Target Setting Report

Improved Design,
24 Ellesmere St, North Perth
Tiger Developments

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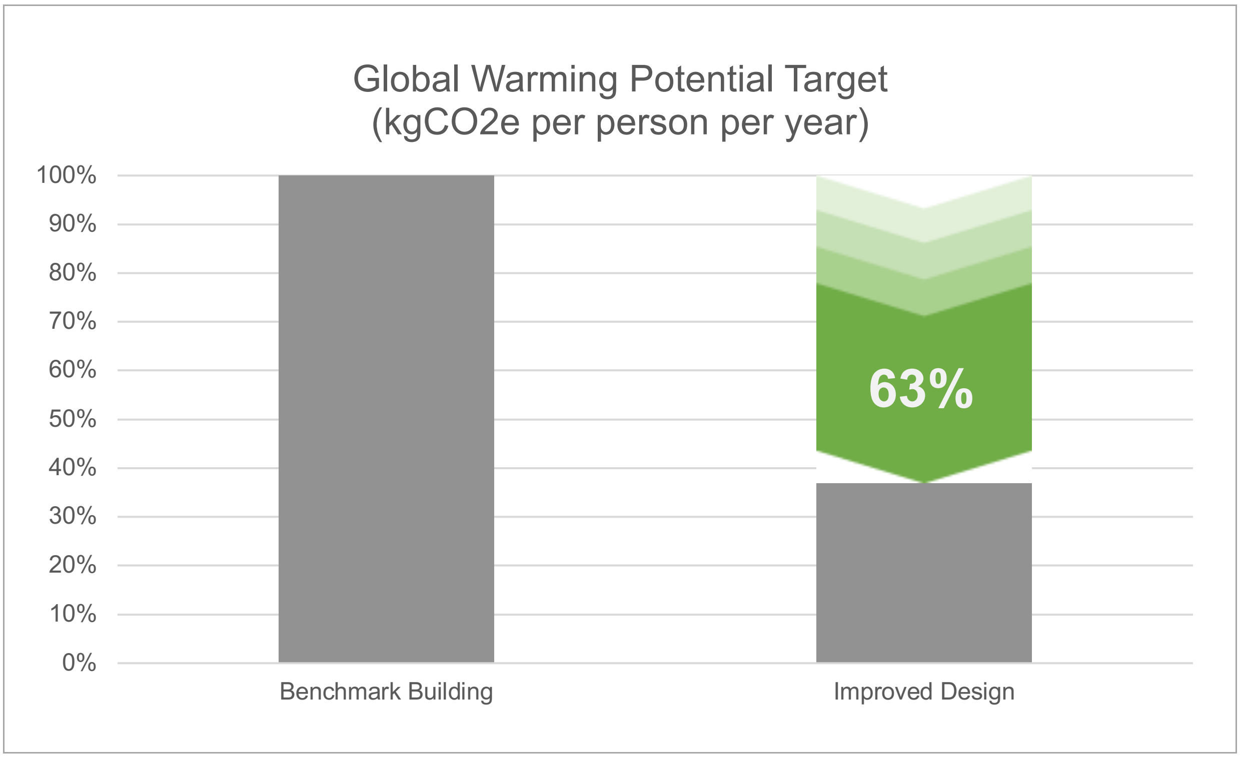
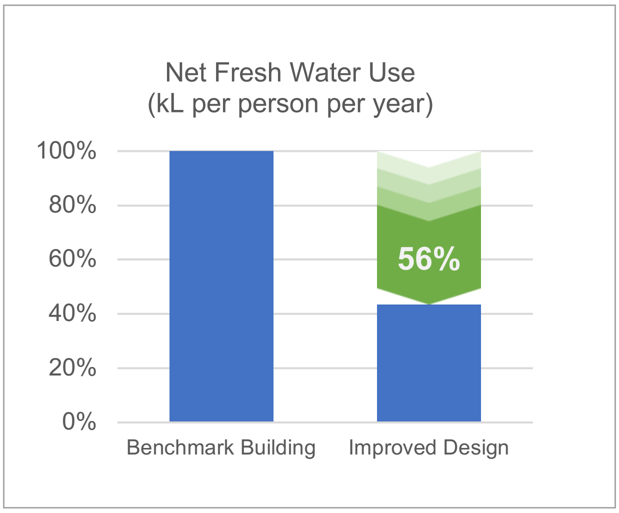
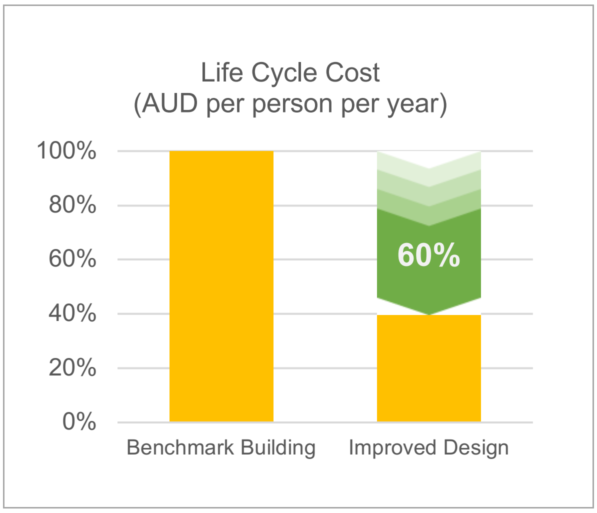
Version 2

Results Summary







Introduction

The target setting service is a very early stage LCA study with the goal of determining the feasibility of various design options and deciding the performance target for a development. Although most elements of study meet the requirements of the EN15978 and ISO14044 standards, there are significant deviations most notably in data collection accuracy. The target setting service is designed for very early stage developments without any more information than a design brief and significant assumptions need to be made to study the life cycle impacts of design options. The study confirms the design team has thoroughly considered the life cycle design performance of the development and has shortlisted strategies that will enable the stated performance target to be met. To prove that the target has been met with the final design, a comprehensive Life Cycle Assessment must be conducted in compliance with EN15978.

Building Design Characteristics

The below table shows the key characteristics of the designs being compared in the report.

	AU Res Ave 2013 Code Compl CZ 5 (10 dwelling) V12 Data Test	Reference Design	Improved Design
Design Details			
Stories (#)	1	2	2
Primary Function	Single Family Residence	Residential units	Residential units
Structural Service Life Limit	100	100	100
Predicted Design Life	54	54	54
Functional Characteristics			
Dwellings	10	4	4
Bedrooms	30	12	12
Occupants	24	10	10
Total Floor Areas			
Usable Floor Area	2,140	472	472
Net Lettable Area	0	0	0
Fully Enclosed Covered Area	3,010	482	482
Unenclosed Covered Area	0	53	53
Gross Floor Area	3,010	535	535
Usable and Lettable Yield	71 %	88 %	88 %

Descriptions of Objects of Assessment

AU Res Ave 2013 Code Compliant CZ 5 (10 dwelling) V11

The benchmark represents the average residential dwelling constructed in Australia. It is not an average of existing stock but new average stock. For residential buildings in Australia there is a broad density mix from detached through to apartments. For each of these density types, eTool have formulated a BCA code compliant building. We have then created a nominal statistical mix of floor areas to match the average new dwelling size in Australia (214m2). In this way we come up with a “dwelling” that is a mix of densities and matches the size of the average Australian dwelling. A similar approach is taken for operational energy use. More details on the calculation of the benchmark is documented at http://etool.net.au/eblog/engineering/etool-residential-benchmark-for-australia/

Building as Usual

The Building as Usual Design (BAU) represents a standard practice reference model which demonstrates minimum building requirements according to the Building Code of Australia. This design is used as a comparative, minimum compliance model of the same scale, function, location and occupancy which is run against the Base Design.

Life Cycle Design Strategies

A target setting workshop has been conducted with eTool and the current design team to profile average indicators of similar dwellings. The root causes of these impacts have been interrogated to understand what influence the design team can have on reducing them. A mix of strategies has been identified and prioritised. The design team will pursue the preferred strategies initially to achieve the LCA targets, but also has a list of back up strategies should these not achieve the targets, or prove unsuitable for this development.

Strategy Description	GWP Savings	FW Savings	AUD Savings
Base Design performance compared to benchmark (e.g. net usable area verse gross floor area yield, occupancy, design life, reduced outdoor water use, exclusion of pool etc)	27.48%	45.29%	48.93%
Finishes: Reduce Carpet Use	0.59%	0.01%	-0.04%
Refrigeration: Reduced Fridge Space (Maximum 750mm Width)	0.36%	0.02%	0.02%
HWS: Gas Instantaneous	8.77%	0.66%	0.76%
Gas Cook Top	1.69%	0.16%	0.21%
Lighting: High Efficiency LED Lights	0.39%	0.02%	-0.01%
Water Efficient Toilets - 5 Star	0.20%	2.33%	3.22%
Upgrade to Water Saving Taps: WELS 6 Star	0.09%	1.02%	1.41%
Low Flow Shower Heads	1.32%	5.71%	7.88%
Concrete Replacement: 30% Fly-Ash Blend Floor Slabs	0.31%	0.01%	0.00%
Finishes: Reduce External Masonry Wall Finish	1.07%	0.06%	-3.58%
Solar PV Grid Connected - 8 kW (2kW per Apartment)	18.48%	0.99%	1.36%
Energy Monitoring: Residential, Basic	1.15%	0.06%	0.17%
Energy Monitoring: Residential, upgrade to building integrated	1.16%	0.06%	0.06%
Total	**63.0%**	**56.4%**	**60.4%**

Anticipated eToolLCD Design Rating

It is anticipated the project will achieve an eToolLCD Gold rating if the preferred strategies are implemented and the project goes ahead with a full LCA once the design is finalised.

Target Setting Workshop Attendees

The following people attended the target setting workshop.

- Richard Haynes
- Myf Zrinski

Appendix A – Design Strategy Details

Gas Cook Top

In regions with fossil fuel dominated electricity grids such as WA, gas represents a large advantage over electricity for providing energy to cook with. This is due to the heat and electricity losses associated with distributed power. Burning the fuel (gas) at the source eliminates these losses and is a more efficient way of using the fuel. The majority of gas cookers sold today include safety features that automatically turn off the gas when no flame is present. The drawback to moving to gas cooking is that a gas pipeline may need to be installed.

More cool details about gas vs electricity click here.

Image Source: publicgas.org

Energy Monitoring: Residential, Basic

This smart technology essentially empowers residents to better control their energy use. It's appealing to people who are conscious of their energy costs, their environmental footprint or just want to have real control of their home. Tech-savvy people will also be drawn to energy monitoring as it's a neat gadget. It can be very marketable if presented well and many new dwellings now come fitted with energy monitoring as standard or offered as an optional upgrade. The technology is user friendly, low cost to install and normally a "no brainer" for influencing all energy consumption in the dwelling. Installation is very straightforward and in many cases existing owners are installing monitoring systems themselves.

The solution allows occupants to:

- Understand what appliances and devices are demanding the most energy (electricity) and adjust behaviour accordingly (immediate improvement)
- Identify unexpected consumption and pre-empt blow-outs before it's too late such as when the energy bill arrives. (longer term improvement)
- Determine which tariff arrangement will be best for them if time of use tariffs are in place on their connection
- View energy generation (if installed) versus consumption to see their net energy use

In most cases monitoring of energy consumption remotely is also an added feature

There are many different types of energy monitors on the market, all are likely to provide a positive impact on average, however depending on the durability, sophistication and effectiveness at influencing behaviour, savings will vary. Studies show that energy monitoring can provide between a 5% and 30% saving in electricity. The savings are largely dependent on the sophistication of the interface and level of customer support available. More details at this eTool online presentationand article.

In this recommendation we have assumed a basic installation with fairly minimal durability and sophistication. This solution will be all that's required to influence energy consumption of residents that are already interested, however will be unlikely to influence those that are indifferent to energy savings. An additional risk of these basic systems is they're not integrated into the building so an departing owner or rental tenant could easily physically pull out the system and take with them when they leave. We have assumed a conservative saving of 5% energy use with the installation of this system. These simple systems are typically a $100/unit capital cost (replaced every 10 years) but will usually have very fast payback periods.If the implementation of this strategy is outside of the project budget the developer may offer the strategy as an upgrade package for purchasers. This eliminates the need for upfront capital while promoting best practices and educating the public.

(Example of a Basic Energy Monitoring System, Current Cost model. Image source: www.diyhomeautomation.com.au)

(Example of dashboard. Image source: www.efergy.com)

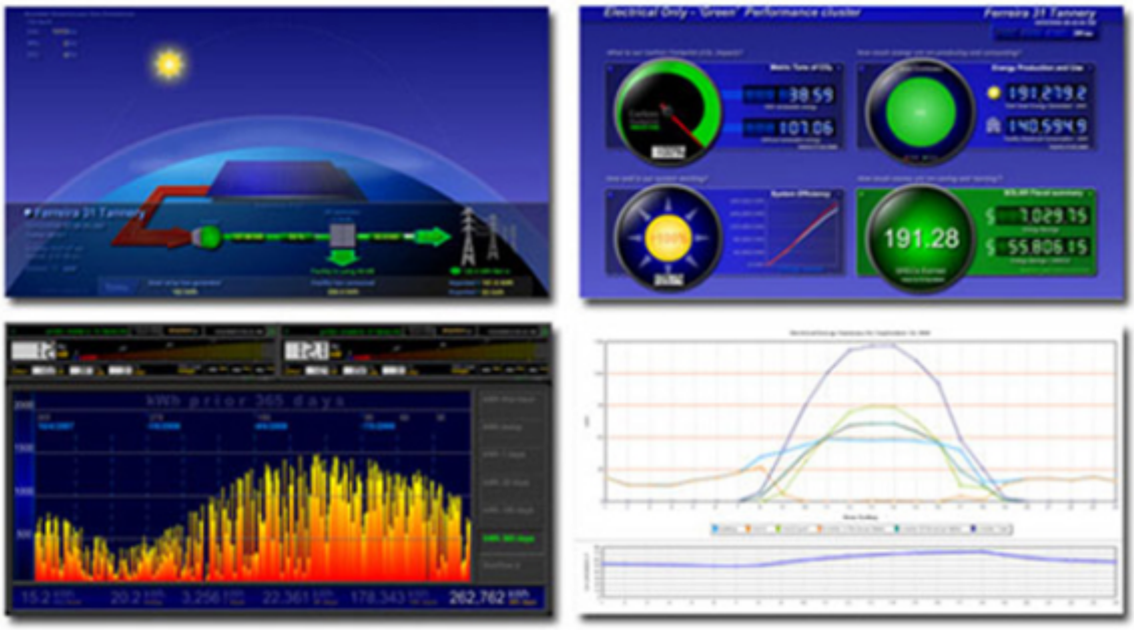


Image Source: www.englertinc.com

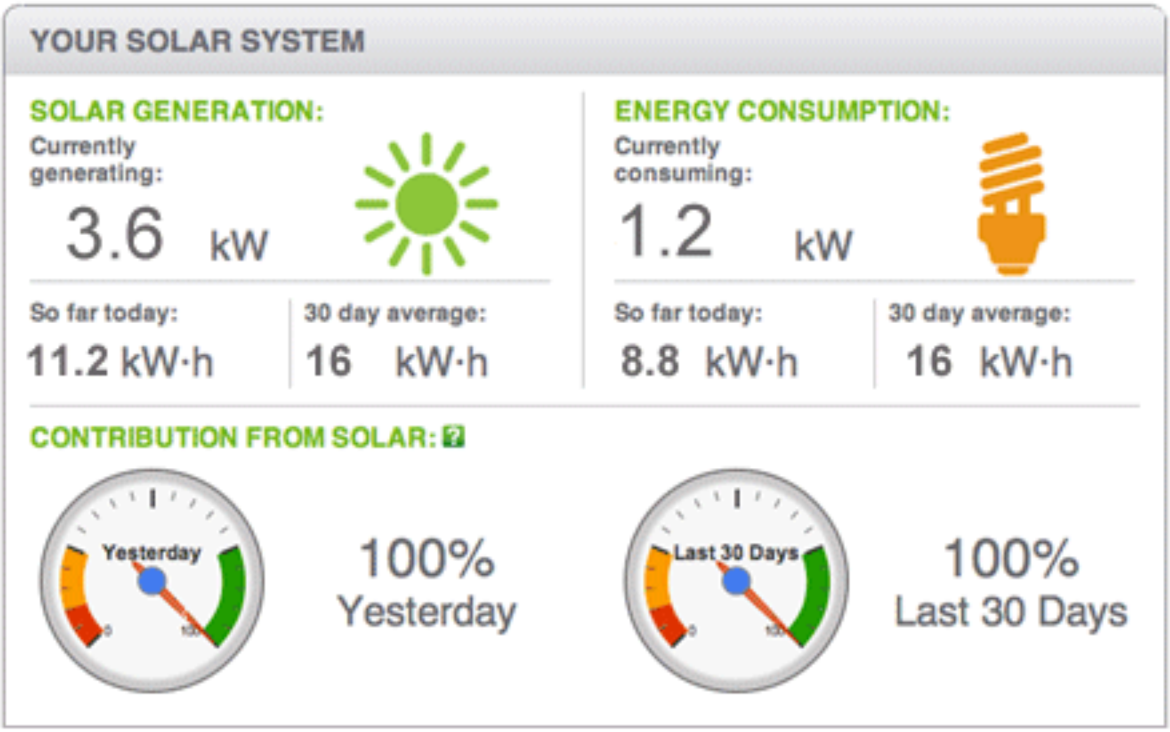
Energy Monitoring: Residential, upgrade to building integrated

By upgrading the energy monitoring system or package to a building integrated system the longevity of the improvements is increased as departing owners or tenants can't take the system with them. There is also less chance the system will cease being used when transmitter batteries run out and / or the system needs troubleshooting.

An integrated system would need to meet the following criteria to justify the energy savings modeled:

- The system is truly building integrated in that the screen is mounted in the wall, and all elements are hard-wired such that no batteries are required, OR
- The viewing system is web based (no internal hardware is provided in the dwelling), the transmitter is hard-wired and maintains it's own connection with the internet for sending data rather than relying on the resident's internet connection and instructions for using the web based system are provided in the dwelling handover information (most cost effective option for apartment buildings)

The building integrated systems (wall mounted screen) likely cost in the up to $500 per dwelling installed. Web based centralised systems in apartment buildings are more likely to cost $250 per dwelling or less depending on the size of the apartment (large buildings usually offer cost efficiencies). We have assumed an additional 5% energy savings with an integrated system (over an above existing energy monitoring associated savings).



(Example of a web or device based dashboard, in this case showing generation and consumption.)

Image source: www.energymatters.com.au

(Example of an Integrated energy monitor.)

Image source: jscp.nepc.or.jp

Finishes: Reduce Carpet Use

Manufacture and replacement of carpets represents a large amount of recurring & embodied energy. Virgin wool has particularly high impacts. Specifying timber flooring or polished concrete will have lower embodied impacts with the latter having the lowest. Grind and polish concrete eliminates the use a polyurethane seal/coating and reduces maintenance associated with a grind and seal finish.

If carpets are required effort should be made to ensure they have an Environmental Product Declaration such as those from Interface Carpets which have over 50% lower impacts than industry average carpets. Hemp, jute and sisal are all low impact alternatives to wool/nylon carpets.

In this recommendation modelling has replaced living and kitchen area carpets with timber floors.

(image source: http://diabloflooring.com)

Low Flow Shower Heads

Standard 3 star WELS rated showers may be anything up to 8.5l/min. By specifying a 7.5L/min shower head, the total shower consumption is reduced by 16%. It is recommended that tests are conducted to ensure the shower head chosen provides an adequate shower to avoid the tendency for residents to rip out the shower and replace with a less efficient model. Differentiation between products is based on the nominal flow rate @ 250kPa. However, flow rate measurements are made at 150kPa and 350kPa to determine the flow rate regulation across this pressure range. The shower heads also have to satisfy performance criteria, such as mean spray spread angle and temperature drop, while operating at lower flow rates.

The cost implications for this recommendation ranges from low to high depending on the manufacturer however the payback period is usually relatively quick. For example, the Methven shower head below from Pure Electric (4.5L/min or 5L/min) retails at $135 at the point of writing and claims to have a 3 month payback period.

Satisfying the technical requirements of AS 3662 enables the establishment of a rating based on the 'the average flow rate' as follows:

- *more than 16L/min. or failing the performance requirement are nominated 0 star*
- *more than 12L/min. but not more than 16L/min. are nominated 1 star*
- *more than 9L/min. but not more than 12L/min. are nominated 2 star*
- *more than 7.5L/min. but not more than 9L/min. are nominated 3 star*
- *more than 6.0L/min. but not more than 7.5L/min. are nominated 3 star (including compliance with force of spray requirements) – to be 4 star but currently only 3 star available*
- *more than 4.5L/min. but not more than 6.0L/min. are nominated 3 star (including compliance with force of spray requirements) – to be 5 star but currently only 3 star available*
- *more than 4.5L/min. but not more than 6.0L/min. are nominated 3 star (including compliance with force of spray requirements and having bonus water saving features (e.g., a sensor with auto shut-off) – to be 6 star but currently only 3 star available*

(source: pure-electric.com.au/methven-kiri-satinjet-ultra-low-flow)

HWS: Gas Instantaneous

Hot water is responsible for 34% of the operational emissions. This is due to the high carbon intensity of the electricity grid (0.82kg CO_2e/kWh) versus gas (0.21 kg CO_2e/kWh). Moving towards an alternative gas base solution would drastically reduce the emissions associated with the hot water supply. Although gas boilers typically have a slightly lower efficiency (85%) than electric (99%), the difference in carbon intensity of the energy supply more than makes up for this.

Lighting: High Efficiency LED Lights

LED lights are a smart way to save electricity and the associated upstream greenhouse gas emissions. In this recommendation, lighting efficiency is increased by specifying LED lighting with high efficacy. Efficacy describes the amount of visible light produced with a unit of power input.

Ensure that the lumens per watt of LED lights are sufficient to meet the required illumination to avoid occupants replacing under-lit areas with less efficient lighting.

Image source: www.beaconlighting.com.au

Upgrade to Water Saving Taps: WELS 6 Star

Investing in taps with a lower water consumption is an effective strategy in saving both money and on water resources.

Typical taps use 15 to 18L/min, a third of this usage can be reduced by installing taps with an aerator or flow restrictor. The national Water Efficiency Labeling and Standards (WELS) scheme lists the registered, rated and labelled taps ranging from a 0 to 6 star, with 6 representing the more water efficient products with an average water consumption of 4.2L/m.

As of the 1st of September 2007 the standards for water efficient fittings on all new houses has been made to meet 3 or 4 stars. These savings are measured against typical 3 Star WELS Taps 8.3L/min taps and represent savings in kL/year.

WELS Star Rating	Litres per min	Features
4 star:	7.35	Minimum Compliance
5 star:	5.7	32%
6 star:	4.2	50%

Concrete Replacement: 30% Fly-Ash Blend Floor Slabs

Fly-ash is a by-product of power generation in coal fired power stations and can be used to directly replace Portland cement in varying proportions up to 50%. Fly-ash is also cost competitive with standard cement depending on the application. Fly ash blend concretes can actually produce a stronger product but typically have longer curing times which can greatly impact multi-story developments. Curing agents are available to alleviate this but may have an impact on the cost.

The recommendation assumes a 30% flyash mix in all floor slabs.Blast furnace slag is another alternative low carbon concrete solution however the savings are not as significant as Fly-ash.

Finishes: Reduce External Masonry Wall Finish

Base design assumes external brick walls with render and paint finish. These finishes represent a significant recurring cost & environmental impact. Although exposed bricks have the least recurring impacts, painted brick walls with no plaster render as a feature is an improvement on recurring impacts.

This recommendation assumes that 25% of external brick walls have no rendering or finishes.

source: www.homeshelf.com.au

Solar PV Grid Connected - 8 kW (2kW per Apartment)

With the rising price of electricity, the economics of solar are very favourable and add to the value of the property. 22% of total Australian dwellings now have solar technologies on their roof. Using solar generated power on site results in much lower emissions associated with the dwelling compared to using the fossil fuel powered grid. Feeding out to the grid assumes a net environmental credit as the electricity will be consumed by a neighbouring consumer therefore reducing the demand on the grid.

By connecting the system to the grid electricity it produces that is not used onsite will feed back into the (predominantly fossil fuel fired grid). This can be thought of as offsetting the carbon associated with the materials used in constructing and maintaining the dwelling

The embodied impacts of the solar PV system is included in the calculations.

eTool have assumed a conservative price of approximately $3000/kW however recent quotes on projects suggest costs more in the range of $1500-$2000/kW. If the implementation of this strategy is outside of the project budget the developer may offer the strategy as an upgrade package for purchasers. This eliminates the need for upfront capital while promoting best practices and educating the public.

Worst case panel dimensions 1070mm x 1685mm.

(Image source: www.forceofthesun.com)

Appendix B – Design Strategy Logistical Constraints

Energy Monitoring: Residential, Basic

These simple systems are typically a $100/unit capital cost (replaced every 10 years) but will usually have very fast payback periods.

Considering the technical competency of the occupancy of the dwelling, the actual energy monitoring product chosen should be one where the user interface can be simplified or adaptable to accommodate different levels of technological aptitude.

If a system has wireless transmitters needing battery power, the life cost of these should be considered as well. Frequent battery changing can be a deterrent to using the basic energy monitoring system.

These simpler systems are typically $100 per unit in capital cost with replacement expected every 7.5-10 years. If the implementation of this strategy is outside of the project budget, the developer may offer the strategy as an upgrade package for purchasers. This eliminates the need for upfront capital while promoting best practices and educating the public.

Energy Monitoring: Residential, upgrade to building integrated

The building integrated systems (wall mounted screen) likely cost in the up to $500 per dwelling installed. Web based centralised systems in apartment buildings are more likely to cost $250 per dwelling or less depending on the size of the apartment (large buildings usually offer cost efficiencies).

Considering the technical competency of the occupancy of the dwelling, the actual energy monitoring product chosen should be one where the user interface can be simplified or adaptable to accommodate different levels of technological aptitude.

Finishes: Reduce Carpet Use

Capital cost of timber flooring or polished concrete in place of all carpets. (approximately $200/m2)

Low Flow Shower Heads

5.5L/min shower head for 23% reduction in water heating energy and water consumption. Capital cost of about $200/head. May have some difficulty sourcing 5.5L/min flow rate shower heads within Australia. Some systems may not operate with this flow rate. Low Flow showers are unlikely to work with gravity fed systems. Mains pressure of between 150-600kPa will be typically required. Furthermore, the hot water system must be compatible with low flow rates.

Lighting: High Efficiency LED Lights

Ensure that the lumens per watt of LED lights are sufficient to meet the required illumination to avoid occupants replacing under-lit areas with less efficient lighting. We have assumed average of 72 lumens per watt for LED lights.

Upgrade to Water Saving Taps: WELS 6 Star

Builders and developers need to ensure products supplied are valid under the Water and Efficiency Labeling Standard (WELS) registration.

Concrete Replacement: 30% Fly-Ash Blend Floor Slabs

Fly-ash is not as readily available compared to blast furnace slag which is another alternative low carbon concrete solution however the savings are not as significant as fly-ash. Adding fly-ash/ BFS will also increase curing times for the concrete which may lead to other additional costs.

Ensure suppliers of Fly Ash can meet the requirements of the developer in terms of supply quantity, consistency, delivery and any other requirements such as ISO certifications such as ISO-9001.

Solar PV Grid Connected - 8 kW (2kW per Apartment)

Panels need to be located predominately north facing and be clear of shade caused by trees or neighbouring structures. Costing will come down to local suppler price, and bulk ordering may attract discounts. Allow 10m2 per kW of installed solar generation capacity (less area will be required with high efficiency panels and/or detailed panel layout design).