Cardinia

Council Enhanced Standard

– Sustainable Buildings 2020–26

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**Cover Images: 85 kW solar electricity system on the Pakenham Library, Hall and U3A*
**National Greenhouse Account Factors July 2018 used for all emissions factors in this standard*

1 Executive summary

The enhanced standard – sustainable buildings outlines the processes and procedures that will be used to ensure that Council's sustainable building design and operation aspirations continue to be achieved. Environmentally sustainable design (ESD) is the intention to reduce or completely eliminate negative environmental impacts through thoughtful designs. This includes items such as energy and water efficiency, renewable energy and rainwater harvesting.

The enhanced standard outlines the responsibilities relating to environmentally sustainable building design and operation for Council buildings. It defines the use of the South East Council's Climate Change Alliance (SECCCA) ESD Matrix for Council buildings and sustainability rating tools including Green Star and NABERS. It includes consideration of the funding required for Council's sustainability aspirations, and the savings their implementation will achieve.

The standard covers ESD for new buildings, environmental upgrades of existing buildings and sustainability considerations for day to day building management and minor maintenance. Relevant case study examples are included in the enhanced standard.

The enhanced standard ensures Council's buildings operate efficiently, reducing utility costs and environmental impacts, and provides examples to the community of best practice sustainable design. Sustainable buildings also provide health and productivity benefits that this enhanced standard will ensure are obtained.

2 Background

In 2018 the International Panel on Climate Change (IPCC) reported that "Human activities are estimated to have caused approximately 1.0°C of global warming above pre-industrial levels, with a likely range of 0.8°C to 1.2°C. Global warming is likely to reach 1.5°C between 2030 and 2052 if it continues to increase at the current rate" (IPCC, 2018).

The IPCC also highlights that "Future climate-related risks depend on the rate, peak and duration of warming. In the aggregate, they are larger if global warming exceeds 1.5°C before returning to that level by 2100 than if global warming gradually stabilizes at 1.5°C, especially if the peak temperature is high (e.g., about 2°C)" (IPCC, 2018).

To reduce the devastating impact of climate change that includes sea level rise, drought and extreme weather events, greenhouse gas emissions must be reduced. Buildings and building construction is responsible for 36% of the world's energy consumption, and 40% of total direct and indirect CO2 emissions (International Energy Agency, 2019). Whilst representing a significant amount of environmental impacts, buildings also offer one of the most fundamental and costs effective ways to reduce emissions. Improving the efficiency of buildings is therefore a key priority, especially considering the urgency to reduce emissions to mitigate the extent of climate change.

The aim of sustainable buildings is for buildings not to use the earth's resources at a rate faster than they are being replenished. Given the history of the impacts of human activity on the planet however, ultimately buildings must move beyond sustainability to become regenerative. Not only do regenerative buildings not degrade the natural environment, they improve it and assist it to regenerate following the damage human activity has caused.

With improving technology, sustainable buildings are becoming more common and regenerative buildings possible. Council aims are for buildings to continue to become more efficient, ultimately achieving carbon positivity and providing regenerative functions to the natural environment. Progress towards this goal is achieved through the design of new buildings and the efficient operation and upgrade of existing buildings.

The council plan (May 2018) includes the intention to reduce energy consumption and greenhouse gas emissions and implement sustainable water practices. These intentions are reflected in Council's Aspirational Energy Transition Plan (2014 – 2024), and Integrated Water Management Plan (2015 – 2025). The Aspirational Energy Transition Plan includes requirements to upgrade Council buildings to improve energy efficiency, operate Council buildings efficiently and include a high level of sustainable design in new Council buildings. The Integrated Water Management Plan requires the efficient use of water and water sensitive urban design to be incorporated into new developments.

Since the development of these plans Council has led the development of the South East Council's Climate Change Alliance (SECCCA) ESD Matrix. The ESD matrix was developed initially by Cardinia as other ESD processes available were too generic and did not consider the specific requirements for each building. The matrix takes specific characteristics about a planned building and develops tailored ESD requirements based on this. SECCCA members worked together to develop an enhanced version of the Cardinia ESD matrix that is now in use.

The need for this enhanced standard was identified to clarify the use of the SECCCA ESD matrix and ensure the ongoing achievement of the intended level of sustainable building design and operation for Council buildings, which is well above the minimum mandatory standards.

Sustainable buildings not only reduce environmental impacts, they also reduce utility costs providing protection from rising energy prices. They create healthier and more productive environments that provide benefits to Council staff and the broader community who utilise Council buildings. Sustainable buildings also consider the impacts of climate change and are more resilient, providing more protection from them.

3 ESD for new buildings and major refurbishments

Incorporating ESD into new Council buildings during design and construction offers the best opportunity to cost effectively reduce the lifecycle impacts of a building on the environment, and the lifecycle costs. At the start of the design of a building there is significant opportunity to incorporate sustainable design features, many of which will not be practical or financially feasible to add to the building at a later date.

3.1 ESD Matrix, features selection and design review

Council's Facilities Management Officer role has a natural correlation with ESD. This role includes a focus on the efficient management and maintenance of Council's existing buildings, the sustainable design of new Council buildings is critical to achieve this. Therefore this officer plays a key role in the design of new buildings in relation to ESD and maintenance considerations.

When issuing a design brief for a new Council building or a major refurbishment, the project manager must obtain from Council's Facilities Management Officer a set of ESD requirements generated from the SECCCA ESD matrix. An example of these is included in Appendix A. These requirements cover key ESD areas including energy, water, climate change adaptation, materials, ecology, indoor environment quality and waste management. These requirements must be issued as part of the design brief, along with an explanation regarding their application as per the example included in Appendix B.

This process ensures that ESD requirements are understood from the commencement of a new Council building design or major refurbishment. Following the engagement of the project design consultant, the project manager must discuss the ESD matrix items with them to highlight the importance of their achievement. During the design process, the design consultant must provide a response to each ESD matrix requirements providing feedback on how it has been achieved. If an

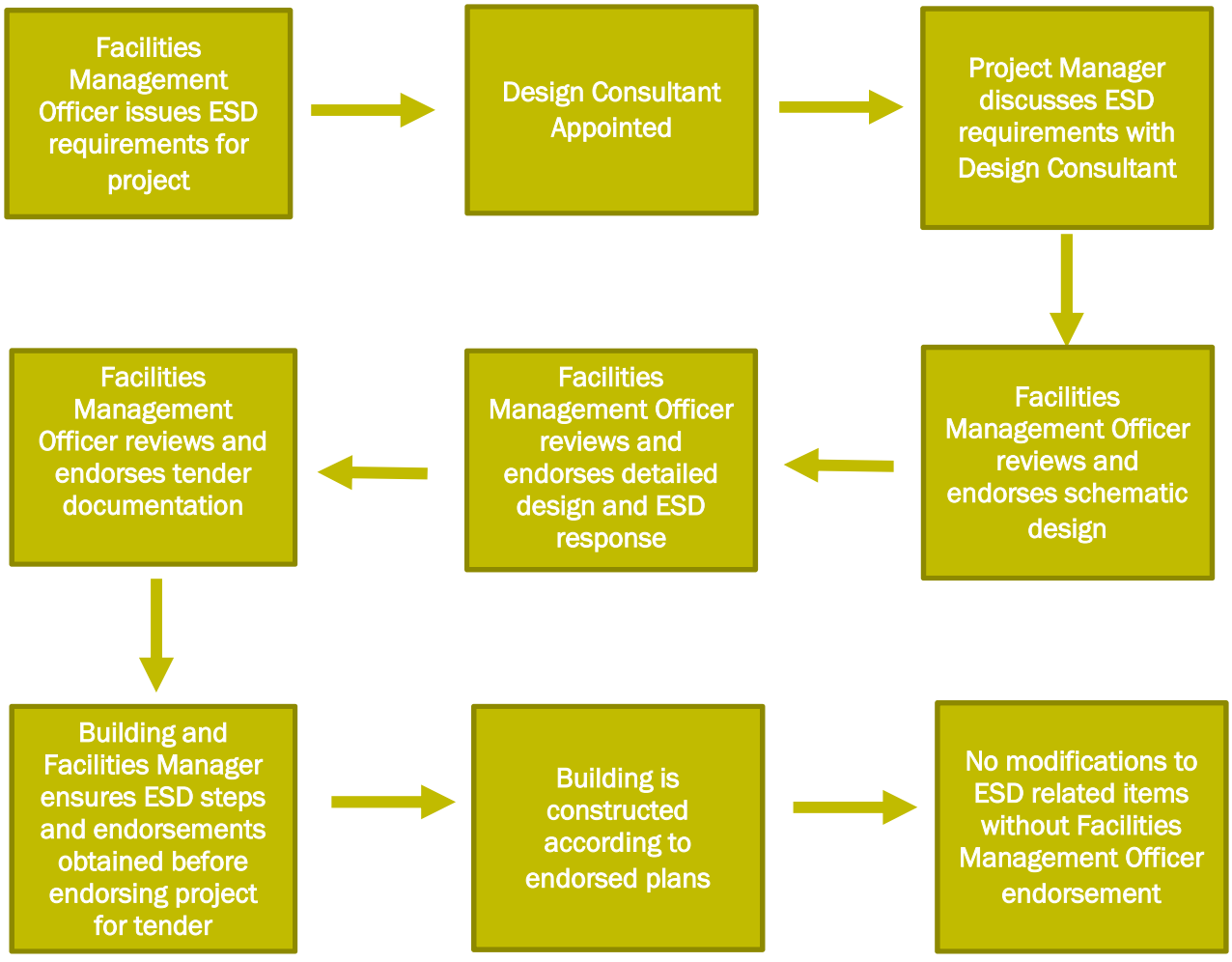
ESD matrix item has not been possible to achieve due to specific challenges with the development, this must be explained. Council's Facilities Management Officer is required to review and endorse a building design and ESD matrix response at the following points, and the project manager is to record evidence of this endorsement in a project register. This detail must be presented to the Manager Buildings and Facilities before a project is endorsed to proceed to tender. The points of endorsement include:

- Schematic design – Facilities Management Officer to endorse building envelope details including orientation, window placement and external shading devices
- Draft Detailed design – Facilities Management Officer to endorse ESD matrix response, Built Environment Sustainability Scorecard (BESS) or Green star details and detailed design (including specification).
- Pre-tender review – Facilities Management Officer to review and endorse full package of tender documentation before released for tender.

The schematic and detailed design ESD reviews may involve a meeting with the project design team and the review of documentation, and 10 working days should be allowed for this process in the project management plan for the development. 10 working days must also be allowed for the pre-tender documentation review.

Once a design is agreed upon and issued for tender, no element of the building that impacts on sustainability, building performance or ESD matrix requirements can be modified without the endorsement of Council's Facilities Management Officer. This process is outlined in figure 1.

Figure 1. ESD requirements review and endorsement process



The SECCCA ESD Matrix provides three sustainability levels, as outlined below:

1. Introductory Level - 'Essential': At this level, ESD initiatives are selected for adding no or minimal capital expenditure, having low payback periods, and/or for being considered minimum recommended contemporary ESD practice in Victoria. Many clauses are classified as optional rather than mandatory, and lower priority initiatives are not included as optional. Project teams are required to choose and implement at least 10% of the optional initiatives. This level is intended to generally add a small additional cost to the building design and construction, and quickly return this in operational savings (e.g. less than 5 years).
2. Mid-Level - 'Best Practice': In addition to the essential initiatives, additional ESD requirements are included which have a moderately higher payback period or which go beyond standard practice. Some of the optional ESD objectives are classified as mandatory at this sustainability aspiration level, and project teams must achieve at least 30% of the optional clauses. This level is intended to generally add a moderate amount of additional cost to the project design and construction cost, and return this in operational savings in a reasonable time frame (e.g. 5 – 10 years)
3. Highest Level - 'Leading': This level is intended for councils wishing to lead the way in terms of Environmentally Sustainability Design for the project. Further ESD initiatives are included which have higher impacts on capital expenditure, which may not necessarily have direct paybacks (e.g. externalised benefits only), or which are yet uncommon in the industry. At least 50% of all optional requirements must be incorporated in the project design and construction. This level is intended to add a more significant amount to the project design and construction cost, and return this in operational savings over a longer time frame (e.g. 10 – 20 years)

The additional cost Council has allowed for building design and construction can be found in table 1. Cardinia Shire Council utilises the below levels of ESD:

- Introductory level is only to be applied to projects to refurbish or repurpose an existing building, which is expected to function for a short period of ten years or less.
- Mid-level is to be applied to all general Council buildings
- The highest level of ESD is to be applied to demonstration projects of best practice sustainable design including any Council residential development and specialised environmental centres.

The matrix cannot consider every aspect regarding a specific development. Therefore the Facilities Management Officer will review the matrix outputs and make any required minor modifications to ensure suitable and cost effective features are included in the building design.

3.2 Built Environment Sustainability Scorecard (BESS)

The Built Environment Sustainability Scorecard (BESS) assesses energy and water efficiency, thermal comfort, and overall environmental sustainability performance a new building or alteration. It was created by the Council Alliance for a Sustainable Built Environment (CASBE) to assist private builders and developers demonstrate that they meet Council sustainability requirements as part of planning permit applications. There are currently 23 CASBE member and BESS subscribed Councils in Victoria.

Cardinia Shire Council intends to join CASBE and subscribe to BESS. Once this occurs all new Council buildings will need to also complete a BESS assessment and exceed a pass result. Project design consultants will be responsible for this. BESS will complement the achievement of the ESD matrix requirements and increase the thoroughness of the sustainable design review.

3.3 Green Star

The Green Building Council of Australia (GBCA) is committed to developing buildings, cities and communities that are healthy, liveable, productive, resilient and sustainable. Established in 2002, the Green Building Council of Australia is the nation's authority on sustainable buildings, communities and cities and has developed the Green Star design and as built tool for new developments.

Figure 2 shows the Green Star design and as built ratings are available, with ratings of 4, 5 and 6 being available for design and as built projects.

Figure 2. Green Star ratings (Green Building Council of Australia, 2013)

Green Star ratings encourage the engagement of a Green Star accredited professional onto the project team, and require a significant amount of rigour and consultancy work, and are not appropriate for small developments such as toilet blocks and small sporting pavilions. The Green Star process however provides a certified rating and process to ensure that a high level of ESD is achieved through a recognised system. Green Star requires buildings to include a variety of unique and innovative features. Green Star buildings have been shown to produce 62% fewer greenhouse gas emissions than average buildings, use 66% less electricity, consume 51% less water and recycle 96% of their construction and demolition waste compared to standard buildings (GBCA, 2013).

Council will achieve a minimum 4 star design and as built certified ratings for any building that exceeds 1500m2 with 40 hours or more of use per week. A minimum 4 star design and as built certified rating will also be achieved for any building that is over 1000m2 and of high use and profile and will benefit significantly from Green Star features (e.g. libraries). For any building that exceeds 3000m2 with over 40 hours or more of use per week a minimum 5 star design and as built rating will be achieved. This is consistent with the 5 star rating that was achieved for the Council's civic centre in Officer that was constructed in 2014. Buildings eligible for Green Star must have ESD consultants appointed to assist with ESD aspects during building design and construction phases. These targets will continue to be reviewed in relation to developments with the Green Star rating tool.

4 star Green Star ratings include deemed to satisfy provisions that make them more attractive and less costly for smaller community facilities. A 4 star Green Star rated building has a much greater level of ESD than the minimum standards required under the building code.

3.4 Independent Commissioning Agent (ICA)

To ensure that buildings are constructed as per design, and all systems operate as per design, an independent commissioning agent will be engaged to ensure that the endorsed design intent has been achieved for all new council buildings, refurbishments and redevelopments that are considered intermediate or complex. Table 1 provides a general outline of building classification, though the complexity of equipment and controls will also be used to determine the need for an ICA. The ICA must provide a report detailing their work to be reviewed by the Facilities Management Officer and Project Manager. The ICA must be engaged directly by Council to avoid any conflicts of interest.

3.5 Budget considerations

To ensure the upfront cost of these sustainable design requirements is available, Table 1 estimates budget allocations to be provided. The budget allocation is shown as a percentage of the total project budget (including design and construction – excluding land acquisition).

Table 1. Budget requirements ESD

Facility Type	Basic Built Form up to 500 m² (e.g. toilets, small basic Pavilion)	Intermediate Built Form up to 1500 m² (e.g. Large Pavilions, Childrens Services, Maternal Child Health, Youth Centres)	Complex Built Form above 1500 m² (e.g. Arts Centre, Swimming Pool, Community Centre, Library)
ESD design cost	N/A	2%	3%
ESD construction cost	3%	4%-7%	8% - 10%
Total ESD cost	3%	6% - 9%	11% - 13%

3.6 Responsibilities

Table 2 summarises the responsibilities in relation to ESD for new Council buildings.

Table 2. Roles and responsibilities new buildings sustainable design

Role	Responsibility
Environment and Heritage unit	Provide strategic direction and input in relation to building performance requirements. Monitor building utility consumption and report on performance. Promote ESD features and achievements to the community and organisation.
Project Manager	Ensure that ESD requirements are followed, and that Facilities Management Officer is engaged to guide, review and endorse building design. Ensure building is constructed according to design.
Facilities Management Officer	Ensure that ESD requirements are incorporated into building designs. Engage and manage ICA to ensure design intent has been achieved.
Manager Buildings and Facilities	Ensure that adequate budget is obtained to incorporate ESD features. Ensure ESD reviews have taken place and endorsements granted before building issued for tender. Ensure time is allowed and available for Project Manager and Facilities Management Officer to follow ESD process.

4 Case Study – Arena Child and Family Centre

The Arena Child and Family Centre in Officer provides a case study on the benefits of sustainable building design and the significant operational cost savings that it can provide. The Arena centre was one of the first buildings that an early version of the ESD matrix was applied to, and it features a number of sustainable design features.

Figure 3. Arena Child and Family Centre

4.1 Passive design features

The building is orientated along an east west axis with major activity areas facing north. Northern winter sun provides warmth to the building when it is needed most. Additional high level windows also provide northern solar access to areas on the southern side of the building.

Figure 4. Arena Child and Family Centre northern facade

The building features high levels of insulation in the roof and walls, as well as the extensive use of double glazing. The buildings concrete slab is designed to absorb thermal energy, providing thermal mass and reducing the need for heating and cooling. A light coloured roof has been used, to reflect heat in summer and keep the building cooler. This also allows the solar electricity system to perform more efficiently. The building also includes external shading to provide protection from the summer sun. Operable windows provide an alternative to the use of air-conditioning.

Figure 4 is looking towards the north facing side of the building in mid-summer. The external shading can be seen to provide protection from the sun. The north facing glazing can be seen, the building's light coloured roof and the high level north facing windows that bring winter sun further into the building.

4.2 Heating and cooling

Air conditioning is only provided to the main activity areas. Areas that are not used for extensive periods are not air conditioned to reduce energy consumption. Efficient split systems and multi-split units are used so air conditioning can be easily controlled and limited to certain areas. Temperature set points are limited to ensure over conditioning does not occur. Ceiling fans are used in summer to assist with cooling, the velocity they generate allow room temperatures to be set at higher levels, reducing energy consumption. Hot water is provided from efficient instantaneous electric and electric storage hot water units close to the point of use. Solar electricity from the building's rooftop array is able to supply all heating and cooling systems, as they are all powered by electricity.

4.3 Water

Water efficient appliances are used throughout the facility. The toilets are supplied by a 5,000 litre rainwater tank that is connected to extensive areas of the building's roof. These features are significantly reducing the buildings water use.

Figure 5. Arena Family and Child Centre rainwater tank

4.4 Solar energy

The facility is powered by a 30kW solar electricity system. The system utilises enphase micro-inverters, allowing each panel to operate independently. This means if one panel becomes dirty or shaded, the rest of the system will not be impacted, unlike on conventional solar energy systems.

Figure 6. Arena Family and Child Centre solar electricity system

4.5 LED lighting

In addition to the use of natural lighting, energy efficient LED lighting is used throughout the facility including the carpark. Occupancy sensing and daylight dimming is incorporated as part of the lighting control strategy to improve energy efficiency.

4.6 Summary of savings

The simple and cost effective sustainable design features incorporated at Arena Children's centre have provided a significant cost and environmental saving. As demonstrated in the table 3, compared to an older children's centre without as strong a focus on sustainable design, the building is saving $10,000 per year in energy costs, 64 tonnes of greenhouse gas emissions per year and 94,000 litres of water per year. The two centres are of comparable size.

Table 3. Energy consumption comparison Arena Family and Child Centre

	12 months Water Use (kL) 2017-2018	**12 months Greenhouse Gas Emissions ($TCO2_e$) 2017 - 2018**	**12 months Energy and Water Costs 2017-2018**
Arena Children's Centre (593m2)	127	-23	-$423
14 year old children's centre (637m2)	221	41	$9741
Savings	**94**	**64**	**$10,164**

5 Environmental upgrades of existing buildings

As part of Council's strategic direction in relation to integrated water management, climate change adaptation and greenhouse gas emissions reduction, an allocation is provided each year to improve the environmental performance of existing Council buildings. Whilst the sustainable design of new buildings is important, it is also important that Council's existing buildings continue to improve. Improving Council's existing building stock can lead to tangible reductions in energy use, greenhouse gas emissions and water use. Community groups that occupy Council buildings are also supported and assisted with environmental upgrades of their buildings through the community capital works grants process.

5.1 Project selection

The Environment and Heritage unit is responsible for obtaining and advocating for the ongoing budget allocation for environmental upgrade projects, which is linked to Council policy that the unit oversees. This budget is split amongst different areas such as street lighting, drainage, parks and buildings and facilities. The funding will also be split between energy and water projects, though some projects may save both energy and water.

Building and facilities projects will be selected based on the projects providing the highest environmental and financial savings for the lowest investment. The project selection process commences by members of the Environment and Heritage unit reviewing energy and water consumption data for Council buildings. High energy and water use buildings will be considered for upgrades. The Environment and Heritage unit will discuss potential sites and projects with the Facilities Management Officer. The Environment and Heritage unit then may need to organise energy audits and feasibility studies to determine project options and project feasibility and discuss the results with the Facilities Management Officer. The Facilities Management Officer may also suggest projects for implementation based on opportunities that are observed during building maintenance activities.

Each year, by December, the Council building projects for the following financial year will be selected for implementation, and a scope of works will be developed. The project plan will be formalised by members of the Environment and Heritage unit and the Facilities Management Officer, and endorsed by the Manager Environment and Heritage for implementation. The project plan will be based on the available budget. Ideally a program of upgrades will be scheduled well in advance, though this is not always possible due to the changes in technology, and the changes in use of Council buildings. Community groups will be able to apply for community capital works grants to implement environmental upgrades at their buildings, whilst the grants application process is open each year.

5.2 Project implementation

Once the projects are selected, the Facilities Management Officer will be responsible for project implementation. The Environment and Heritage unit will be responsible for promotion and communication relating to these projects. If external grant funding is involved, the Environment and Heritage unit will be responsible for obtaining grant funding and completing grant funding reports. The Environment and Heritage unit and Facilities Management Officer will work closely together on the implementation of these projects.

5.3 Project review

The success of these projects is largely determined by energy and water savings achieved, as well as how well they promote sustainability to the community. These projects will be reviewed by the Environment and Heritage unit by reviewing project cost and environmental savings achieved. This will assist with planning future projects. The Environment and Heritage unit may develop case studies of successful projects for general promotion.

5.4 Responsibilities

Table 4 summarises the responsibilities in relation to environmental upgrades of existing buildings.

Table 4. Environmental upgrade projects roles and responsibilities

Role	Responsibility
Environment and Heritage unit	Secure budget for projects. Identify suitable projects, manage energy and water audits and feasibility studies and scope selected projects. Apply for and manage external grant funding. Promote projects and outcomes. Complete project review.
Facilities Management Officer	Assist with project identification and scoping, energy and water audits and feasibility studies, implement projects.

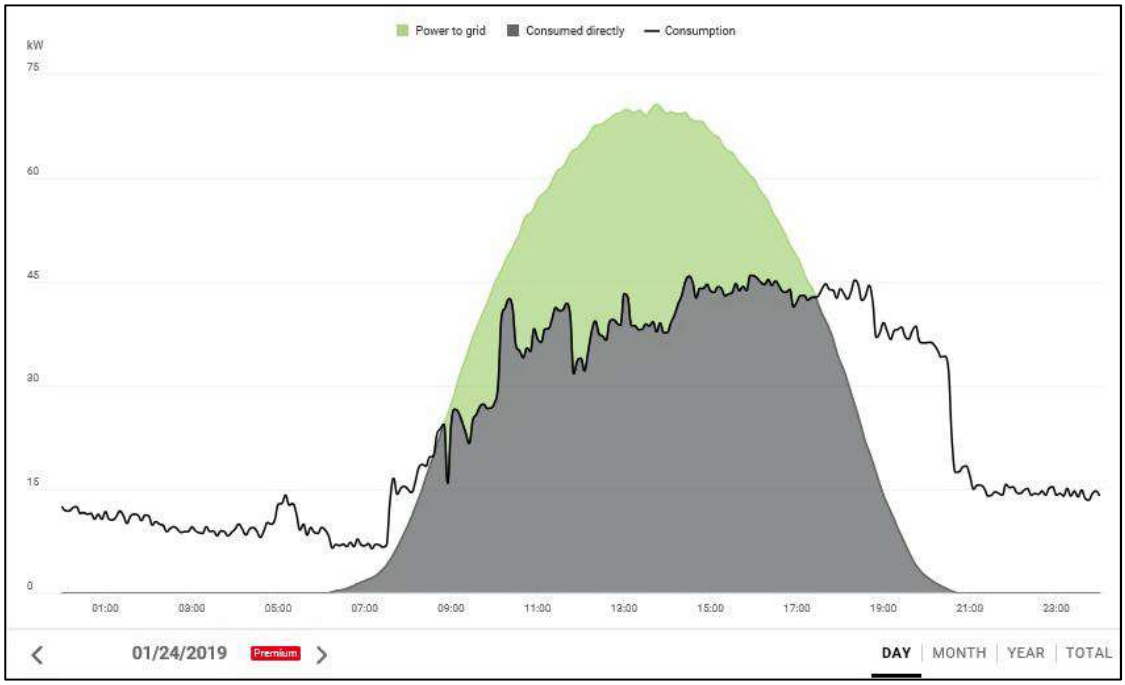
6 Case Study Pakenham Library, U3A and Hall environmental upgrade

The Pakenham Library, U3A and hall is a large community complex in Pakenham. The building was constructed in 2011 and incorporated a reasonable level of ESD based on industry standards and the available and cost effective technology at that time. Since 2011 though, there have been major developments in energy efficient LED lighting and solar energy. These new technologies provided an opportunity to enhance the operation of the facility. In 2018 the building was selected for major environmental upgrades, as part of Council's annual environmental upgrades program.

6.1 Solar energy system

An 85kW solar electricity system was installed on the building. Figure 7 shows the production of the solar system and site consumption on a summer's day. The system produced 541 kWh on this day, provided 67% of the sites electricity, and the site consumed 71% of the solar electricity produced.

Figure 7. Solar PV production and site consumption Pakenham Library U3A and Hall



Panels were installed on 20 degree tilt frames to maximise solar output and self-cleaning by rain. The system was designed to provide the greatest value for money by utilising the available roof space with panels installed in ideal positions for maximum generation. The system is providing approximately 50% of the sites electricity needs on average. The system was sized generously, to maximise available solar energy all year round. Whilst this leads to some generated electricity being exported (approximately 40%) especially in summer, it also maximises the overall financial and environmental benefits of the system. Images of the solar electricity system on the building are included on the cover of this document.

6.2 LED lighting upgrade

Over 600 lights at the library, hall and U3A were replaced with energy efficient LED products. These products reduce lighting energy consumption by approximately 50%. The new lighting has also increased lighting levels throughout the facility, improving comfort and amenity. The replacements included carpark lighting, tubes, dimming systems and downlights. The internal lighting upgrades were integrated with the existing dimming system and indoor architectural fittings to preserve the original building design.

Figure 8. Library with Updated Lighting

6.3 Summary of savings

Electricity consumption data from January to June 2019 has been doubled to indicate annual consumption for considering the reductions the upgrade has achieved. A full 12 months of post upgrade data is not yet available. 2017 consumption data has been used as a benchmark, and 2019 rates have been applied to 2017 data to normalise the costs for comparison. As can be seen in table 5 costs have reduced by $20,000 per annum, and greenhouse gas emissions have been reduced by 113 tonnes per annum. This equates to a 6.5 year payback period.

Due to higher than average use of the facility in early 2019, including use as a bushfire relief centre, feed in credits not being recognised until late January and other factors, savings from the upgrade in isolation would be greater than the figures shown in table 5. The savings the upgrade is achieving are providing significant cost and environmental benefit.

Table 5. Pakenham Library U3A and Hall Reductions

	Electricity Use less solar feed in (kWh)	**Electricity Greenhouse Gas Emissions (TCO2e)**	**Calculated Electricity Cost (2019 rates)**
Pakenham Library 2017	148,736	159	$38,460
Pakenham Library 2019 (calculated)	42,862	46	$18,178
Reduction (calculated)	**105,874**	**113**	**$20,282**

7 Sustainable building operation

Significant savings can be made by making adjustments to building controls, monitoring building performance and ensuring that buildings operate efficiently. The Building and Facilities unit will lead this area, with crucial support from the Environment and Heritage unit regarding staff engagement and consumption tracking.

7.1 Building maintenance and renewal

Council's existing buildings have ongoing minor maintenance and renewal projects. As part of these works, sustainable building operation is a key consideration. Where applicable ESD requirements from the ESD matrix outputs will be implemented as part of these projects (based on the mid-level).

Specific sustainable design features such as solar electricity systems and rainwater harvesting systems require appropriate maintenance to ensure their correct operation. A challenge of these systems is that they are often supplementary, so a building can still provide its function even without their operation. A key part of building maintenance includes monitoring and ensuring sustainable design features are maintained and operational.

7.2 Settings and controls

Council's buildings contain a range of complex systems with various settings and controls. Many of these are controlled through building management systems. These settings and controls will be utilised to provide the required function (e.g. heating, cooling, pumping, lighting, dehumidification, filtration) with the most minimal use of energy and water as practically achievable. Council's Facilities Management Officer is responsible for managing building's settings and controls. Where

practical, thermostat control adjustments will be limited to builder occupants to ensure air conditioning is run at an appropriate efficient level, and that spaces are not overcooled or heated.

7.3 Thermal comfort

To balance energy use with thermal comfort a warm season indoor temperature range of 24 - 26 degrees Celsius (warm season period is November to March) will be aimed for. A cool season temperature range of 20 – 22 degrees Celsius will be aimed for (cool season period is April to October). The band of temperatures maybe widened within these ranges to improve energy efficiency. Temperature will also be set with consideration of other factors such as radiant temperature from building surfaces.

Generally issues with building temperature will be managed by the Building and Facilities unit. Staff will be encouraged to dress appropriately for the season to ensure they do not feel discomfort with these settings. If there is a widening of temperature dead bands to improve efficiency, the Environment and Heritage unit will deliver staff engagement programs to promote these changes.

Personal heaters are not to be used by individuals as they can send false signals to air conditioning thermostats, and subsequently create discomfort and cause excessive energy consumption.

7.4 NABERS and Green Star performance ratings

NABERS is the National Australian Built Environment Rating System, which measures a building's operational efficiency against the market. Any Council owned and managed building that is practically eligible for NABERS energy and water ratings, will be rated using the NABERS system on an annual basis. Council's Facilities Management Officer will coordinate these ratings. The intention is to obtain the highest rating possible, and buildings will be improved to benefit ratings. As NABERS expands to cover more facility types, it is anticipated that more Council buildings will be eligible for ratings in coming years. Other NABERS ratings, such as waste and indoor environment quality, will also be considered.

Green Star performance ratings are much more comprehensive than NABERS ratings, and look at variety of factors including materials, energy, water, transport and indoor environmental quality. The work involved with obtaining and maintaining a Green Star performance rating is more significant than a NABERS rating. Green Star performance ratings however provide a holistic approach in measuring building's sustainability. Green Star performance ratings will be explored for Council's major buildings (e.g. the Civic Centre) with the intention for at least one of Council's building to be maintain a Green Star performance rating in the coming years.

7.5 Performance monitoring

Green Star and NABERS are two key tools that can be used to monitor the environmental performance of Council's buildings. In addition to this, Council's Environment and Heritage Unit will track the energy and water use of Council buildings generally when performing regular reporting on Council's utility tracking, and the review of implemented projects. The Facilities Management Officer may work with the Building and Facilities unit to also provide additional targeted utilities tracking where required in addition to that being provided by the Environment and Heritage Unit.

7.6 Responsibilities

Table 6 summarises the responsibilities in relation to sustainable building operations.

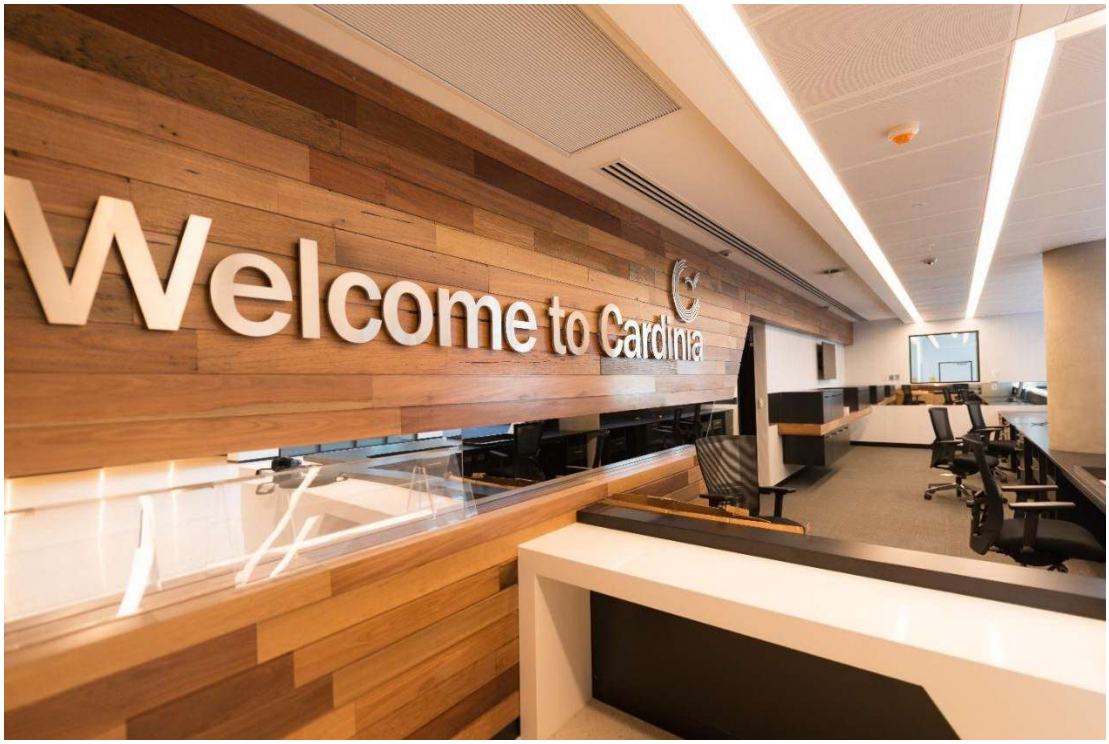
Table 6. Sustainable building operations roles and responsibilities

Role	Responsibility
Environment and Heritage Unit	Conduct tracking of building utility consumption (e.g. carbon footprint reporting). Deliver staff engagement campaigns required to improve building efficiency (e.g. use the stairs not the lifts, turn off screens in meeting rooms, temperature set point band widening).
Facilities Management Officer	Undertake NABERS and Green Star Performance ratings, manage any additional utility tracking, and adjust controls and settings to optimise building performance. Respond to concerns regarding building temperature. Manage the operation of ESD features on existing buildings.
Building and Facilities - facilities maintenance and client services teams	Ensure that ESD matrix requirements are incorporated into building maintenance activities. Assist with utility data tracking if requested.

8 Case study Cardinia Civic Centre optimisation

The Cardinia Civic Centre includes a range of sustainable design features. The building achieved a 5 star Green Star Design and Operation rating (v3 rating tool).

Figure 9. Civic Centre reception counter



Some of the key sustainable design features include:

- Improved thermal envelope including high levels of insulation and extensive use of double glazing
- Building orientated to the north with limited areas facing the summer sun
- External shading to protect from summer sun
- Efficient plant and equipment and sophisticated building management system
- Natural ventilation mode that shuts off active heating and cooling systems and opens windows for ventilation when conditions are suitable
- Night purge and economy cycle to utilise outside air for free cooling
- Significant thermal mass in the building to store and release thermal energy
- Gas fired peak load lopping generator
- Activity based working, reducing the required number of desks and occupied office area
- Rainwater harvesting and use of recycled water supply

To maximise the benefit of the sustainable design features of a building, building performance must be monitored, the building must be appropriately maintained, and ongoing tuning and adjustments must take place.

8.1 Building maintenance

Building maintenance is managed carefully at the Civic Centre. A variety of contractors are regularly engaged and overseen to ensure appropriate maintenance takes place to all building systems. The performance of all plant and equipment is closely monitored, and any items that fail are replaced quickly. For a new building like the Civic Centre, it is minor components that have a short lifespan that require replacement such as sensors. Without replacing these, the performance of the entire building can be impacted.

Figure 10. North West corner of Civic Centre

8.2 Optimisations implemented

Through detailed monitoring of the building, a number of optimisations have been implemented to improve the buildings performance since it was occupied, these are outlined below:

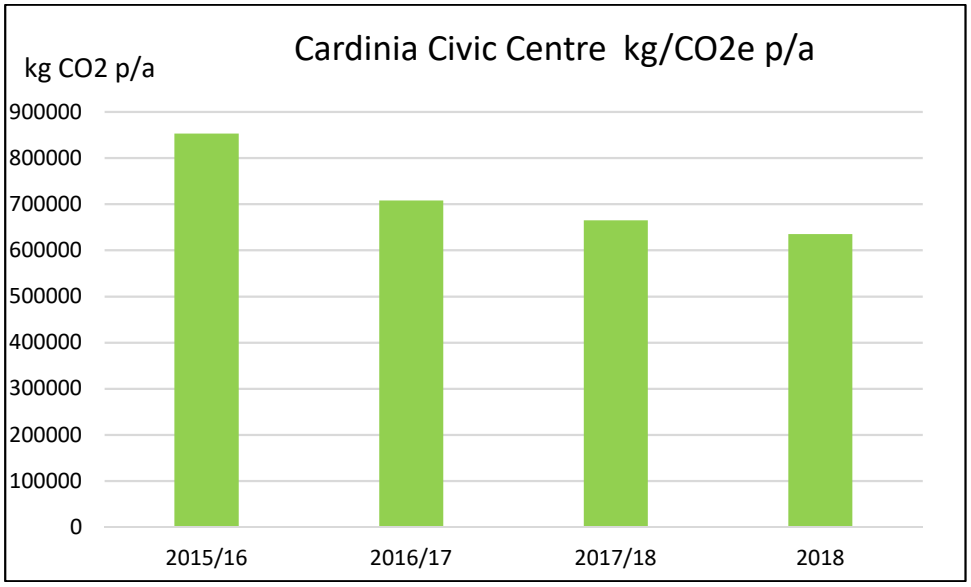
- Reducing the duration of operation of exhaust fans to plant and back of house areas
- Adjustment of temperature set points to maximise energy savings
- Widening of natural ventilation parameters to increase utilisation of this mode
- Activation and adjustment of night purge mode in summer to purge heat from building
- Programming of domestic hot water system to shut down out of hours
- Programming of meeting rooms and seldom used office space to only be conditioned when needed, and the introduction of push button wall controllers to active air conditioning as needed
- Adjustments to chilled water temperature set points to reduce chiller demand
- Careful programming of building plant to limit its hours of operation
- Upgrade of building lighting control system and reprogramming of lighting to limit operation

8.3 NABERS ratings and consumption analysis

With many of the above optimisations implemented the building achieved a 4 star NABERS energy rating based on the 2018 calendar year. This rating is expected to increase in future years as the results of the implemented optimisations are fully realised for a full 12 month period, and additional measures are implemented to further increase savings.

Figure 10 shows the year by year greenhouse gas emissions from the civic centre. Optimisations have reduced emissions by 25% from 2015/16 and 2018 (218 tonnes of CO2e per annum). These optimisations have only cost a small amount to implement. They have been calculated to be saving $36,000 per annum in energy costs (current rates) by comparing 2015/16 consumption levels to 2018 consumption levels.

Figure 11. Cardinia Civic Centre Greenhouse Gas Emissions



9 Building fuel transition

As natural gas is a fossil fuel, which cannot be provided by renewable energy, Council buildings will move away from the use of natural gas where practical. As currently certain specific functions are more practically achieved by natural gas or with a natural gas boost (e.g. hot water for football showers), natural gas maybe acceptable in limited scenarios.

The electricity grid and Council supply is moving towards renewable electricity, electricity will therefore have a lower carbon intensity than natural gas as this transition progresses.

10 Conclusion

This enhanced standard will ensure Council meets its ESD aspirations for the buildings it owns and manages. This will reduce costs and environmental impacts and improve health and wellbeing. Additionally, this will ensure Council buildings act as examples to the broader community in relation to sustainable design, having flow on benefits as the example Council has set is followed.

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Appendix A: SECCCA ESD Matrix example

These guidelines form the ESD brief for a new Childrens' Centre

Compulsory ESD initiatives

Building & Construction Management

● 75% of construction and demolition waste by weight should be diverted from landfill.

● All building systems should be fully commissioned in accordance with CIBSE or ASHRAE codes before handover. Provide or update Operational & Maintenance manuals, building user guide and training to occupants, as built drawings for all services and a log book. Ensure they include system descriptions, and guidance on operating procedures and maintenance requirements.
● Set or update energy and water targets for the building and monitor consumption quarterly to ensure targets are met. Facility management to tune the building if targets are exceeds or building optimisations are identified.
● A project-specific Environmental Management Plan (EMP) to minimise environmental impacts during construction must be created and implemented.

Climate change resilience

● Review the capacity of the development to cope with key climate change impacts (flooding risk, increased storm intensity, heat waves, droughts), and alter the design to mitigate impact of high risks identified.

Ecology

● At least 70% (by area) of new plants should be indigenous and drought-resistant.
● No old growth forest to be cut down. If within 100m of a wetland, a project specific Wetland Management Plan must be prepared.
● Align with long term urban planning density objectives.

Energy & Carbon emissions

● Locate hot water appliances close together near the hot water system, or consider distributed hot water systems.
● High speed hands dryers with short run times should be installed instead of paper towels. Ensure hand dryer noise is adequately contained.
● Electrical appliances (other than air-conditioning) should have an energy rating no less than 1.5 star below the highest available energy rating under the E3 Program. Refer to http://www.energyrating.gov.au/ for current ratings.
● The number of fridges and fridge locations should be limited.

● Install a tier 1 Solar PV system if feasible and the payback is less than 6 years. Installation must follow CEC guidelines and AS/NZS 5033, and consider the use of non-penetrative fixings for rooftop PV. Solar PV systems must have remote monitoring.

● If a BMS is present or part of the project, it must be commissioned at its installation or following changes to the BMS, the metering, or the controls. Alerts and automatic report generation must be set up, and controls must be verified.
● Automatic shutdown internal lighting overnight using timers and/or motion sensors (security lighting excepted)
● Any chilling and boiling water units installed must be well-insulated, and only rapidly heat or cool an appropriately small volume of water to meet the demand. They must be programmed to go into standby mode outside building occupation hours, and maintain hot water at the lowest possible temperature which does not pose a health risk.
● Minimum efficiency for any new Domestic Hot Water plant:
- DX: exceed MEPS COP requirements by at least 15% If part of the E3 program, the energy rating must be no less than 1.5 star below the highest available energy rating for that size.
● No gas connection to the premise, unless necessary for pool heating or commercial kitchens.

HVAC

● Include operational energy as a consideration during initial HVAC strategy option analysis.
● Design outside air rates to maintain CO2 levels below 800 ppm, or to be at least 50% above AS1668.2-2012 minimum. Install CO2 sensors in occupied spaces to modulate outside air flows accordingly.
● Minimum efficiency for new HVAC equipment:
- DX: exceed MEPS COP requirements by at least 15%. If part of the E3 program, the energy rating must be no less than 1.5 star below the highest available energy rating for that size.
- chillers: COP to exceed current NCC or MEPS requirements by at least 10%
● Investigate economy cycle for the ventilation systems. If suitable, include if payback is less than 6 years or unit cooling capacity exceeds 20kWr.

● Investigate reducing supply water temperature if possible to improve overall heating system efficiency.
● Minimise all water and refrigerants' pipe run lengths to minimise distribution losses and pump energy. Circulation pumps should be time-switched off when the building is unoccupied.
● Refrigerants must have zero ODP and a GWP less than 2,100 for all systems, and less than 700 for small HVAC equipment such as split systems.

● Minimum total system static efficiencies at design operating point:
- Fans > 55%
- Pumps > 60%
New three-phase electric motors must meet "high Efficiency" MEPS requirements.

● Perform cost-benefit analysis for VSDs on large fans and pumps; install if payback is less than 6 years. Consider EC Plug fans alternative for non-life safety systems.

● Rooms used intermittently (e.g. meeting rooms) must have sensors or HVAC switches (with instructions) to run air-conditioning for a preset time only. These rooms should be served by a separate HVAC system if possible, and have separate, individual BMS schedules.
● Liaise with client on wider heating and cooling setpoint design criteria, with at least a 2°C - 3°C deadband.

● Ensure ASHRAE Standard 62.1:2013 is followed for minimum separation distances between pollution sources and outdoor air intakes. Ducts to be cleaned before occupation or sealed off during construction. Ensure minimum 10 year warranty on large plant equipment.
● Provide easy and safe access to all mechanical plant and equipment, and all components requiring maintenance.
● All HVAC systems should have time schedules, linked to a BMS if present. The BMS must allow cooling and heating lockouts based on outside air temperatures or calendar.
● If a server room forms part of the development, its air-conditioning should:
- be able to operate independently from the main HVAC system
- have an economy cycle where feasible
- have the highest acceptable setpoint for server rooms
For smaller rooms, door vents and extraction fans regulated by thermostats should be considered.

Indoor Environment

● All new windows should be fitted with blinds (VLT <10) to minimise glare.
● Provide good levels of natural light to most of the occupied area. Consider light-coloured internal finishes to maximise natural light levels.

Lighting

● Any newly installed or upgraded electric lighting systems should have a luminous efficacy of at least 100 lm/W for troffers and 72 lm/W for other lights. General lighting systems must be LED.
● Install daylight sensors in perimeter zones, and occupancy sensors where appropriate. Lighting must be zoned to enable efficient dimming or switching off of lights when not required. Provide visual instructions next to light switches.
● Carpark illumination levels must adhere to AS1158.3.1:2005. Install LED type carpark lighting with a minimum luminous efficacy of 95 lumens/Watt. Install motion sensors to turn on car park lights outside hours for 10 minutes when triggered. To maintain minimum illuminance levels for safety, install dimmable lights or operate a reduced number of luminaires.
● External car park lighting must include PE cells and/or timers (programmable per day of the week) to limit operation to night-time only. Solar powered carpark lighting (including batteries) only to be installed when cost effective over lifecycle, including replacement costs of batteries.
● Minimise light pollution to neighbouring bodies and the night sky. All non-safety external lighting must comply with AS 4282:1997. External luminaires cannot have an Upward Light Output Ratio (ULOR) exceeding 5%, relative to its actual mounted orientation.

Materials

● Select dimensions to suit standard material sizes where applicable to reduce waste.
● Insulants must have zero Ozone Depletion Potential (ODP) in processing and manufacturing.
● A comprehensive hazardous material survey must be carried for any existing buildings and structures on site (if present). Any lead, asbestos, or PCBs must be removed and disposed off appropriately.
● At least 95% of all structural steel used should be sourced from a responsible steel maker: a current member of the World Steel Association's (WSA) Climate Action Programme (CAP) holding a valid ISO 14001 EMS Certificate for the relevant manufacturing site.

● At least 5% (by cost) of materials should be re-used, contain recycled content, or have a third party certification recognised by the GBCA. Glass, steel, and concrete excluded.

● The Portland Cement content of the concrete should be reduced by 20% through replacement with supplementary cementitious materials such as fly-ash, slag, or metakaolin.

● At least 95% of all engineered wood products should have low formaldehyde emissions or contain no formaldehyde, in accordance with Green Star Design & As-built Credit 13 Indoor Pollutants. Formwork and car park applications are excluded.

● Any new furniture should be easily adaptable to changing layouts.

● At least 95% of all paints, adhesives, and carpets should have low Total Volatile Organic Compound (VOC) emissions in accordance with Green Star Design & As-built Credit 13 Indoor Pollutants.

Other

● Include signage with acknowledgement of the traditional owners of the land.

Passive Design

● Minimum building fabric insulation levels (total R-values) for new elements part of the thermal envelope:
- Roof & ceiling ≥ R4.2
- Slab on ground with in-slab heating ≥ R2.0 and R1.0 vertical insulation around perimeter edge
- Other floors ≥ R2.5
- External Walls ≥ R3.3
- Internal Walls ≥ R2.3

● Minimum thermal performance new glazing (whole-of-system values):
a) U-value ≤ 2.8 W/m2K
b) Solar Heat Gain Coefficient (SHGC) at appropriate levels for window orientation and shading. Both peak cooling and annual energy to be considered.

● Provide horizontal shading to North-facing glazing, and vertical shading elements to glazing on East and West facades.

● Main building entrances facing south, south-east or south-west, must include an airlock or revolving door. This is recommended for other orientations.

● Roofing materials to be light-coloured. Area-weighted average Solar Reflectance Index (SRI) across site (aerial view) > 50. An SRI of 80 can be assumed for vegetated areas.

● Orient building along East-West axis where possible and appropriate.

● Façade design and construction must incorporate wind barrier layers and appropriate detailing to draught proof and minimise infiltration heat gains and losses. Impermeable layer must be documented.

● Infiltration rate must be less than 3 ac/h at 50Pa. Air leakage testing is encouraged to demonstrate building infiltration rate.

Transport

● Provide 1 bike rack for visitors per 20 peak visitors near the entrance, and the following cyclist facilities for regular occupants.
a) secure bike parking for 10% of regular occupants.
b) at least 1.2 lockers per bike park space
c) change rooms and showers to meet demand, e.g.
- 1 to 6 bike spaces: 1-2 showers
- 6 to 12 bike spaces: 4 showers
- 2 further showers per 10 additional bike park spaces

● 5% of car park spaces should be designated for use solely by small cars, motor bikes, or other fuel-efficient transport.
● Provide clear pedestrian routes to nearest public transport facilities. Display a map near the building entrance showing access to and key details of nearby public transport.

● Electric vehicle charging stations must be provided. Where possible, the charging stations must be located to enable usage from multiple car parks. The number of charging stations must be equal or greater than 5% of new car park spaces.

● Integrate on-site bike paths with existing public cycling infrastructure

Waste Management

● Provide dedicated storage for recycling waste, with easy access for collection. The required storage area must be calculated using anticipated waste generation rates and collection frequency (indicative area 0.8% of GFA). Refer to City of Sydney's Policy for Waste Minimisation in New Developments.
● A waste management plan should be developed for the project (refer The Guidelines for preparing a waste management plan 2017 by the City of Melbourne).

● Provide separate collection and storage waste bins for the different recycling streams identified as appropriate for the building. Collection bins must be evenly distributed across the building and clearly marked for each stream. The following recycling streams should be considered:
- Paper and cardboard
- Commingled
- Glass
- Plastic
- Organic

Water

● All installed fixtures, fittings and appliances must be water-efficient:
- Wash hand basin taps: flowrate ≤ 4.5L/min;
- Toilets: dual flush, 3/4.5 L/flush;
- Showers: flowrate ≤ 7.5 L/min;
- Dishwashers: ≥ 5 Star WELS
- Washing machines: ≥ 5 Star WELS
Showers must have push buttons to time out after 2 minutes.
● Either no irrigation or drip irrigation (under mulch or subsurface)

● Provide a rainwater harvesting tank and reuse the water for irrigation and toilet flushing. Minimum tank capacity: 10L per m2 GFA.

● Implement Water Sensitive Urban Design (WSUD) initiatives to achieve:
1) a STORM rating of ≥ 100%; OR
2) the following pollution reduction targets in MUSIC modelling:
- Total Suspended Solids (TSS)*: 80%
- Gross Pollutants: 90%
- Total Nitrogen(TN)**: 45%
- Total Phosphorus (TP)**: 60%
- Total Petroleum Hydrocarbon: 90%
- Free Oils***: 90%

* Particulate size distribution (by mass) in 20% intervals (< 20, 60, 150, 400, 2000 µm)
** includes particulate and dissolved fraction
*** not applicable if less than 200m2 for vehicles to park or transit

● Install leak detection device on water supply that halts water supply if leak is detected until manual reset.

Optional ESD initiatives - at least 30% (12 of 39) of the optional initiatives must be implemented.

● All settings on mechanical and electrical building systems should be fine-tuned for 12 months after practical completion.

● The site induction to (sub-)contractors must include a segment on sustainable building practices, highlighting some of the project's sustainability initiatives, their benefits, and the role contractors play in achieving them.

● Provide at least 20% pervious ground coverage in outdoor areas to allow rainwater to infiltrate the soil rather then drain off the site.

● Minimise impact of construction works on topsoil and reuse on-site or off-site.

● Use native creepers or vines to green building facades.

● Install a rooftop garden.

● Restore or improve the ecological value of the project site compared to pre-development stage. Any ecological offsets should be made within the local Council area.

● Use deciduous trees to shade north, west and east windows from the summer sun

● If not possible via BMS, install a shutdown switch to shut off non-essential electrical systems outside operating hours.

● 100% GreenPower to be purchased by the building operator, or equivalent Power Purchase Agreement

● If PV is (being) installed, conduct a cost-benefit analysis of battery storage. Install if payback is less than 6years; if not, futureproof PV design and allow space for future battery.

● In spaces with a natural ventilation mode, BMS must be able to operate louvres. All louvres must seal up to maintain air tightness when closed.

● Consider indirect evaporative cooling system to complement heat rejection plant.

● Install ceiling fans where appropriate to form or complement the heating and cooling strategy.

● Based on the area of the new development, it is recommended the design team considers these options for the main HVAC strategy:
- DX Split systems
- DX Packaged Units
- VRF system

● Incorporate connection(s) with the natural environment in the design.
● Provide access to external views to the majority of the occupied area.
● Include some vision glazing at appropriate heights for children.
● Provide indoor plants distributed across occupied areas at a ratio of 500cm2 soil area per 10m2 occupied area (0.5%).
● Design and material choices to ensure that the
- internal ambient noise levels in occupied spaces are no more than 5dB(A) above the lower figure recommended in Table 1 of AS/NZS2107:2016
- reverberation time in occupied spaces is below the maximum 'Recommended Reverberation Time' provided in Table 1 of AS/NZ 2107:2016
- noise transmission is minimised between sensitive spaces. The total Rw value of the partition as a whole should exceed 45 (or 35 if it contains a door)

● All timber used on the project should be recycled or FSC certified with a Chain-of-Custody certificate.
● All new timber is sourced from an Australian, sustainably managed plantation.
● For pipes, conduits, cables, blinds and permanent formwork, either use PVC-free products or PVC products which adhere to Best Practice Guidelines in Green Star Design & As-Built Credit 20 Responsible Materials.
● Reuse an existing building or structure where possible.
● Design buildings which can easily be adapted to other uses, e.g. reduce the amount of structural partitions.
● Consider exposed floors, walls and ceilings to reduce materials use.
● Select products with a product certification scheme recognised by the GBCA where viable.
● Design for efficient fitout upgrades.
● The ergonomics of all new furniture and equipment are reviewed and considered appropriate to meet the needs of the users.
● Where possible, design for ease of disassembly. This may include façade elements which can be re-used on other buildings.
● Minimum 5 year warranty on fitout items
● The building should be located close to available public transport and amenities where possible.
● Engage an ESD consultant to help develop the sustainability strategy for the project.
● Design to achieve possibility of effective natural ventilation. Include high and low operable openings that utilise both buoyancy and cross-flow ventilation. Consider local wind effects.
● Consider increasing the amount of exposed thermal mass to reduce peak cooling loads and temperatures. Ensure the building is well-sealed and well-insulated to avoid excessive energy use to heat up thermal mass in winter.
● Provide fixed shading to external spaces
● Develop and implement a Green Transport Plan.
● Investigate feasibility of a bus stop and/or car-share provision
● Provide compost units or worm farms for on-site organic waste recycling.
● No mains water used for water features (e.g. fountains)
● Engage an Independent Commissioning Agent to ensure the building is appropriately commissioned.

Disclaimer

This tool has been developed by WSP, for SECCCA. While care has been taken in its development, to the maximum extent permitted by law, WSP and SECCCA do not accept responsibility for any inaccuracy within this tool, make no warranties (including fitness for purpose), nor assume any legal liability or responsibility to its users or third parties for the accuracy, completeness, or use of any information contained within this tool.

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Glossary

● AFUE: Annual fuel utilization efficiency: a thermal efficiency measure, a dimensionless ratio of useful energy output to energy input

● CIBSE: Chartered Institution of Building Services Engineers: an international professional engineering association based in London that represents building services engineers

● ASHRAE: American Society of Heating, Refrigerating and Air-Conditioning Engineers: a global professional association seeking to advance heating, ventilation, air conditioning and refrigeration systems design and construction

● BMS: Building Management System (also known as BAS or BMCS): a computer-based control system installed in buildings that controls and monitors the building's mechanical and electrical equipment such as ventilation, lighting, power systems, fire systems, and security systems

● HVAC: Heating, ventilation, and air conditioning

● DX: Direct Expansion: Type of air-conditioning system where the air is cooled or heated by using refrigerants in the coils of the air handling unit (as opposed to using water). Split systems and packaged units are examples of DX systems.

● MEPS: Minimum Energy Performance Standards: energy efficiency requirements for certain products and appliances under the national Greenhouse and Energy Minimum Standards (GEMS) Act 2012

● COP: Coefficient of Performance: the COP of a heat pump, refrigerator or air conditioning system is a ratio of useful heating or cooling provided to work required

● EER: Energy Efficiency Ratio: the EER of a heat pump, refrigerator or air conditioning system is a ratio of useful cooling provided to work required. Equivalent to COP (which can be used for both heating and cooling)

● ACOP: Annual COP: indication of the COP over an entire year, using weighting for COP at different partloads.

● AEER: Annual COP: indication of the EER over an entire year, using weighting for EER at different partloads.

● NCC: National Construction Code: The NCC provides the minimum necessary requirements for safety, health, amenity and sustainability in the design and construction of new buildings (and new building work in existing buildings) throughout Australia. It is managed by the ABCB

● E3: Equipment Energy Efficiency: The E3 program is a cross jurisdictional program through which the Australian Government, states and territories and the New Zealand Government collaborate to deliver a single, integrated program on energy efficiency standards and energy labelling for equipment and appliances.

● ODP: Ozone Depletion Potential: The ozone depletion potential of a chemical compound is the relative amount of degradation to the ozone layer it can cause

● GWP: Global Warming Potential: Global warming potential is a relative measure of how much heat a greenhouse gas traps in the atmosphere

● VSD: Variable Speed Drive: equipment used to control the speed of machinery (fans, pumps)

● EC: Electronically Commutated. EC motors are electric motors which have permanent magnets on the rotor and use electronics to control the voltage and current applied to the motor.

● MUSIC: Model for Urban Stormwater Improvement Conceptualisation: A software tool used to calculate the impact of stormwater treatment designs. More complex than STORM.

● STORM: Stormwater software tool in webbrowsers to calculate the impact of stormwater treatment designs. Less complex than MUSIC.

● ABCB: Australian Building Codes Board: the ABCB is responsible for the development of the National Construction Code (NCC) Series.

● VAV: Variable Air Volume is a type of heating, ventilating, and/or air-conditioning system, whereby the air flow rate is varied to meet comfort conditions.

● GreenPower: The GreenPower Program (the Program) is a government managed scheme that enables Australian households and businesses to displace their electricity usage with certified renewable energy, which is added to the grid on their behalf.

● AIRAH: Australian Institute of Refrigeration, Air conditioning and Heating: AIRAH is an independent, specialist, not-for-profit technical organisation providing leadership in the HVAC&R sector through collaboration, engagement and professional development

● UFAD: UnderFloor Air Distribution: UFAD is an air distribution strategy for providing ventilation and space conditioning in buildings as part of the design of a HVAC system.

● Green Star: Green Star is is a voluntary, holistic sustainability rating system for buildings, interior fitouts, and communities in Australia and is administered by the GBCA.

● WSUD: Water-Sensitive Urban Design: WSUD is a land planning and engineering design approach which integrates the urban water cycle, including stormwater, groundwater and wastewater management and water supply, into urban design to minimise environmental degradation and improve aesthetic and recreational appeal.

● PE: Photoelectric. PE cells are daylight sensors. They can be used to control the amount of light output from light fittings.

● NLA: Net Lettable Area: The area of a building that can be let to tenants. It is less than the gross building area as it excludes such things as walls, common areas, and lift wells.

● NABERS: National Australian Built Environment Rating System: NABERS is an initiative by the government of Australia to measure and compare the environmental performance of Australian buildings and tenancies. There are four type of NABERS ratings: Energy (carbon emissions), Water, Indoor Environment, and Waste

● GBCA: Green Building Council of Australia: the GBCA, established in 2002, is a not-for-profit industry association that promotes sustainability in the built environment. The GBCA is best known for developing the Green Star rating system for buildings and communities.

● GFA: Gross Floor Area: The total floor area contained within the building measured to the external face of the external walls.

● VRF: Variable Refrigerant Flow (also referred to as VRV, trademarked by Daikin): VRF is an HVAC technology, which uses refrigerant as the heating and cooling medium. This refrigerant is conditioned by a single outdoor condensing unit, and is circulated within the building to multiple indoor units.

● ESD: Environmentally Sustainable Design:(ESD) principles aim to improve the health and comfort of buildings for occupants whilst at the same time reducing negative impacts on the environment.

Appendix B: SECCCA ESD Matrix text for design brief

Early integration of sustainable design is strongly advocated by the Cardinia Shire Council. Consultants are to prepare designs and documentation in accordance with Environmentally Sustainable Development principals that embody objectives including energy efficiency, greenhouse gas emission reduction, indoor environmental quality, water efficiency and waste minimisation.

Cardinia Shire Council has provided its ESD Matrix outputs with this quotation documentation (see appendix x). The ESD Matrix Outputs set out Council's ESD requirements for this facility that are intended to be achieved.

The successful design consultant and sub consultants are required to review the ESD requirements in the matrix outputs and incorporate them in the facilities design. The design consultant must report back to Council on each item in the ESD Matrix and explain how it has been incorporated in the design.

Council understands there are specific site constraints and limitations that may create challenges in relation to the achievement of some specific matrix requirements. Council will work through these items with the successful design consultant to determine the best way forward. If there is a reason that is acceptable to Council regarding why a specific ESD requirement cannot be met, Council may accept this but will look to offset this loss by ESD improvements in other areas.

The design consultant and sub-consultants are required to utilise their skills, training and experience when applying the ESD matrix requirements, and ensure that all relevant building standards and legislative requirements are met.

The ESD matrix outputs are points to guide the design and support the project team achieve a high level of ESD in the facility. The demonstration of leading ESD features to the community and utility cost reductions are important to Cardinia Shire Council. Council has set the target of zero net emissions by 2024 in its Aspirational Energy Transition Plan, and a high level of ESD for new facilities is a key part of this.