MJA stu

Kate Miller
Statutory Planning
City of Vincent
244 Vincent Street
Leederville WA 6007

MJA Reference No. 13108

22 October 2018

Dear Kate,

RE: 150 CLAISEBROOK RD, PERTH
PROPOSED EXTENSION OF TIME REQUEST TO EXISTING APPROVAL

Further to the carbon reducing strategies outlined in the submitted eTool Target setting Report, the following notes respond to queries raised by the City of Vincent in regards to the ESD provisions of the Built Form Policy:

P1.8.1 - Passive solar heating; cooling; natural ventilation and light penetration.

- Aspect:
  - 50% of tower apartments face directly north with 33m between the two towers ensuring no overshadowing in Winter.
  - Of the four south facing tower apartments within each building, 50% are corner apartments ensuing access to north-eastern and north-western sun.
- Solar penetration:
  - Apartment depths intentionally shallow.
  - Glazed balustrades.
  - Full width, full height glazed sliding doors to living rooms.
  - Top floor apartments include high level clerestory windows.
- Natural Ventilation:
  - All habitable rooms include operable windows and doors to the perimeter façade.
  - Communal lobby spaces include operable windows at the end of each hall to capture breezes and naturally ventilate.
  - All corner apartments have access to excellent natural ventilation.

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P1.8.2 - Recovery and re-use of water.

- Refer to eTool water ESD initiatives within Target Setting Report.
- In addition, there are opportunities for rain water storage within the basement to provide storage to supplement irrigation from the mains for landscaped planters.

P1.8.3 – Climate moderation devices.

- Mass:
  - Balcony slab projections encircle the building to assist shading the high summer sun. Lower winter sun can enter the living spaces, whilst the balconies also provide direct access for residents seeking sun.
- Light weight:
  - Public art screening proposed for the western façade will shade the west-facing walls from the direct afternoon sun.
  - Additional white perforated screens are proposed to mid-level balconies on the east and west to assist shading from the extremes.
  - First floor commercial spaces include powdercoated louvres in front of full height glazing to assist shading the glass.

We believe the aforementioned base passive design initiatives satisfy the intent of the City's Built Form Policy.
If you require any further information please do not hesitate to contact the undersigned

Yours sincerely,

Christopher Dwyer
P.P. MJA_Studio

Target Setting Report

Low Impact Design , 150 Claisebrook Road, Perth

MJA

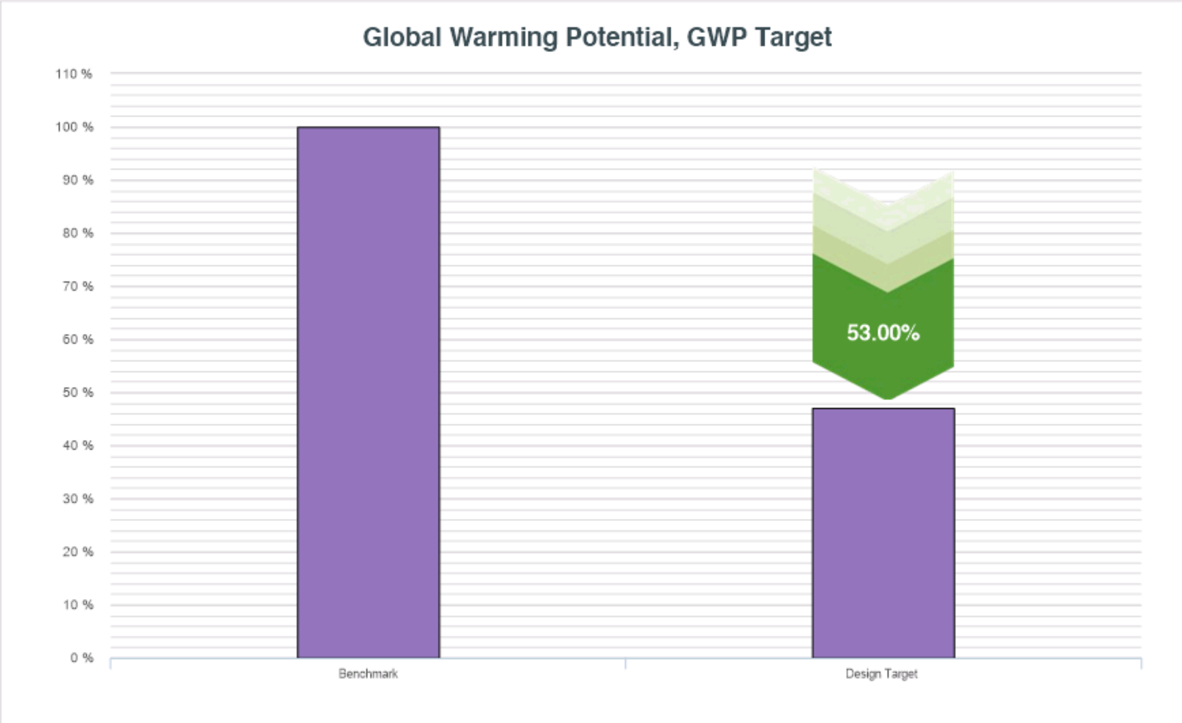
Assessed by : Gabrielle Luff

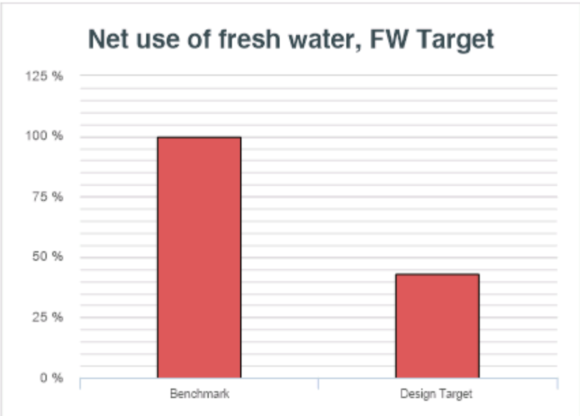
Certified by : Jonathan Gieselbach

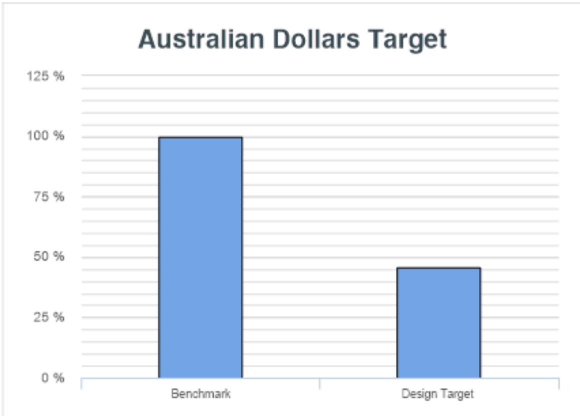
30 October 2018

GLOBAL WARMING POTENTIAL AND
WATER SAVINGS

150 Claisebrook Road, Perth LCA Target Setting Report







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 such as 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	Business as Usual	Low Impact Design
Design Details			
Stories (#)	1	9	9
Primary Function	Single Family Residence	Apartments	Apartments
Structural Service Life Limit	100	130	130
Predicted Design Life	54	80	80
Functional Characteristics			
Dwellings	10	116	116
Bedrooms	30	173	173
Occupants	24	173	173
Total Floor Areas			
Usable Floor Area	2,140	9,386	9,386
Net Lettable Area	0	0	0
Fully Enclosed Covered Area	3,010	15,082	15,082
Unenclosed Covered Area	0	3,252	3,252
Gross Floor Area	3,010	18,334	18,334
Usable and Lettable Yield	71 %	51 %	51 %

Design Description

AU Res Ave 2013 Code Compl CZ 5 (10 dwelling) V12 Data

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/

Business as Usual

This Target Setting Assessment for the Claisebrook Road Apartments project outlines that the development is seeking to achieve a 50% savings outcome, which is beyond the 4 star Green Star in terms of GHG performance. The life cycle GHG reductions for the project will be verified prior to the preparation of the Building License with a full Life Cycle Assessment (LCA) in accordance with standard EN159781 which sets out strategies and specifications to ensure the 50% savings outcome target is met.

The following Assessment is based on early preliminary designs, this can mean that certain specifications and details are not yet available. In these cases, assumptions have been made to ensure a full building comparison can be made. The design strategies have been chosen with the intent of implementing them into the proposed design. In the situation that certain design strategies are found to be unfeasible the 50% reduction target will still be met by incorporating reserved strategies.

The Project occupies Lots 17 and 32 on the corner of Claisebrook Road and Caversham Street. The 116 units will cover 8 story apartment towers with separate parking facilities located on the Ground level and first floor. There will be shared communal facilities and communal terrace located on the second level.

The units will range between 2x2, 2x1 and 1x1 apartments.

150 Claisebrook Road, Perth LCA Target Setting Report

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.

Preferred Strategies

Recommendation Name	Logistical Constraint	GWP % Saving
Base Design perfomance compared to benchmark		15.12 %
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.	2.66 %
Energy Monitoring: Residential, upgrade to comparative feedback	Difficult to estimate costs if a customised system needed to be developed from the ground up. Assumed $1,000's per dwelling for very customised systems. Going down this route for energy monitoring, it is essential that a system capable of handling the volume (housing quantity) and monitoring requirements be documented, costed and trialed before permanent installation. 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. To keep comparisons fair between dwellings, any changes in geography (such as solar opportunity, occupancy, purpose etc.) should be considered to ensure dwellings are evenly compared. eTool can assist in ideas in this area.	2.64 %
Appliances: High Efficiency	Energy savings will depend on the amount of appliances that the developer will be providing. For detailed energy savings can be modelled if provided with energy ratings for all appliances specified. 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.	.19 %
Water Efficient Dishwasher-Upgrade to 6 Star	5 Star WELS Rated Dishwasher. White good appliances are required to carry a WELS starring label, however there is no minimum compliance. There may be a varied cost difference between higher efficiency models.	.06 %
Refrigeration: Reduced Fridge Space (Maximum 750mm Width)	specialised cabinetry required.	.41 %
Masterswitch		1.09 %
Upgrade to Water Saving Taps: WELS 6 Star		.12 %
Refrigeration: Well Ventilated	Specialised cabinetry with suitable ventilation required.	.45 %
Cooking: Induction Cooktop	$1000/unit capital cost. 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.	.4 %
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.	4.49 %
Low GWP Impact Refrigerant Gases R32		1.8 %
Finishes: Reduce Carpet Use	Capital cost of timber flooring or polished concrete in place of all carpets. (approximately $200/m2)	.57 %
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.	.47 %
Lighting: Increase Natural Lighting (Multi-Res)	Cost varies depending on measures taken but a day lighting simulation should be undertaken to ensure expense is not incurred without benefit.	.41 %
Lighting: Motion+Lux Sensors & 3min Timers (Carpark)	There will be additional costs associated with the installation of sensors, approximately $50/sensor.	.33 %
Vertical Transport: Elevator - High Efficiency Drive & Reduced Running Speed (2m/sec)	Retrofitting an already installed elevator for energy efficiency may include reconditioning the hoist machine and replacement of a number of system components. The installation of a new drive may involve review of design drawings and a specific fire resistant rating.	.05 %

Lighting: Motion+Lux Sensors & 3min Timers (Common Area)	There will be additional costs associated with the installation of sensors, approximately $50/sensor	.42 %
Additional 43kW Solar PV (High Efficiency Panels)	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 7.5m2 per kW of installed solar generation capacity (less area will be required with very high efficiency panels and/or detailed panel layout design).	6.41 %
Water Efficient WC		.22 %
100kW Solar PV (Au Grid Connected)0	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).	14.92 %
Total		53.27 %

Preferred Strategies

Recommendation Name	**Net use of fresh water % saving**
Base design performance compared to benchmark	29.90%
Energy Monitoring: Residential, Basic	0.60%
Energy Monitoring: Residential, upgrade to comparative feedback	0.60%
Appliances: High Efficiency	0.00%
Masterswitch	0.30%
Water Efficient Dishwasher-Upgrade to 6 Star	2.90%
Upgrade to Water Saving Taps: WELS 6 Star	7.10%
Water Efficient WC	10.20%
Refrigeration: Reduced Fridge Space (Maximum 750mm Width)	0.10%
Refrigeration: Well Ventilated	0.10%
Cooking: Induction Cooktop	0.10%
HVAC: High Efficiency Air-Source Heat Pump (COP-4.4, EER-4.4)	0.20%
Low GWP Impact Refrigerant Gases R32	0.00%
Finishes: Reduce Carpet Use	0.00%
Lighting: High Efficiency LED Lights	0.10%
Lighting: Increase Natural Lighting (Multi-Res)	0.10%
Lighting: Motion+Lux Sensors & 3min Timers (Carpark)	0.10%
Lighting: Motion+Lux Sensors & 3min Timers (Common Area)	0.10%
Vertical Transport: Elevator - High Efficiency Drive & Reduced Running Speed (2m/sec)	0.00%
100kW Solar PV (Au Grid Connected)	3.10%
Additional 43kW Solar PV (High Efficiency Panels)	1.40%
Total	**57.00%**

150 Claisebrook Road, Perth LCA Target Setting Report

eTool Rating Target

- Life Cycle Greenhouse Gas Saving of 53% -

Target Setting Workshop Attendee List

Recommendation Information

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 presentation and 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 comparative feedback

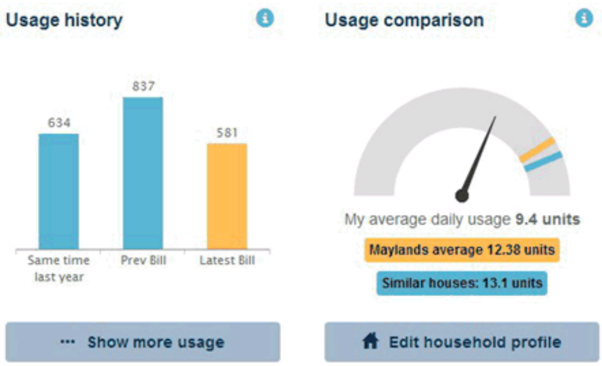
By further upgrading the energy monitoring system or package so that comparative feedback is provided to the residents the solution will draw the attention of otherwise indifferent consumers due to the "social norm" psychology. This is well documented in studies, including studies on energy consumption, a good example is explained in this video on the subject.

The requirements of this system to justify the savings assumed are:

- The system must not only display absolute energy consumption but compare this to a benchmark consumption for similar dwellings.
- Preferably the benchmark should be the average of the 25% lowest (best) energy consumers, rather than just the average consumption
- If energy generation is installed, this is reported separately to the consumption, so excessive consumptions is still highlighted

These solutions are somewhat customised at present and as such would be normally involve a cost increase. Generic solutions will evolve, We have assumed an additional 5% energy savings with an integrated system (over an above existing energy monitoring associated savings).

The additional cost is very difficult to estimate, if a customised system needed to be developed from the ground up, costs could be very high ($1,000+ per dwelling for detached residences). On the other hand, if an existing system has this capacity built in (or previous code can be duplicated) there may be no cost premium.



(Example of a Comparative Energy Consumption Dashboard. Image source: www.synergy.net.au)

Appliances: High Efficiency

Appliances account for a large percentage of the residential carbon emissions. High efficiency appliances (7 Star TV, 3 Star washing machine, 4 star dryer, 4 star dishwasher) help to reduce total energy consumption.

Caution should be applied when considering highly rated energy efficient fridges, as the embodied energy of the food is likely to be at least 10 times more than the energy consumed by the fridge. Sometimes a fridge which is actually less efficient and uses a bit more power can extend the life of food quite considerably making it the more sustainable option.

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.

Water Efficient Dishwasher-Upgrade to 6 Star

Selecting white goods with higher water efficiency is one of the easiest ways of reducing internal water consumption. New higher efficiency dishwashers use less than half the amount of water of older models, in some cases less then 1L per wash.

As of November 1st 2011 all white good appliances are required to carry a WELS starring label.
In this recommendations we have modelled the effect of specifying 5 star water efficient dish washers (26% savings in dishwasher water consumption). A further incentive to

selecting high efficiency products are the government rebates available in selected states.

The following figures are based on the average consumption of registered products as of July 2016.

Higher efficiency dishwashers use an average of half of the water used in older models. The savings we have calculated are based on a older low efficiency model with an average water consumption of 15.2kL

Dishwasher:	Savings:
3 Star: 13.1	14%
3.5 Star: 12.9	15%
4 Star: 12.5	18%
4.5 Star: 11.4	26%
5 Star: 11.3	**26%**
5.5 Star: 10.1	34%
6 Star: 9.43	38%

Refrigeration: Reduced Fridge Space (Maximum 750mm Width)

Restricting cabinetry space around the primary refrigerator to limit its size to a maximum width of 750mm will have an estimated 10.3% energy saving for that refrigerator (see below for assumptions and calculations). There are also likely to be indirect savings in that less food is wasted as residents will be encouraged to shop and replenish groceries more frequently.

Below is the estimated minimum refrigerator space based on family size:

- Family of 2
  - Refrigerator: about 127L per person + 28L per additional person over 2
  - Freezer: about 57L per person + 57L per additional person over 2
  - (http://www.bhg.com/kitchen/appliances/selecting-a-refrigerator/)
- Family of 5
  - Refrigerator: about 26L per person + 20L per additional person over 5
  - Freezer: about 12L per person + 10L per additional person over 5

(https://www.admin.ox.ac.uk/media/global/wwwadminoxacuk/localsites/accommodation/documents/HMOAmenitiesandFacilitiesGoodPracticeGuide2011.pdf)

Some information on refrigeration applicable to this recommendation:

- eTool base case energy predictions are derived from top down allocation of energy use (not bottom up analysis as there are too many and not enough statistical data)
- Average occupancy of Australian dwellings is 2.37 persons per dwelling, for the base building this is adjusted up and down using regression analysis of ABS Census data with suburb density and number of bedrooms being the two most influential variables.
- It is assumed that in the base case model there is no specific restriction on primary refrigeration size unless the plans specify a reduced size.
- In detached dwellings it is assumed that
  - 55% of energy is used by primary refrigerator
  - 20% by secondary refrigerator
  - 25% by separate freezer
- An average Australian household has 1.25 fridges and 0.4 Freezers (Australian Residential Building Sector Greenhouse Gas Emissions 1990–2010, Greenhouse Office, 1999).
- It is assumed that the second fridge is less efficient than the first due to MEPS requirements which are increasing at a rate that would certainly offset any differences in size)
- For apartments, due to limited space and inability to house fridges on balconies, the allowance for separate freezers is removed unless the apartment is of unusually large size or the occupants have access to a fully enclosed private garage.

To estimate energy savings due to this recommendation:

- The listed MEPS consumption figures for upright fridges less than 750mm gives an average consumption of 419kWh
- Listed MEPS consumption figures for side-by-side fridges between 750mm and 1000mm gives an average consumption of 695kWh which is a 66% increase in energy consumption.
- This is partly due to volume, but also largely effected by the prominence of ice and cold water dispenses in larger upright freezers that allow large heat transfer.
- In base case scenario it is assumed that uptake of side by side fridges with un-restricted cabinetry would be equal to that of current market share in Australia (17.5%)
- By reducing cabinetry size and removing the 17.5% of predicted side by side fridges installations, we see a overall average drop of

10.3% drop in energy demand for the primary refrigerator.

Masterswitch

Master switch for lighting and selected power outlets. Assumed this would reduce entertainment appliances, washing machines, dryers, dish washers energy consumption by 5%. Potentially there would be additional savings if hooked up to lights (lights that were left on would be switched off), heating and cooling devices and ventilation (eg bathroom fans).

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.

In this recommendation we have modelled the effect of selecting 6 star tap ware throughout the development (50% saving).

WELS Star Bands Water Saving %
4 Stars: 7.35L/minMinimum Compliance
5 Stars: 5.7L/min 32%
6 Stars: 4.2L/min 50%

Refrigeration: Well Ventilated

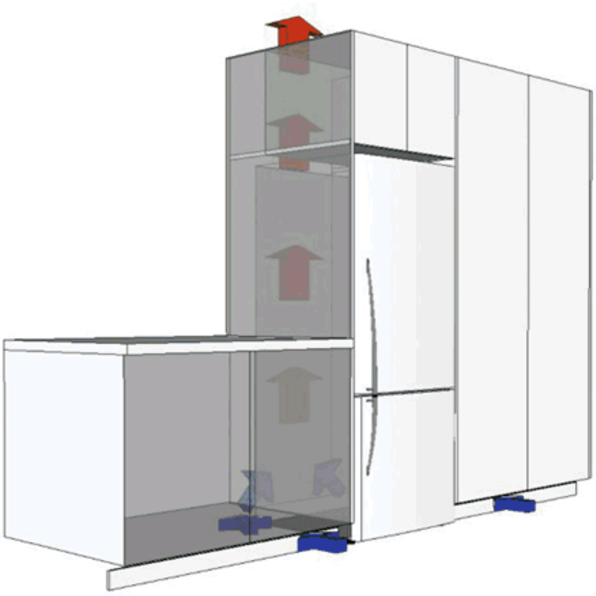
Customized ventilation for free standing refrigerators can save up to 25% on refrigeration energy consumption. We have assumed an average saving of 12.5% in energy consumption for primary refrigerator due to this measure. By ensuring that the adjacent cabinetry to the fridge is vented at the bottom and above, superior fridge ventilation can be achieved when an upper and lower vent point is provided to enable air circulation for the fridge condenser as heated the air rises and draws cool air from the bottom vent. Ensure that any external air ventilation is sealed from the rest of the room to avoid thermal leakages from conditioned spaces.

The New South Wales government's BASIX system defines a well ventilated fridge as follows:

A well ventilated refrigerator space meets the following criteria:

1. *the refrigerator will be unenclosed; or*
2. *the refrigerator will only be enclosed on three sides, including the rear and top; or*
3. *if the refrigerator is to be enclosed on three sides (not including the rear and top), ventilation grills are installed below the refrigerator (either in the floor underneath the refrigerant coils, from the rear, or within the plinth) and above the refrigerant coils, to allow air flow equal to the air flow that would pass over the refrigerant coils were the refrigerator unenclosed*

https://www.basix.nsw.gov.au/iframe/basix-help-notes/energy/other-energy-uses/refrigerator-space.html



(image source: eTool)

Cooking: Induction Cooktop

An all induction cook-top is an alternative that could deliver carbon savings over a standard electric cook-top. Induction cook-tops work by transferring electrical energy through induction from a coil directly to the magnetic pan. Only the area in contact with the coil heats up and therefore the cooker can be up to 12% more efficient than a standard electric conduction cooker. The controls on an induction cooker are also far more precise giving a greater range of cooking techniques.

$1000/unit capital cost. 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.

(source: hometone.com)

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. A number of 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.

Low GWP Impact Refrigerant Gases R32

Refrigerant gasses used in HVAC and refrigerators such as R134 can be over 1000 times more potent in global warming potential than CO2 per mass of refrigerant gas. By using lower GWP impact gasses in mechanical equipment such as heat pumps, refrigerators and chillers, significant environmental savings can be achieved. CO2 (R744), ammonia, Isobutane (R600) and R32 alternatives currently available.

CO2 is a non-flammable and non-explosive refrigerant. Its thermodynamic features in low temperatures enable to reduce the volume of refrigerant circuits and to lower the energy consumption.

Currently, large refrigeration systems can be serviced with CO2 refrigerant, however residential scale systems will be dependant on where the dwelling is built. It is imperative to check the local technical services available on refrigerant systems and associated logistical concerns.

R32 is now provided by several mainstream manufacturers. It has half the GWP of the equivalent R410a.

References:
http://www.scantec.com.au/images/resources/Paper_R744_SnapFresh_final.pdf

The Low Down on R32

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 reduce 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.

For this recommendation, 'timber plank' vinyl finish has been found as the more appealing option. Vinyl is another low impact alternative to carpet.

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 modeled LED light to produce 72 lm per watt. These lights are modeled in conjunction with the specified annual usage hours.

(Images from www.beaconlighting.com.au)

Lighting: Increase Natural Lighting (Multi-Res)

Increasing natural light levels means less use of artificial lighting energy. Where suitable, skylights or light tubes can easily increase the amount of natural lighting in an apartment. However, not all units will be suitable for light tubes so other techniques can be employed instead. Specifying lighter matte colours to surfaces such as the balcony, ceiling and walls will bounce light deeper into the dwelling thus increasing natural lighting. Light shelves in windows is a passive way to divert and bounce light deeper into the dwelling. Similar systems using adjustable louvres can also be used.

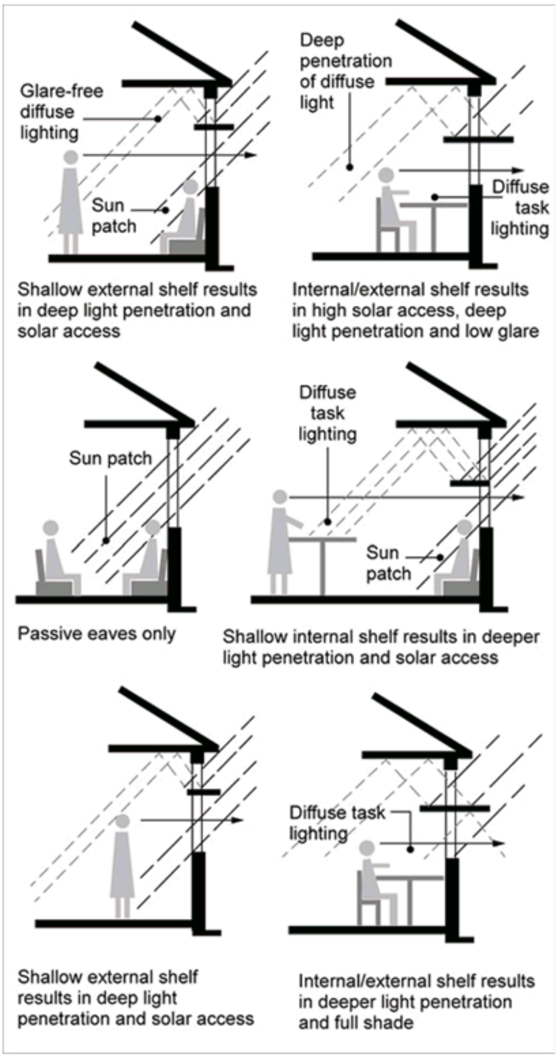
Providing translucent shading material in addition to heavier curtains allow the option of diffused daylight to penetrate whilst maintaining privacy. The top of the windows is where light penetrates deepest into the dwelling, so it is important to ensure that this part of the window is not obstructed by drapery or blinds. Translucent partitions between rooms also allow light to be drawn into deeper rooms.

Clerestory windows also provide a method of introducing more natural light into central rooms. Ideally these should be utilised with higher ceilings and high reflectance surfaces in order to encourage light to penetrate.

In order to prove the value of these initiatives a daylighting simulation should be undertaken to ensure expense is not incurred for not benefit. This will likely make this recommendation hard to justify economically (there will be many far easier wins elsewhere in the building). It is assumed that an intelligent approach to increasing natural light could lead to a 0.4hr/lamp reduction in average run time.

(source: http://thechronicleherald.ca/)

Clerestory windows (Source: houzz.com)

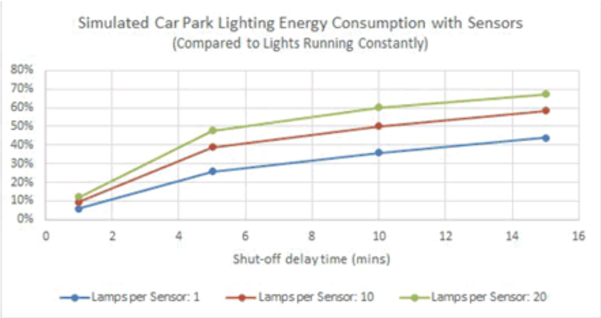


(source: http://www.yourhome.gov.au/)

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 fairly 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.



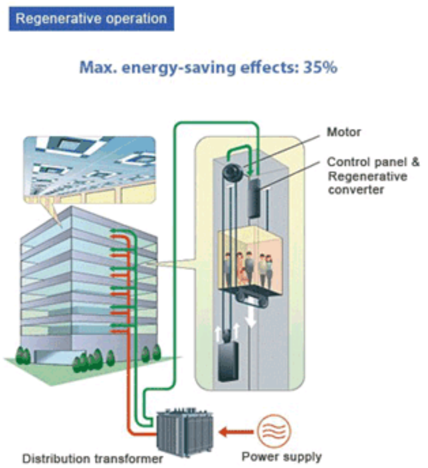
The simulation results shows that an energy saving of up to 90% can be achieved with well configured lighting controls. Three minute sensors with 10 lamps wired to a single sensor should deliver a 75% saving in run-time (6 hours per day run time verses 24 without any controls). Less lamps per sensor,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

Vertical Transport: Elevator - High Efficiency Drive & Reduced Running Speed (2m/sec)

eTool have quantified this energy consumption assuming Kone regenerative lifts are running at a speed of 4m/s. Reducing this speed to 2m/s would provide a saving in lift energy demand of approximately 30%.

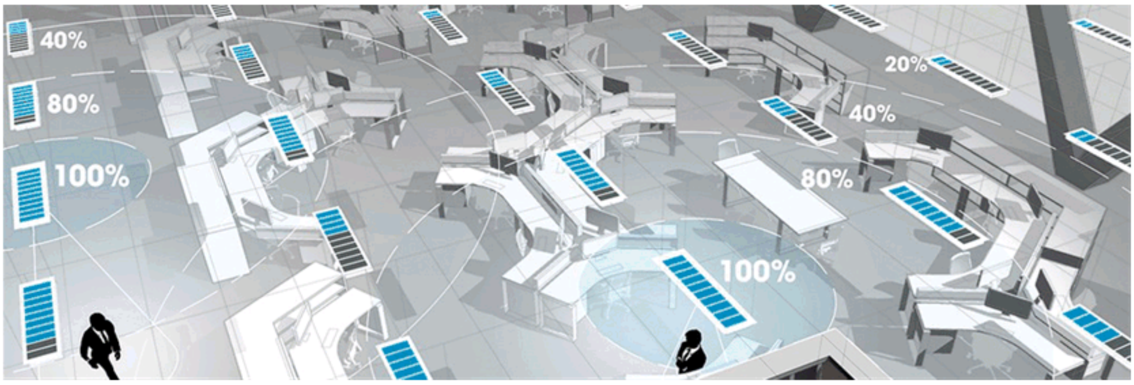
Incorporating regenerative lift drives will also significantly reduce lift energy.



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

The common area lighting is largely made up of communal outdoors area, lobbies, stairs and hallways and is assumed to be running 12 hours per day due to some utilisation of natural light reducing day time utilisation. Application of motion and lux sensors and 3 minute timers in these areas is likely to reduce common area lamp run-times significantly. The diagram below helps explain how lamp runtime can be reduced with sophisticated motion and lux sensors)

For this recommendation, we assume that common areas will run about 4 hours a day.



(Image source: Organic Response)

Additional 43kW Solar PV (High Efficiency Panels)

Photovoltaic panels have a large range in efficiency. When roof space is restricted an opportunity exists to increase the solar generation capacity by specifying high-efficiency panels. In this recommendation, we have assumed a 25% increase in the system size. Greater system sizes may be possible, the Sunpower 330W E20 models, for example, are a 38% more efficient use of roof space than standard 250W 1 x 1.6m panels.

Based on the available roof space, the system size could be maximized further by selecting panels which are of high efficiency while occupying less roof space per panel.

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. With a budget of $3000/kW there is a good chance that higher efficiency panels may be installed at the same cost per KW (however overall costs may increase as the system size is larger). 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.

(Image source: www.solargaincommercial.com.au and www.panasonic.net)

Water Efficient WC

The water consumed by flushing the toilet is the second largest internal water use, accounting for 26% of household water usage (excluding irrigation). Up to 12L of high quality, treated drinking water are flushed away to waste each use. In order to save on this high-level wastage, the toilet could be plumbed with lower quality water such as grey water reuse or rainwater. To complement these options or where these options may not be available it is encouraged that developers invest in more water saving toilets which use less water per flush and are dual flush-able.

As of the 1st of September 2007 regulations were introduced on water fittings and fixtures, for all new buildings to meet a minimum requirement of 5.5L per flush. Replacing a traditional single flush toilet in an older building to a newer dual flush can save about 51L per person per day and can reduce internal water use by 40,000L per year

The average water consumption of a dual flush system is calculated from one full flush and four half flushes.The below figures are based on WELS Registered products as of 23rd January 2017

In this recommendation we have assumed that 6 star toilets are installed reducing water consumption for toilets by 30%.

WELS Star Rating	Water Saving %	Features
4 star: 3.4L Half Flush	BCA Minimum	No hand basin for the diverted flush, Only available as a dual flush system.
5 star: 3L Half Flush	25% Savings	Only available with installed hand basin for the diverted flush, Only available as a dual flush system.
6 star: 2.5L / Half Flush	30% Savings	No hand basin for diverted flush, available as a single and dual flush system.


Example of Extremely Water Efficient Toilet Design

100kW Solar PV (Au Grid Connected)0

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 roof area to support this large system size has been based on the available roof space identified in the P.06 Roof Plan drawing by MJA. The recommendations assumed maximizing the available 1005m2 roof space.

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)

Recommendation 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 comparative feedback

Difficult to estimate costs if a customised system needed to be developed from the ground up. Assumed $1,000's per dwelling for very customised systems.

Going down this route for energy monitoring, it is essential that a system capable of handling the volume (housing quantity) and monitoring requirements be documented, costed and trialed before permanent installation.

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.

To keep comparisons fair between dwellings, any changes in geography (such as solar opportunity, occupancy, purpose etc.) should be considered to ensure dwellings are evenly compared. eTool can assist in ideas in this area.

Appliances: High Efficiency

Energy savings will depend on the amount of appliances that the developer will be providing. For detailed energy savings can be modelled if provided with energy ratings for all appliances specified.

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.

Water Efficient Dishwasher-Upgrade to 6 Star

5 Star WELS Rated Dishwasher. White good appliances are required to carry a WELS starring label, however there is no minimum compliance. There may be a varied cost difference between higher efficiency models.

Refrigeration: Reduced Fridge Space (Maximum 750mm Width)

specialised cabinetry required.

Refrigeration: Well Ventilated

Specialised cabinetry with suitable ventilation required.

Cooking: Induction Cooktop

$1000/unit capital cost. 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.

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.

Finishes: Reduce Carpet Use

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

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.

Lighting: Increase Natural Lighting (Multi-Res)

Cost varies depending on measures taken but a day lighting simulation should be undertaken to ensure expense is not incurred without benefit.

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

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

Vertical Transport: Elevator - High Efficiency Drive & Reduced Running Speed (2m/sec)

Retrofitting an already installed elevator for energy efficiency may include reconditioning the hoist machine and replacement of a number of system components. The installation of a new drive may involve review of design drawings and a specific fire resistant rating.

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

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

Additional 43kW Solar PV (High Efficiency Panels)

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 7.5m2 per kW of installed solar generation capacity (less area will be required with very high efficiency panels and/or detailed panel layout design).

100kW Solar PV (Au Grid Connected)0

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).