smart). Dumb meter: every time the silver wheel spins 170 times another kWh on the bill. Smart meters have different tariff rates which we will revisit.

(Go to whiteboard) kWh is a measure of energy, commonly used to measure electrical energy.

The word can be broken into two parts:

- Kilowatt
- Hour

Kilowatt (power) is the RATE the electricity is used or how much electricity the device draws Energy = Power x time i.e kilowatthour. Therefore kWh = Rate of using energy x the amount of time it was used.

Kilo means 1000 so kilowatt can stated as 1000 Watts

Hour stands for time

So kilowatthour is the rate the electricity is consumed multiplied by the time it is consumed.

Example:

Clothes dryer draws two kilowatts of electricity for 2 hours (go to the whiteboard).

The total kilowatthours is:

2 kilowatts x 2 hours = 4 kWh (THAT GOES ON THE BILL)

Whiteboard - The laptop draws approximately 30 watts which is 0.03 of a kilowatt.

So if you use the laptop for an hour the amount of electrical energy you have used is:

0.03 kW x 1 hour = 0.03 kWh

THAT'S NOT MUCH

Jug is 2.2 kW - isn't it lucky you only put enough water into the jug for the number of teas or coffees you are making and are not filling the jug right up with water each time you use it?

Slide 2 electricity bill (dumb meter) – Hand out the actual bill

The bill indicates the household has two meters. One for hotwater and one for all the other electricity consumed in the period. Discuss the tariffs for peak.

Controlled loads 1 – only heat at night after signal sent to ripple meter. Describe what a ripple meter is. The network sends out a message (usually around 10pm) and via the ripple meter that turns the power on. You may have noticed that your lights at home blink at night times about 10pm. That's the signal coming out from the network. Controlled load 2 can heat outside those hours if necessary. Point out the difference in kWh rate.

Note the supply charge per DAY and discounts available.

Mention the new product on the market where charges are prescribed and how they work.

Mention rebates available for electricity, natural gas, LPG, life support etc. Write on board:

http://www.resourcesandenergy.nsw.gov.au/

Slide 3 - smart meter bill with daily tariff times included

Note only those on a smart meter need get up in the night to dry their clothes (go to the whiteboard to explain by multiplying 2kW x 10.09 cents/kWh.

Slide 4 consumption graph. Create your baseline. Comparing monthly /quarterly consumption. Seasonal variations – impact – the next part of the workshop will explain why.

Go to the whiteboard and draw the system of power supply in Australia with generator, network and retailer. Draw in wind farm and touch on RECs and green power (how retailers buy extra RECs).

Choice of provider – reflect on questions to ask people ringing to sell retailer contracts:

- kWh rates (peak and controlled loads)
- Supply charge rate
- Discount on kWh or total bill

Now the gas bill Slide 5 same basic structure as the electricity bill, both energy bills.

Slide 6 Where to get help – useful inks and websites (eg Energy Matters; Energy Made Easy etc)

Human thermal comfort

When discussing home energy processes it is important to remember the most important outcome: to achieve and maintain human thermal comfort. Human thermal comfort has two components: psychological and physiological, both are affected by:

- Temperature
- Humidity
- Air movement (breeze or draught)
- Exposure to radiant heat sources (e.g the sun)
- Exposure to cool surfaces to radiate, or conduct to, for cooling.

Our most effective cooling method is the evaporation of perspiration. Evaporation rates are influenced by air movement. Generally, a breeze of 0.5 m per second provides a comfort benefit equivalent to a 3°C temperature drop.

Radiation is also a source of heat gain. As with cooling, radiation is very important to our perception of comfort. For example, we can feel cold in a room that is a comfortable 22°C if there is a cold window nearby; conversely, we can feel warm at 0°C if we are well insulated with warm clothing and standing in the sun.

In summary, maintaining a comfortable temperature in the home is part of the thermal comfort solution. The second part is addressing the psychological aspects like eliminating draughts and thermal bridges or utilizing thermal mass and cross ventilation opportunities.

The Australian Greenhouse Office (2005) estimated that failure to address psychological comfort can increase heating and cooling energy use by up to 50%.

Thermal performance

Heat wants to even out with cold (like pressure)

If the temperature inside a building is the same as outside the building, then the temperature inside the building will remain stable. But if a difference develops, for instance it becomes colder outside, then the heat in the building will want to move to the outside to even out again. Take a book and show pen rolling down it at different slopes.

It's called thermal heat loss. Stopping heat loss is depends on the insulation qualities the material in the way of the heat trying to escape like:

Curtains & pelmets because glass leaks heat easily (unless you have double glazing) Slide 7 curtain and pelmet shows how hot air rises towards the ceiling. If it is warmer inside the home, the hot air will spill over the top of the curtain and go out through the glass window. The pelmet slows this up. If it is hotter outside, the hot air will seep through the window and tend to spill over the top of the curtain into the room.

But what is wrong with the image?

Yes, the curtain should be right to the floor to stop airflow between the curtain and the window.

Other measures:

Bulk ("wool") insulation roof, walls, floor

Double glazing

Draughts Slide 8 house diagram – tell the story of my wife and what we did at home in the Blue Mountains. Air typically leaks through:

- Unsealed or poorly sealed doors and windows
- Unsealed vents, skylights and exhaust fans
- Gaps in or around ceiling insulation and around ceiling penetrations (e.g. downlights, pipes and cables)
- Gaps around wall penetrations (e.g. pipes, conduits, power outlets, switches, air conditioners and heaters)
- Gaps between envelope element junctions (e.g. floor-wall or wall-ceiling)
- Poorly fitted or shrunken floorboards

Show caulking, door seal to attendees. Mention filling the gap between window frame and brick.

Letting the radiant heat of the sun in (show attendees the model house):

- Deciduous trees
- Thermal mass tiling where the sun comes in when it is lower in the sky
- Open the curtains on the sunny side.
- Try to spend most of your awake time in the warmer part of the house
- Partition off rooms of the house
- Rug up •

Heating

Slide 9 - Percentage break up of electricity consumption in the house Reference: South Australian Government www.sa.gov.au. This summary is a generalization. The % for each type of consumption varies from house to house because of number and age of people in the house, personal habits, the times people are at home, the climate, thermal performance etc.

Slide 10 – Cost of options

Brief discussion on gas vs reverse cycle. http://www.thefifthestate.com.au/spinifex/is-gas-heating-really-cheaper-than-

electric/82097

Buying: When you are in the market for a heater establish the kilowatt draw of the models you are interested in. Usually there is a specification plate on the unit or you will find it in the manual. For example if the power draw is 2000 watts (2 kW) then after an hour of use the heater will use 2 kWh of electricity. From there you can work out how much it will cost by multiplying by your electricity tariff rate. Suffice to say that if you have heaters drawing 2 kW dotted around your home and on regularly, the piece of the pie in this pie chart for heating and cooling will grow in size as a % of total household consumption.

The air conditioners in the table have a price range. It's all to do with how hard it has to work to put heat you want into the room. If it's 9°C outside and you want it to be a toasty 26°C inside then it's going to cost \$1 per hour. If you are happy with 21°C then it's going to cost 20 cents per hour.

If you are in the market for a new air conditioner make sure you select one with an inverter. This is a VSD which will significantly reduce the unit's energy consumption (same principle as the VSD for pool pumps).

Cooling

Thermal performance - bring the model house out again

- Shading & deciduous trees ٠
- Ventilation and watch outside and inside temperatures to catch cooling breezes.
- Whirlybirds (that turn off for winter months)
- Thermal mass (i.e tiling is cool as it is protected from the sun when it is higher in the sky
- Curtains & pelmets
- Insulation •

Slide 11 costs of cooling devices As with heating, it's all to do with how hard the equipment has to work. If it's 40°C outside and you want it to be a cool 18°C inside then it's going to cost about \$1 per hour to operate a split system air conditioner. If you are happy with 26°C then it's going to cost 20 cents per hour.

Note the tiny operating costs of fans at 1 to 2 cents. Provided the air isn't too humid a fan will seem to reduce the temperature in the zone of air movement by 3°C. Also evaporative coolers are inexpensive at 6 cents per hour. However they cool by water evaporation so they increase the room humidity. In areas away from the sea with low humidity they work really well. They need to be used with windows or doors open and are less effective on humid days.

It may be sensible to seal off living areas for cooling by air conditioning to reduce the volume of air to be cooled.

Hotwater

Hotwater heating comprises approximately 18 to 20% of the total energy consumption in the typical home.

Basically there are seven main types of domestic hotwater systems:

- Electric storage
- Electric instantaneous
- Gas storage
- Gas instantaneous
- Solar electric boost
- Solar gas boost
- Heat pump

Electric storage is the most expensive system to operate. They are very efficient in that 85% of electrical energy supplied to them is directly converted to heating the water, but it takes a lot of energy to heat water.

Electric storage comes in different sizes with the small 50L version most commonly installed in home units (especially where there is no gas connected to the block).

The 50 L models commonly draw 3.6 kW when heating. Bigger systems up to over 300 L capacity draw 4.8 kW while heating water.

The most effective way to reduce hotwater electricity consumption is to minimise the use of hotwater in showers and baths. There are a number of other ways to reduce the electricity consumption of electric storage systems including:

- Set the temperature on the hotwater system to 60°C (higher temperature settings mean the hotwater system has to heat longer to reach the set temperature).
- Install pipe lagging on the exit pipe from the hotwater system that allows hotwater to come through more quickly.
- Put a valve cosy on the pressure relief valve.
- Install water efficient showerheads.
- Put aerators on the kitchen and bathroom taps.
- For new installations position the storage tank in a sun exposed place.

The per minute cost of having a shower using an electric hotwater system varies between 2.5 cents on off-peak hotwater to 12 cents on peak hotwater (for those with a smart meter). For those on a 25 cents per kWh tariff a shower costs 6 cents per minute. Let's compare someone on that tariff who has a five minute shower every day to someone who has a 15 minute shower each day. That 10 extra minutes daily adds up to an extra \$55 on your quarterly bill. A 100 litre bath (half hotwater) will cost 66 cents on a 25 cents per kWh tariff.

Electric instantaneous hotwater systems are marginally cheaper to use than electric storage as energy is not used maintaining stored hotwater set temperature.

Gas hotwater systems are actually less efficient than electric systems but gas is cheaper. Showers cost approximately 4 cents per minute.

Slide 12 – How solar hotwater systems work Solar hotwater systems normally are installed on the building roof. The water is preheated as it is pumped through tubes (on the roof) exposed to the sun. There is a boost function (either electric or gas) to counter prolonged periods of cold weather. In warmer climate of Western Sydney these systems are very effective. Showers and baths cost virtually zero cents for most of the year. The hurdle with these systems is the installation costs, usually about \$5,000. However they have a good payback for those people with a smart meter who need to shower in the afternoons (peak tariff rate).

Heat pump hotwater systems use the same technology as the common household air conditioner in that they take the latent heat from outside air and transfer it to the water being heated. Therefore they don't work as efficiently in colder climates

Lights

Slide 13 – lightbox and results of testing What to look for when buying lights:

- Wattage refer to testing results
- Lumens
- Colour Slide 14 colour temperature
- Beam angle and glare
- Lifetime
- Australian compliance C tick or RCM Slide 15 certification marks
- Replacement Discuss tubes and downlights ballast replacement

Go to whiteboard and go through business case exercise:

• How much does it cost me to replace my halogen downlight? New halogen costs \$5

• New LED downlight costs \$10

So you are \$5 behind. Ongoing electricity savings Assume light on 6 hours per day for 365 days Assume electricity cost is \$0.25 per kWh Halogen draws 50 watts LED draws 10 watts Saving per hour 40 watthours or 0.04 kWh What is the payback? Annual savings: 6 hours x 365 days x 0.04 x \$0.25 = \$21.90 That puts you **\$16.90** in front each year. Look at the life of the lamp. 2,000 hours for halogen – lasts one year 15,000 hours for LED replacement – lasts seven years

Appliances

Appliances, refrigeration and cooking are responsible for 30% approximately of energy use in the home. The table below gives you an idea of the amount of power used by different types of appliances (without being product specific). Slide 16 – power draw of appliances

Most appliances have an energy rating (as required by law) which give an estimate of the amount of power the device will use per annum. This consumption amount is estimated from the amount of power the appliance will draw while it is in operation by estimating the time the device will be in use.

Dishwashers use a fair amount of power because they heat water in the process of washing the dishes. A 35°C wash will use half of the energy compared to a 65°C wash.

Refrigerators operate on the same principle as air conditioners in shifting heat from inside the refrigerator to the outside. The consumption of the device will be dependent upon the temperature settings you have for the cooling and freezer compartments. They ideally should be 4°C and -17°C respectively. Other important aspects of the operation of refrigerators include:

- Ensure there is good air flow around the unit to help hot air to get away.
- Make sure the condenser underneath the unit is kept dust and grime free.
- Check and replace seals to prevent air leakage.
- Try to limit the number of times the door is opened as every time hot air will invade the refrigerated space.
- Ensure the vents that move air around inside are not blocked by food products.
- Keep the fridge full so that less cold air escapes each time it is opened

Microwaves draw more power while they are in use than electric stove tops, but they use a lot less energy to do the same tasks. The reason is because they cook more efficiently and therefore take less time.

Washing machine are not very hungry power consumers if you use the cold water cycle. Take a look at your washing machine and you will see two labels: one for cold water wash and one for hotwater wash. The difference calculated on a per annum basis is about 600 kWh (depending on the size of the machine). A Cold wash will use one fifth of the energy compared to a 60°C wash and half compared to a 30°C wash. Heating water requires a lot of energy.

Modern electronic equipment has only a small power draw like laptop computers (about 30 W). The same applies to standby by power that is much less these days because of LED and electronic technology. For instance a mobile phone charger draws less than 1 W if left on while not charging.

Sub-metering Show Efergy meter

Purpose:

• To find out what is using the power

• Create a load profile Slide 17

Mention Energy Savings Scheme

The Energy Savings Scheme provides incentives for accredited businesses (known as Accredited Certificate Providers) to implement their energy savings project. Accredited Certificate Providers may be able to assist householders to:

- Acquire up-to-date energy efficient appliances
- Remove inefficient appliances, or
- Install a range of energy efficiency upgrades.

PV systems

The most common systems use monocrystalline or polycrystalline panels. You see them on house roofs. 4 panels generates 1 kW. So you can tell the size of your neighbours system by counting the panels. Main things to consider when contemplating buying a system is:

- Cost \$1 \$2 net of RECs (that provides the purchaser with solar generated electricity at between 4 and 5 cents per kWh).
- System size refer to the load profile in slide 17
- Orientation
- System component quality
- Roof slope

PV systems are coming down in price. Systems are available that cost \$1 - \$2 per watt installed (net of renewable energy certificates). That provides the purchaser with solar generated electricity at between 4 and 5 cents per kWh. The payback is approximately 5 and 7 years.

The return on investment for a PV system would improve if all generated electricity can be consumed in the home when it is generated. Battery storage is the way that this opportunity can be realised but the cost is generally high-

The return on investment for a PV system would improve if all generated electricity can be consumed in the home. Battery storage is the way that this opportunity can be realised, but the cost is generally high. Tesla announced the imminent release of its 7kWh battery storage systems with the forecast cost of \$4,300. These are preliminary costs and offer paybacks of 5-7 years (10 year warranty, probably a 15 year life) for those on time of use tariffs with peak charges over 48c/kWh.

Key areas to consider with battery storage technology are:

- How many recharges does the system allow? Lower recharge numbers indicate a shorter useful life of the system.
- The minimum charge level. Some battery systems can be run down to zero charge but others have a minimum charge level which will impact on the how many kWh are available for consumption.

The other areas to consider with battery storage are:

- Prices for battery storage technology are high but prices are dropping quickly making the business case more appealing.
- The business case will be affected if your electricity is charged on a time-of-use basis. This is because the battery stored electricity can be applied to peak consumption times.
- Electricity retailers are introducing finance packages for battery storage (to complement their PV packages).