Target Setting Report

LCA Improved Design – High Street, Perth WA 6000

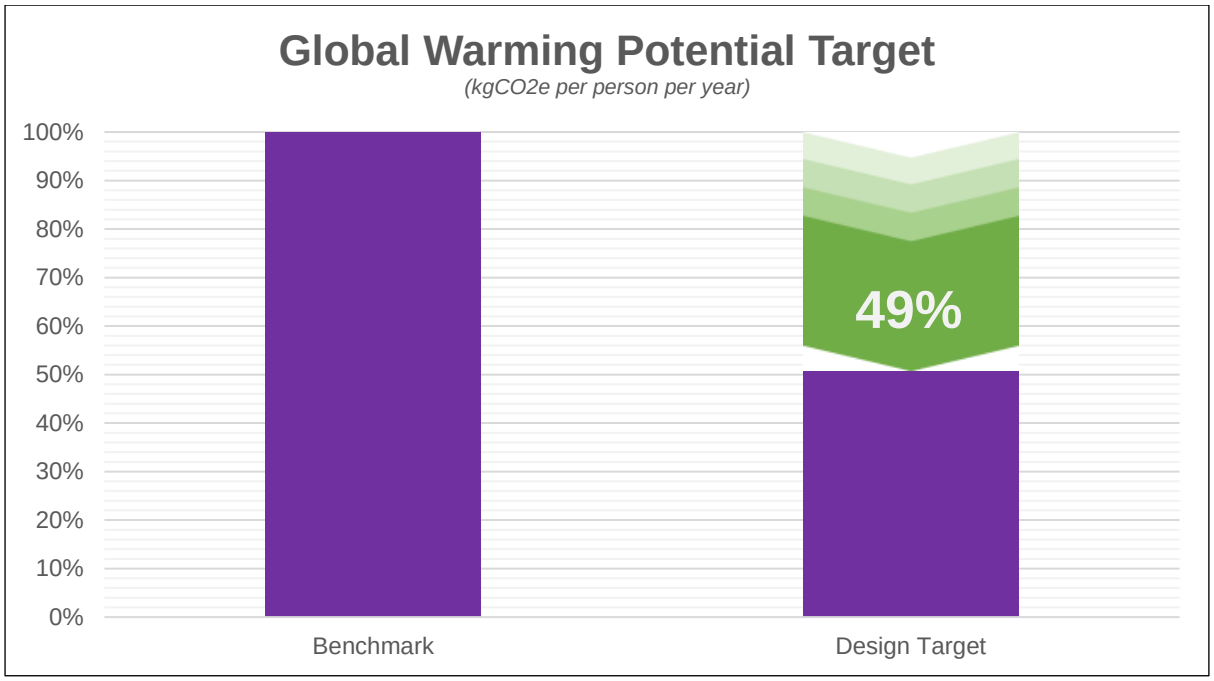
Development Group

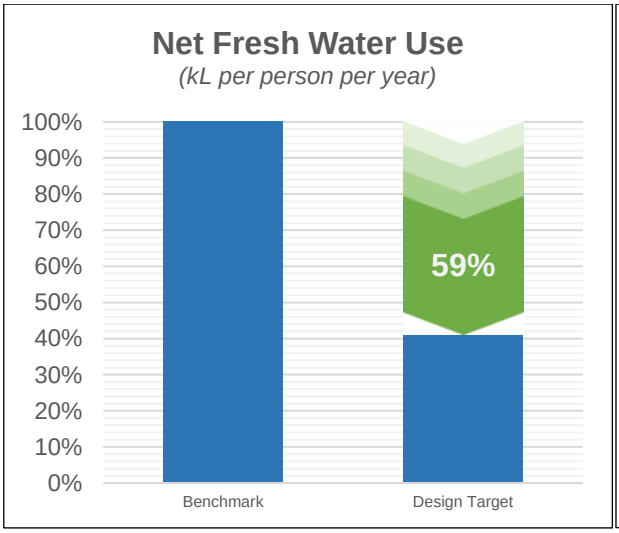
Assessed by: John Smith

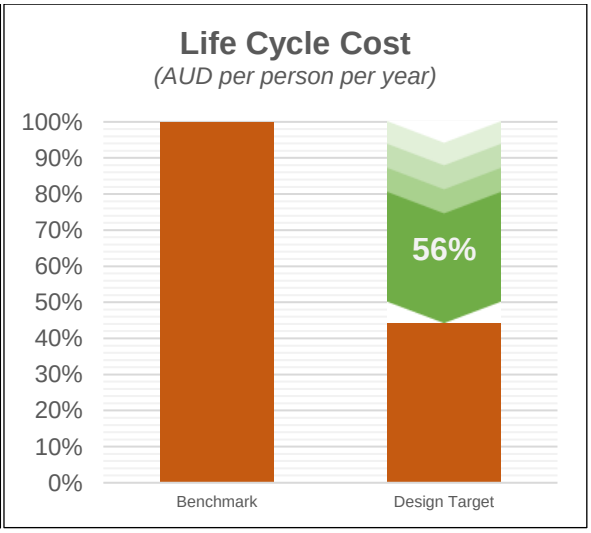
Certified by: Fei Ngeow

06 September 2019

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 WA Office Benchmark	LCA Target Setting - DA Submission - Revision 2	LCA Improved Design - DA
Design Details			
Stories (#)	10	2	2
Primary Function	Theoretical Average Office	Entire Development	Entire Development
Structural Service Life Limit	60	200	200
Predicted Design Life	60	55	55
Functional Characteristics			
Occupants	836	90	90
Tenancies	1	1	1
Work Stations	836	20	20
Annual Operating Hours	2,000	2,350	2,350
Life Cycle Occupant Hours	100,320,000	11,632,500	11,632,500
Total Floor Areas			
Usable Floor Area	0	0	0
Net Lettable Area	10,450	907	907
Fully Enclosed Covered Area	14,400	907	907
Unenclosed Covered Area	0	0	0
Gross Floor Area	14,400	907	907
Usable and Lettable Yield	73 %	100 %	100 %

Descriptions of Objects of Assessment

AU WA Office Benchmark

The benchmark has been created to represent a generic commercial office building built in a developed country. The design has then been adapted to reflect the energy and water use of Western Australian office buildings based on NABERS calculations.

The statistics for a range of developed countries have been population weighted and combined into a single theoretical average dwelling.

Country	U.S.A	Japan	Germany	Sweden	U.K.	Italy	Australia	Total
Population Weighting[1]	46%	19%	12%	1%	9%	9%	3%	100%

The structure of the commercial benchmark model takes a generic 10 storey office building with 2 basement levels for car parking plant equipment etc. The building is a typical double-glazed concrete structure. More details on the calculation of the benchmark is documented at https://support.etoollcd.com/index.php/knowledgebase/etool-international-commercial-office-benchmark-methodology-summary/

LCA Target Setting –Proposed Design

Alteration & Addition of existing two storey office building. New additional office & Showroom to the West side of existing building. Street Level parking at front of building with under croft parking at rear of site. Lift on Ground Floor up to Level 1. Stairs have been placed to be used over lift. Neighbour commercial developments to East & West of site to remain as-is.

- New GF Showroom: 479m2
- Existing GF Office: 84m2
- New Mezz Office: 260m2
- Existing FF Office: 84m2
- Under croft Carpark: 477m2
- Ground Floor Carpark: 135m2
- Construction of brick cavity, double glazing and skillion metal deck roof.
- Concrete footings and slab to ground floor and mezzanine.
- Feature Artwork as shading device on West facade of glazing.
- Landscaping, bicycle parking & footpaths included in scope of works.

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 Saving	FW Saving	AUD Saving
Base Design performance compared to benchmark (e.g. density, yield, occupancy, design life, reduced outdoor water use)	23.49%	40.09%	52.16%
Energy Monitoring: Commercial, upgrade to building integrated	2.31%	0.65%	0.48%
HVAC: High Efficiency Air-Source Heat Pump (COP-4.4, EER-4.4)	3.63%	1.01%	0.76%
25kW Solar PV (Au Grid Connected)	15.14%	3.54%	1.22%
Lighting: High Efficiency LED Lights	1.40%	0.38%	0.31%
Lighting: Motion + Lux Sensors & 3min Timers (Carpark)	0.98%	0.27%	0.20%
Upgrade to Water Saving Tapware: WELS 6 Star	0.20%	12.00%	0.00%
HWS: Individual Gas Boilers	2.02%	0.81%	0.57%
Total	**49.17%**	**58.75%**	**55.71%**

Anticipated eToolLCD Design Rating

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

- Life Cycle Greenhouse Gas Saving of 49% -

Target Setting Workshop Attendees

The following people attended the target setting workshop:

- John Smith
- Bob Davey
- Jane Doe

Appendix A – Design Strategy Details

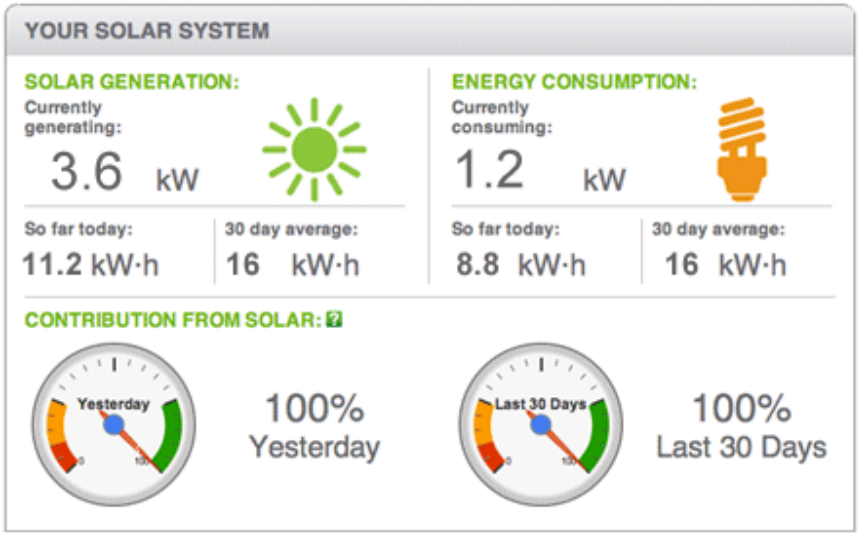
Energy Monitoring: Residential - Building Integrated

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 modelled:

- 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 its 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 and 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)

HVAC: High Efficiency Air-Source Heat Pump (COP-4.4, EER-4.4)

By increasing the efficiency of the air-conditioners, gains in environmental performance can be made. In the LCA, it was assumed that the COP (heating) was increased from 3.4 to 4.4 and the EER increased from 3.65 to 4.4. This will require changing to a single split system instead of a multi-split. Several single split air-conditioners that currently match or go above this specification (EER/COP - 5.9/5.77 from Daikin) are available on the market (not available for multi-split).

Estimated additional costs: approximately $500/dwelling. 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.

25kW Solar PV (Au Grid Connected)

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, the 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 are 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)

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.

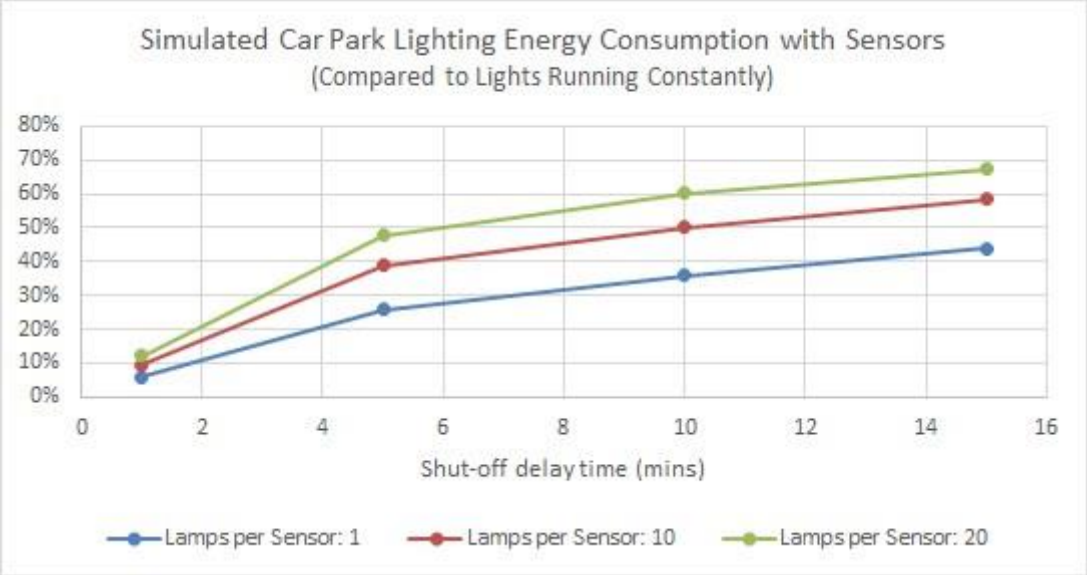
eTool have modelled LED light to produce 72 lumens per watt. These lights are modelled in conjunction with the specified annual usage hours.

(Images from www.beaconlighting.com.au)

Lighting: Motion + Lux Sensors & 3min Timers (Carpark)

Car parks need to be adequately lit for obvious safety reasons. Without motion sensors there is a requirement to light underground car parks 24 hours a day. Even the most efficient lamps will consume excessive energy when run non-stop in this fashion.

Reducing the run time may be achieved with motion sensors. The interplay between vehicle traffic, pedestrian traffic, simultaneous use of certain areas of the car park, shut-off delay timing and the distribution of sensors requires a complex simulation to understand how much energy can be saved. The below chart shows the results of one such simulation on a 150-bay car park in a residential building.



The simulation results show that an energy saving of up to 90% can be achieved with well configured lighting controls. Three-minute sensors with 10 lamps wired to a single sensor should deliver a 75% saving in run-time (6 hours per day run time verses 24 without any controls). Less lamps per sensor, or faster shut down will further reduce the runtime.

Lux sensors may also be utilised with dimmable lamps to ensure light levels over the requirements are not delivered and hence energy savings may be achieved due to lower average lamp power. The benefit of lux sensors in underground car parks is limited however due to a lack of natural light.

Upgrade to Water Saving Tapware: 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 Labelling 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 Bands Water Saving %

- 4 Stars: 7.35L/min (Minimum Compliance)
- 5 Stars: 5.7L/min 32%
- 6 Stars: 4.2L/min 50%

HWS: Individual Gas Boilers

Hot water is responsible for 34% of the operational emissions. This is due to the high carbon intensity of the electricity grid (0.82kg CO2e/kWh) versus gas (0.21 kg CO2e/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.

The design may directly replace the current individual electric boilers (requiring a gas supply to each dwelling) or a communal system may be incorporated with hot water fed directly to each dwelling from a central plant room.

Appendix B – Design Strategy Logistical Constraints

HVAC: High Efficiency Air-Source Heat Pump (COP-4.4, EER-4.4)

At this point, MEPS ratings are only available for single split systems. Credit for COP efficiency can only be given if single split units are specified. Costs approximately $500/dwelling.

25kW Solar PV (Au Grid Connected)

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).

Lighting: High Efficiency LED Lights

www.etoolglobal.com | info@etoolglobal.com | +61 08 9467 1664 Page 9 of 10Ensure 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.

Lighting: Motion + Lux Sensors & 3min Timers (Carpark)

There will be additional costs associated with the installation of sensors, approximately $50/sensor.

Upgrade to Water Saving Tapware: WELS 6 Star

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