Prepared for Wenona School
5th June 2015

WENONA GIRLS SCHOOL

Sustainability Development Application Report

Wenona Girls School

Sustainability - DA Report

Client: Wenona School

ABN: N/A

Prepared by

AECOM Australia Pty Ltd
Level 21, 420 George Street, Sydney NSW 2000, PO Box Q410, QVB Post Office NSW 1230, Australia
T +61 2 8934 0000 F +61 2 8934 0001 www.aecom.com
ABN 20 093 846 925

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Prepared by	Ian Dixon
Reviewed by	Tim Dunn

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Signature	

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EXECUTIVE SUMMARY

Executive Summary

This report summarises the Ecologically Sustainable Development (ESD) strategies in consideration for the proposed new 6 storey building at Wenona School which will include:

- A 25m indoor pool
- A Learn to swim pool
- A gymnasium and weights room
- Classrooms
- Laboratories
- Food technology areas
- Staff areas
- New footbridge over Elliot Street connecting into the existing school campus.

Wenona School is committed to a number of long term sustainability outcomes and has set challenging objectives and targets for the new building project (known as 'Project Archimedes') as part of their own internal Wenona Sustainability Policy.

Project Archimedes will be designed to reflect the objectives of the School's Sustainability Policy as well as comply with BCA Section J Energy Efficiency and the Department of Planning and Environment – Secretary's Environmental Assessment Requirements.

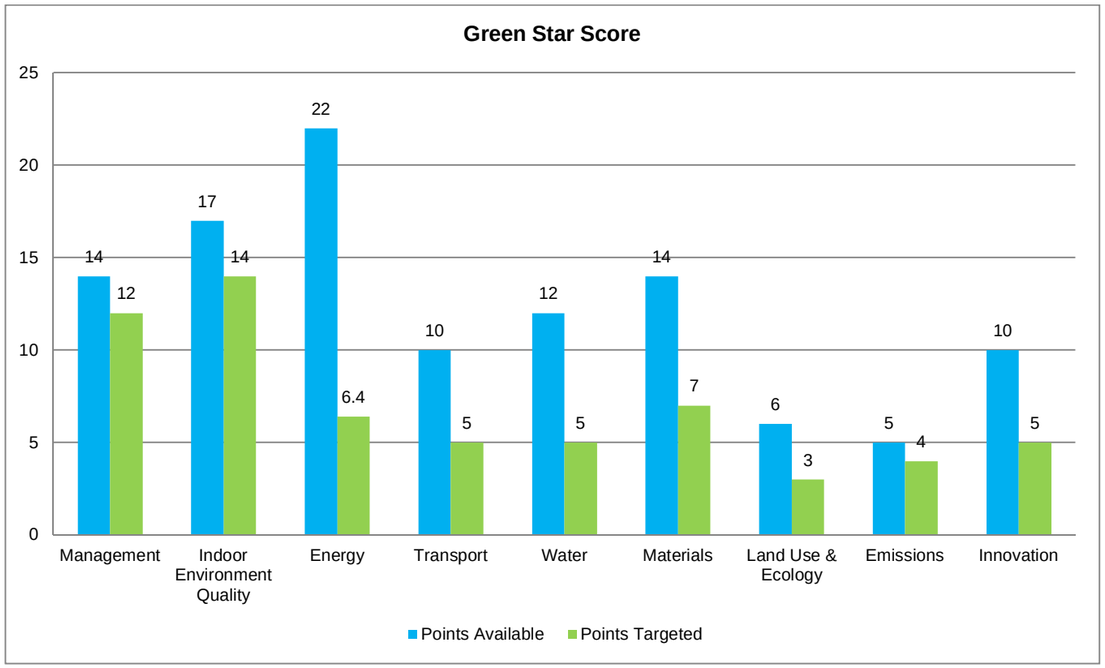
In addition to being designed to operate with exceptional environmental performance, the building itself will be an active learning space containing a number of features and initiatives that will contribute to the education of students and visitors.

The project will actively incorporate the principles of ecologically sustainable design in order to contribute to the broader sustainability goals and help facilitate cultural changes to improve sustainable behaviour and reduce resource consumption.

A number of sustainable design initiatives have been considered and are proposed for the new facility. These include:

- Strategies for a low energy use building:
  - good passive design – including thermal insulation, shading devices, light coloured external finishes, natural / mixed ventilation;
  - energy efficient building services – including highly efficiency HVAC equipment, building management system and controls, heat recovery for swimming pool, LED lighting throughout with occupant detection and daylight adjustment
  - Alternative or renewable energy opportunities including potential to use Photovoltaics.
- Strategies for reducing potable water use:
  - Efficiency fixtures and fittings
  - Water sub metering
  - Efficient appliances
  - Rainwater capture and reuse
- Initiatives to enhance environmental quality, health and wellbeing of students;
  - Increased fresh air rates
  - Control of external traffic noise and internal building services noise
  - Well-designed / zoned artificial lighting
  - Use of natural daylight where possible
  - Mixed mode HVAC coupled with well insulated building fabric for thermal comfort
  - Low VOC / Formaldehyde content of internal finishes
- materials selection for low toxicity, low embodied energy and good operational / whole of life performance
- Recommendations for physical and curriculum based learning initiatives and topics.
- Strategies to reduce waste include:
  - Contractor to divert at least 80% of waste from landfill
  - Adequate facilities to separate and store multiple waste streams will be provided

Project Archimedes is not targeting a formal Green Star rating; however, the Green Star Design and As Built Rating tool will be used to provide guidance on sustainability. A detailed breakdown of Project Archimedes ESD initiatives benchmarked against the Green Star Design and As Built rating tool is included in Appendix B. Based on the Information available and the level of design completed up to the Development Application submission the Green Star position is as follows: The Project has the potential to achieve a 5 Star Rating (61.4 points). A summary of the category scores is shown in the chart below.



INTRODUCTION

1.0 Introduction

This report summarises the Ecologically Sustainable Development (ESD) strategies in consideration for the proposed new 6 storey building at Wenona School (known internally as Project Archimedes) which will include:

- A 25m indoor pool
- A Learn to swim pool
- A gymnasium and weights room
- Classrooms
- Laboratories
- Food technology teaching areas
- Staff areas
- New footbridge over Elliot Street connecting into the existing school campus.

The project seeks to provide:

- a building of outstanding architectural merit that meets the aspirational objectives & functional requirements to be "amazing in a humble way"
- a facility that pursues innovation to meet specific project aims, not for its own sake;
- an asset that articulates Wenona's core principals, values and actively influences and contributes to learning outcomes;
- connections with existing and future school facilities as well as local community and wider world;
- contribution to the "greening" of the campus and a sustainable future;
- a peaceful, calm, and reflective space with excellent indoor environmental quality;

Project Archimedes will not only provide a building to house students, moreover the building itself will be an active space containing a number of features and initiatives that will be used to contribute to the education of students and visitors.

Wenona School is committed to a number of long term sustainability outcomes and has set challenging objectives and targets as part of the internal Wenona Sustainability Policy.

Project Archimedes will actively incorporate the principles of ecologically sustainable design in order to contribute to the broader sustainability goals and help facilitate cultural changes to improve sustainable behaviour and reduce consumption.

This Development Application report presents sustainable design opportunities that have been identified for the new facility. This includes:

- Strategies for a low energy use building, including
  - good passive design
  - energy efficient mechanical equipment
  - energy efficient lighting
  - alternative or renewable energy opportunities
- water harvesting and re-use
- Initiatives to enhance environmental quality, health and wellbeing of students
- materials selection for low toxicity, low embodied energy and good operational / whole of life performance
- Recommendations for physical and curriculum based learning initiatives and topics.

1.1 Sustainability Targets

AECOM have reviewed potential objectives and targets which are to be further developed in collaboration with the School and broader Archimedes design team. These objectives have been drawing from relevant sections of the Wenona Sustainability Policy, and statutory obligations contained in BCA Section J and the Secretary's Environmental Assessment Requirements for the Department of Planning and Environment. Additional references were also obtained from the Green Star Design and As Built rating tool for guidance purposes.

1.1.1 Wenona Sustainability Policy

The Wenona Sustainability Policy defines the sustainability objectives and targets established for the Wenona School. The Policy includes sustainability initiatives to minimise the consumption of energy, water, waste and material.

The Wenona Sustainability policy aims to be a framework that can be used for all projects at the school whether new buildings or refurbishments.

1.1.2 Building Code Australia – Section J

The BCA 2015 Section J contains a number of mandatory provisions for minimum energy performance requirements. Requirements cover: Section J compliance for the development will be demonstrated with the Deemed to Satisfy (DTS) where possible. Option exists to use the alternative pathway using the JV3 method where it is not practical to apply a DTS solution. The relevant DTS requirements are:

- Part J1 – Building Fabric
- Part J2 - Glazing
- Part J3 – Building Sealing
- Part J5 – Air Conditioning and Ventilation Systems
- Part J6 – Artificial Lighting and Power
- Part J7 – Hot Water Supply and Swimming Pool and Spa Pool Plant
- Part J8 – Access for Maintenance and Facilities for Monitoring

1.1.3 Department of Planning and Environment – Secretary's Environmental Assessment Requirements

The ESD principles (as defined in clause 7(4) of Schedule 2 of the Environmental Planning and Assessment Regulation 2000) will be incorporated in the design, construction and ongoing operation phases of the development.

- The new facility development will be assessed against a suitable accredited rating scheme to meet industry best practice
- Sustainability initiatives will be implemented to minimise consumption of resources, water and energy

A detailed description of the requirements along with a design response summary is included in Appendix A.

1.1.4 Green Star – Design and As Built Rating

Green Star is a voluntary scheme administered by the national, not-for-profit organisation Green Building Council of Australia (GBCA). The Green Star suite of tools provides an environmental rating of buildings performance. The tools are performance based and assess the environmental attributes of new and refurbished buildings in every state across Australia. The Green Star rating system is scaled to a star level from 0 to 6 stars, where ratings of 4 stars or higher are able to be submitted for certification.

The Green Star Buildings rating tool assess a project's performance against eight environmental categories

1. Management
2. Indoor environmental quality
3. Energy
4. Transport
5. Water
6. Materials
7. Land use & ecology
8. Emissions

9. Innovation

Project Archimedes is not targeting a formal Green Star rating, however, the Green Star Design and As Built Rating tool will be used to provide guidance on sustainability.

A detailed breakdown of Project Archimedes ESD initiatives benchmarked against the Green Star Design and As Built rating tool is included in Appendix B.

Based on the Information available and the level of design completed up to the Development Application submission the Green Star position is as follows: The Project has the potential to achieve a 5 Star Rating (61.4 points).

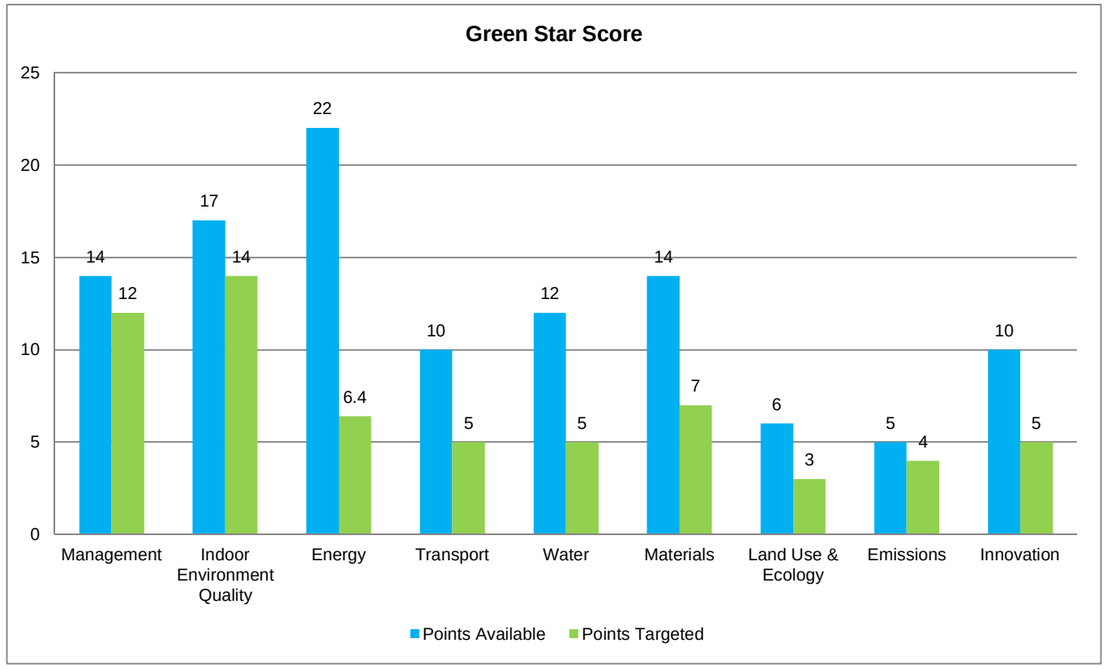


Figure 1 Green Star Potential of Project Archimedes

1.2 Project approach to sustainable design

A sustainability strategy specific to Project Archimedes will be developed and updated as the design progresses. Our approach to the strategy will be to identify and prioritise the appropriate sustainability response for the development. The approach to sustainable and environmental design focuses around the following strategies:

- Design according to site context with regard to constrains and opportunities e.g. microclimate and orientation
- Whole of life decision making – implement a project wide decision making framework based on lowest overall life cycle costs optimisation.
- Durability, resilience and adaptation – decisions and design choices made with regard to durability, adaptability and resilience.
- Hierarchal sustainable design philosophy focused around design priorities will be adopted as a foundation for energy and water strategies and underpins the sustainable design approach. The process is summarised in the Figure 1 below:

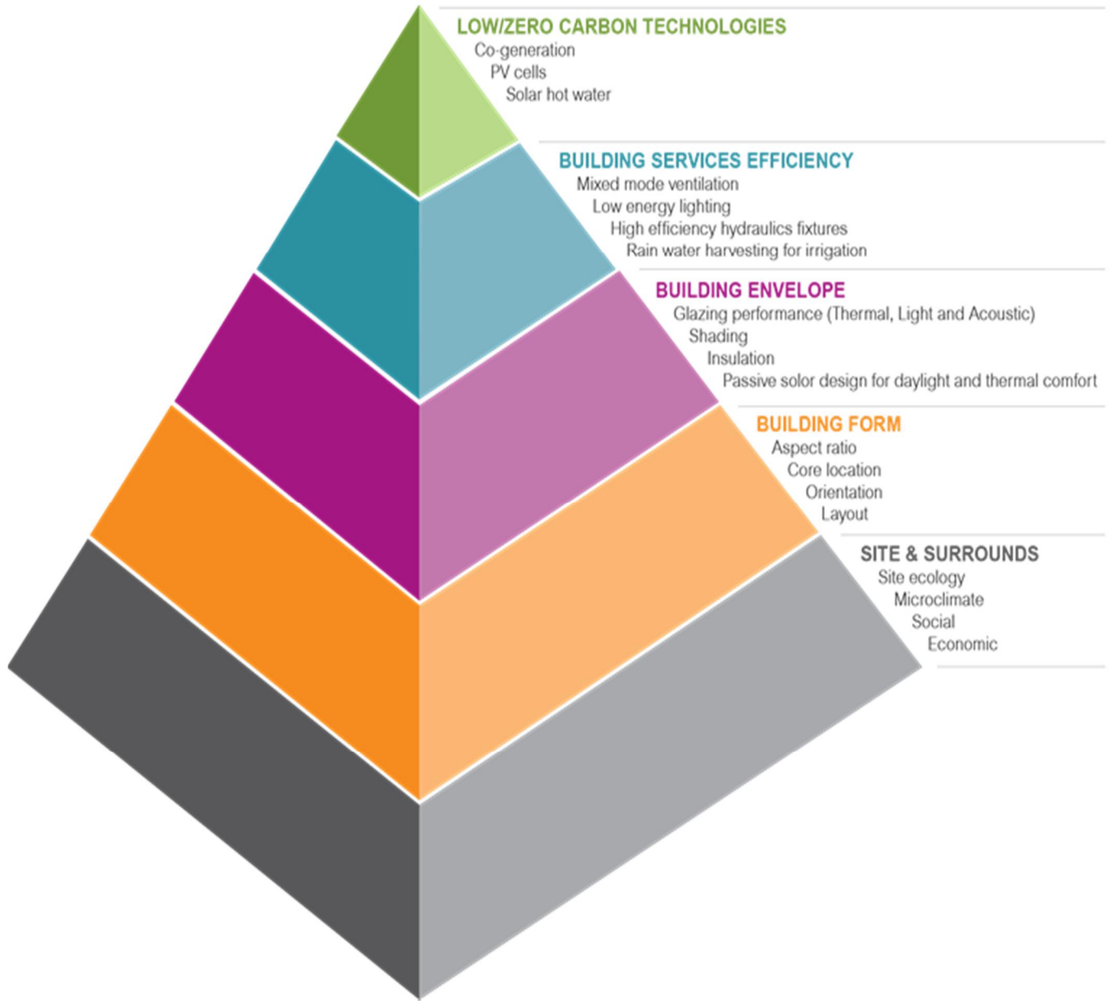


Figure 2 Sustainable design hierarchy

Using this approach a number of sustainability initiatives for the proposed developed have been identified. These are intended to improve building energy efficiency, reduce the environmental impacts of the development, enhance economic and social benefits and offer high quality indoor and outdoor amenity to building users. These strategies are summarised in the following report sections and will be investigated further and refined during the detailed design of the development. They include:

- Energy conservation and greenhouse gas strategies;
- Water Conservation strategies;
- Indoor environment strategies;
- Materials strategies; and
- Educational opportunities.

SITE ANALYSIS

2.0 Site Analysis

Ecologically sustainable design requires the facility to respond to its local environment. A well designed facility can use the natural energy available within its microclimate to sustain natural cooling in summer, natural heating in winter, and good levels of daylight and water demands. All of these strategies contribute to overarching objective of conserving natural resources.

This section presents an analysis of the local weather, including the direction of prevailing winds, seasonal and diurnal temperature ranges, wind speed and relative humidity. These attributes are critical for building orientation and form, and for identifying relevant additional sustainable design strategies.

2.1 Site location

Wenona School is located in North Sydney between St Leonards Park and the Bradfield Highway, with Ridge Street to the north and McLaren Street to the south. The site of the Project Archimedes lays between Elliot Street and Miller Street as indicated in Figure 3.

Figure 3: Wenona School and Location of Project Archimedes

2.2 Microclimate Analysis

The International Weather for Energy Calculation (IWEC) hourly data for Sydney City has been analysed to understand local climate conditions. The data is taken from 18 years of weather records. The key seasonal and diurnal statistics are presented below.

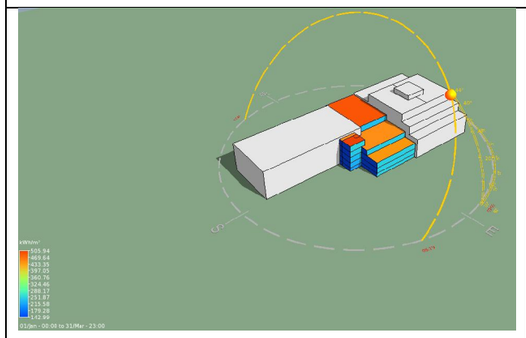
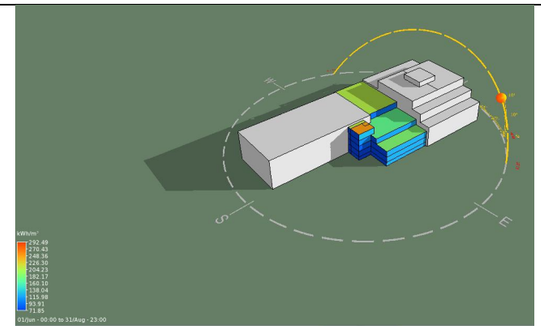
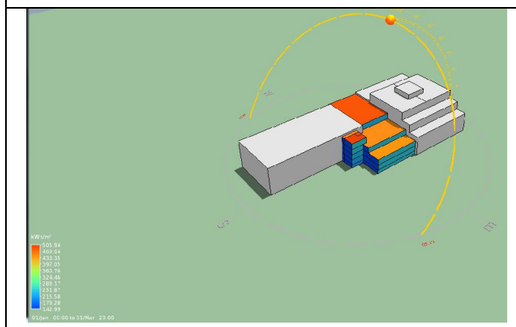
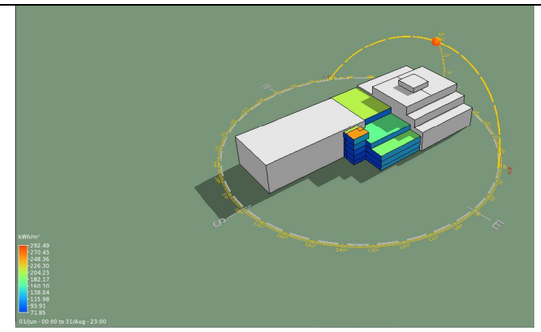
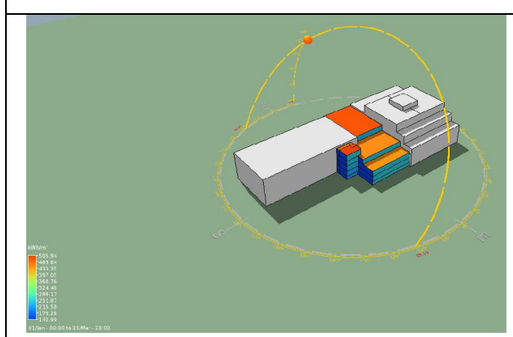
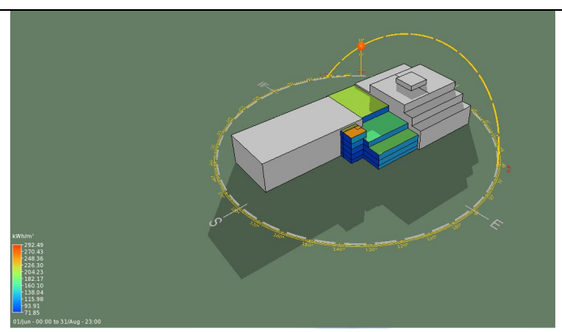
2.2.1 Solar Insolation

The proposed building height and surrounding buildings means the Wenona site has varying levels of solar access. The northern aspect is shaded by the residential apartment block immediately north. This aspect will receive limited sunlight during winter however the will be exposed to high levels of solar radiation during the summer and shoulder seasons. Civic park and a general lower rise development to the site's west will result in the western elevation be exposed to low angle sun in the later afternoon which will increase heat gains particularly in the summer and shoulder seasons. There are however existing trees along Miller Street that afford some shading and protection.

A solar insolation investigation has been conducted on the proposed Wenona building using a solar analysis simulation tool. The simulation only took into account of the immediate adjacent buildings. The simulation results shows that during summer seasons there are minimal shading and high concentration of solar insolation on the roof top throughout the day (9am to 3pm) due to the high angle of the sun during summer solstice.

During winter seasons, the building's main rooftop will receive minimal amount of solar insolation due to the low sun angle of winter solstice and obstruction from the adjacent apartment building. Table 1 shows the comparison of solar insolation during summer and winter seasons.

Table 1 Comparison of solar insolation and sun path of proposed Wenona building during summer and winter seasons

Solar Insolation on proposed Wenona building during Summer Season	Solar Insolation on proposed Wenona building during Winter Season
 Morning (9am)	 Morning (9am)
 Noon (12pm)	 Noon (12pm)
 Afternoon (3pm)	 Afternoon (3pm)

During summer, the proposed building rooftop will receive twice as much solar insolation compared to winter season (505kWh/m^2 during summer compared to 248kWh/m^2 during winter). There is great potential for solar panels to be installed on top of the proposed Wenona building rooftops to harvest solar energy

2.2.2 Temperature and Diurnal Averages

Figure 4 below shows the outdoor air temperature (mean, max and low) and the ASHRAE 55-2010 Adaptive thermal comfort range for Sydney, NSW.

The initial analysis of monthly average temperature range indicates that outdoor conditions are favourable for large periods of the year for supporting occupant comfort with no requirement for active heating or cooling. However during winter and peak summer active heating and cooling will be required to maintain comfort conditions. Climate conditions indicate that a mixed mode ventilation system would be suited to the site.

Monthly diurnal averages highlight the difference in temperature between day and night. The diurnal range is used to evaluate night time purging (cooling). The diurnal ranges indicate that the building could benefit from night time purging whereby cooler night air is allowed to enter and cool the building which can this assist in reducing daytime temperature for the following day thereby reducing cooling loads.

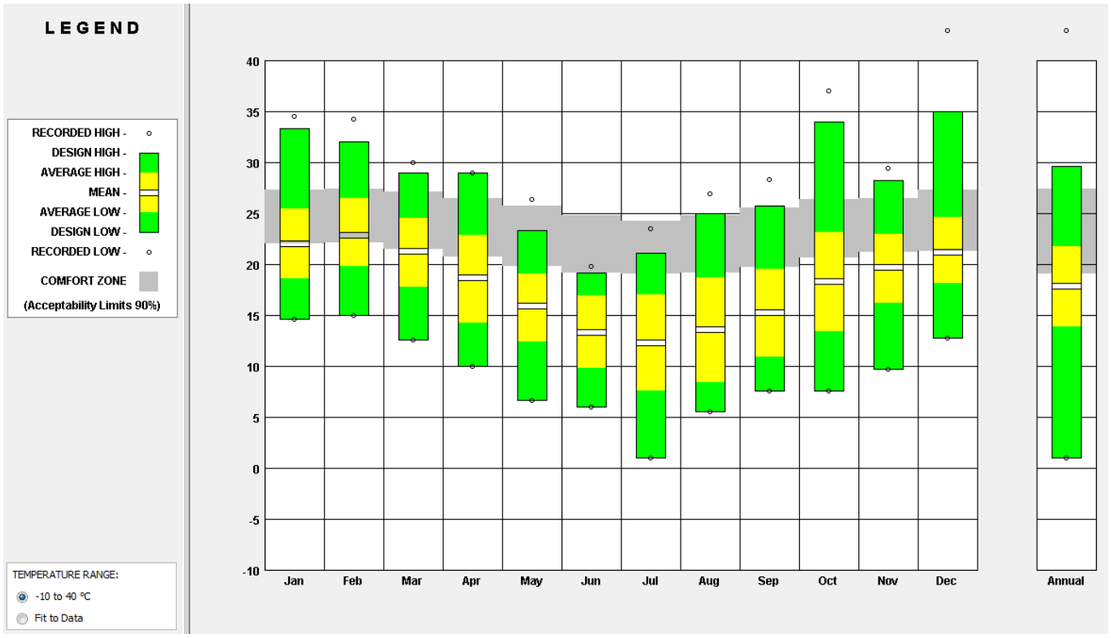


Figure 4 Sydney, Temperature and diurnal range

2.2.3 Prevailing Winds

Australia's two prevailing wind streams are determined by the seasonal movement of high pressure systems (i.e. anticyclones). Variations in wind direction and speed are greatest at the coastal areas due to the influence of the diurnal and sea breeze affects. The local wind pattern of all months of the year for Sydney is shown in Figure 5.

The wind analysis indicates that cooling breezes during summer, spring and autumn days arrive most commonly from the north, east and north-east.

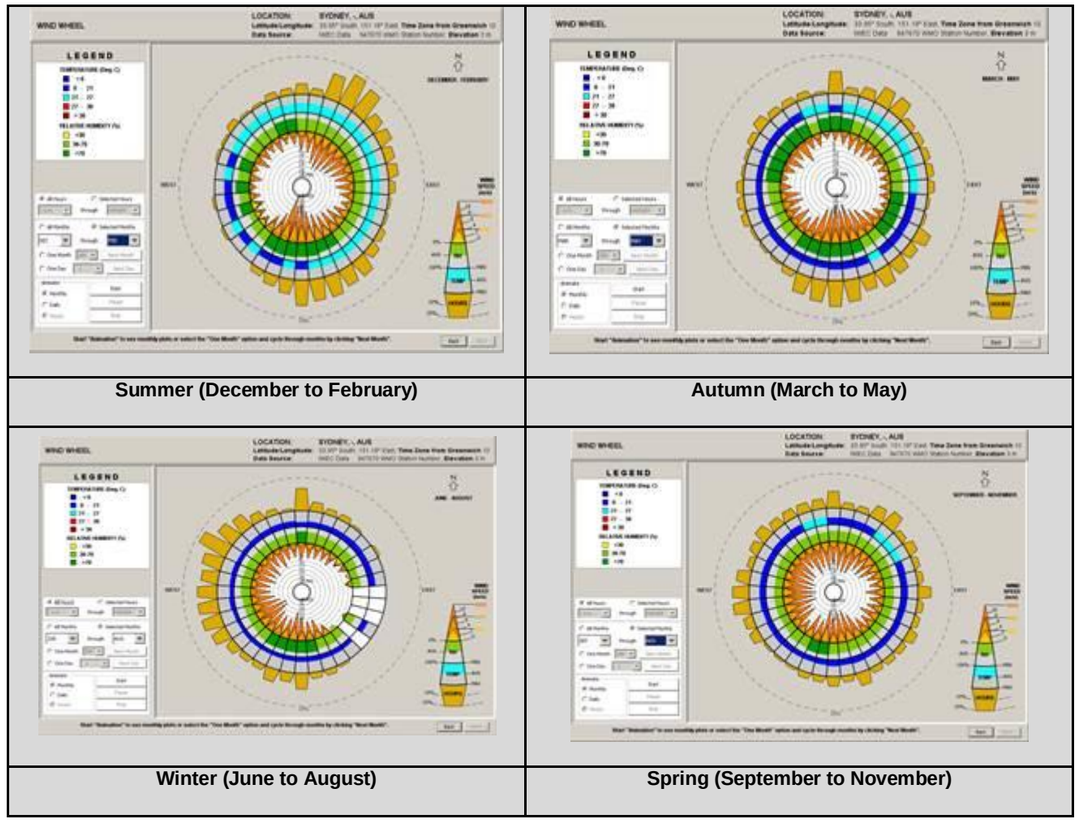


Figure 5: Wind Pattern

2.2.4 Other Environmental Considerations / Constraints

The local road network carries a relatively high traffic flow which means that external noise intrusion and local air quality are environmental factors that need to be considered alongside the potential sustainability strategies. Of particular relevance is location of outdoor air intakes, louvres ort other apertures in the building form to facilitate ventilation.

SUSTAINABLE DESIGN STRATEGY

3.0 Sustainable Design Strategy

3.1 Energy

The design strategy to target low Energy consumption and Greenhouse Gas (GHG) emissions is through:

1) Energy conservation through passive design approaches;
2) Energy efficiency through active / mixed mode design approaches; and
3) Renewable energy / Low carbon application.

3.1.1 Passive Design

The proposed passive design approach responds to the local climate, local sun path and wind profile, reducing the building's demand for active building-services systems to provide thermal comfort and lighting and reducing peak energy demand and annual energy consumption. The following passive design opportunities have been considered:

3.1.1.1 External fabric/insulation to reduce solar radiation and heat transfer

The building is required to meet the Building Code of Australia (BCA) Section J *Part J1 Building Fabric* and *Part J2 Glazing* Deemed to Satisfy (DTS) requirements.

Part J1 Building Fabric requires roofs, walls and floors that forms the building envelop to air-conditioned spaces to be insulated to the R-values specified. Part J2 Glazing stipulated the minimum glazing performance required and assesses the façade orientation, relative glazing areas and shading.

The project team will investigate the possibility of designing the building fabric and glazing performance beyond the DTS requirements, to prevent unwanted additional heat loads during summer and reduce heat loss from the interior of the building to the outside during winter. The improved building fabric and glazing may also provide additional noise reductions.

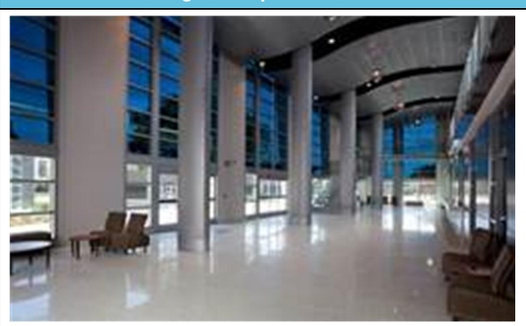
Some building fabric and glazing examples that may be considered includes:

- Light-coloured tin roof/walls to reflect solar radiation (with a solar absorptance <0.4)
- Heat Reflective paint coating on tin roof (e.g. Durabond Solaheat)
- Electro-chromatic glass in the western façade to provide solar reactive shading
- Deciduous tree planting can be used to reduce solar penetration during summer months and promote solar penetration during the winter months.

The examples listed above will be evaluated in detail at a later stage.

Deciduous tree to reduce solar penetration

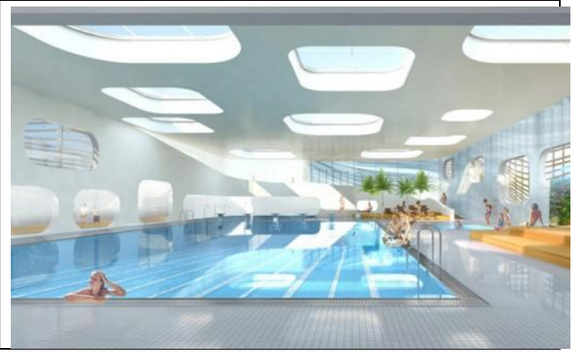
Electro-chromatic glass to provide solar reactive shading



3.1.1.2 Skylights to provide sunlight and reduce lighting energy consumption

Skylights may be installed at strategic areas to provide natural sunlight and outdoor views to improve the indoor environment quality. Areas that could benefit from skylights include the pool areas and gym which have limited access to natural daylight.

Skylights to provide natural sunlight and outdoor views



3.1.1.3 Natural ventilation and mixed mode ventilation to reduce mechanical heating and cooling

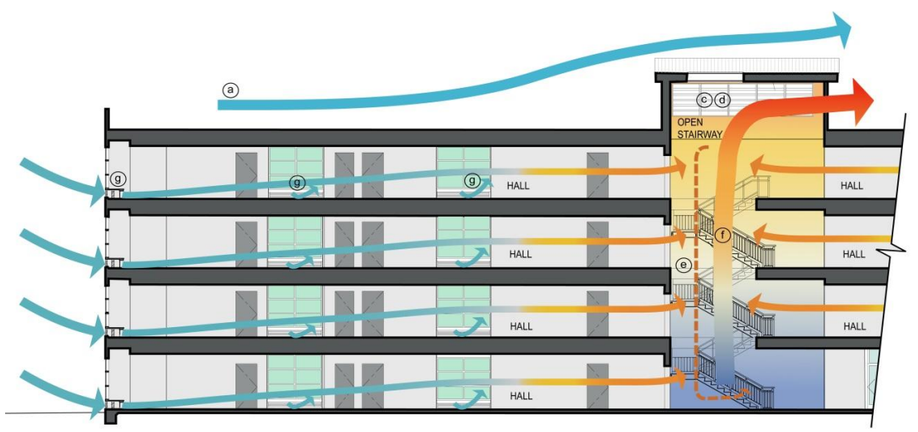
Openings to allow for natural ventilation may provide the following benefits:

- Opportunities for mixed mode ventilation;
- Provided passive microbial control through effective air change; and
- Reduce the use of mechanical HVAC systems which results in a reduction of greenhouse gas emissions.

Natural ventilation will be considered for certain areas of the building where maximum benefit can be obtained.

The number of hours per annum during which natural ventilation may be possible is dependent on the microclimate and the willingness of occupants to tolerate adaptive thermal comfort. This may not be suited to all spaces due to operational temperature requirements and constraints on natural ventilation openings.

Natural ventilation to utilise free cooling and reduce the use of mechanical HVAC systems



3.1.1.4 Other Considered Passive Designs

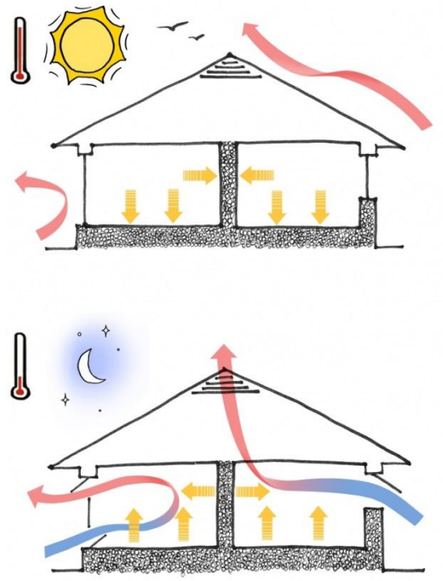
Other passive designs that were considered but evaluated as unfeasible at this stage for various reasons include:

- Green Roof
- Night Purge/Thermal Mass

A green roof is typically a roof surface covered with vegetation and soil which acts as thermal mass. Green roofs can reduce the heating and cooling requirements of the building and provide acoustic insulation.

Night purge/ Thermal mass, or heat capacity, is the ability of a material to store heat. Exposing the thermal mass surfaces or structure within a building allows the building to store and release thermal energy into the occupied zone. This has the effect of stabilising space temperatures and reducing the required peak air conditioning load.

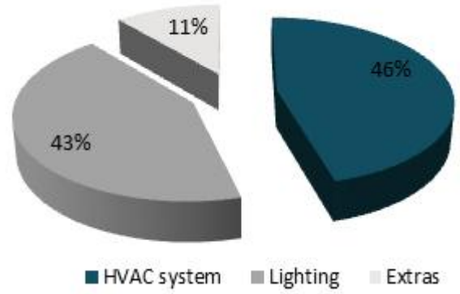
If used effectively in conjunction with natural ventilation, night time purging, passive solar design and night cooling, the total air conditioning energy consumption can be significantly reduced.

Green roof	Night Purge
	

3.1.2 Active Design

Good passive design will extend the hours per annum during which natural and mixed mode ventilation can be used. Beyond this, there is a need for low energy space heating and cooling, in addition to the specific environmental control needed in gym and pool areas.

The figure below shows that the use of low-energy HVAC systems and efficient lighting, in particular, will contribute to reducing the Greenhouse Gas (GHG) impact of energy use on site



Typical breakdown of energy use in a commercial building (Source AECOM)

3.1.2.1 HVAC Systems

HVAC energy efficient initiatives that are considered for Project Archimedes are:

- Selection of highly efficient HVAC equipment with high performance levels that are correctly sized
- Appropriate zoning and control for HVAC systems to condition spaces when required. Well zoned systems enable buildings to respond to variable heat loads which can lead to energy savings.
- Building Management Control and Systems (BMCS) for controls of all HVAC system
- Reverse cycle heat recovery type specialist pool air conditioning units, dedicated for the main pool and learn to swim enclosures
- Mixed mode ventilation where possible
- Consideration will be given to the following initiatives;
    - Widen temperature set points
    - Displacement ventilation system
    - Variable fan Speed air handling units with heat recovery
    - Demand control ventilation (CO_2) and economy cycle
    - Occupancy based AC operation
    - Desiccant dehumidifiers and ultrasonic humidifier for areas required humidity control
    - Thermal Energy Storage

3.1.2.2 Lighting

The following lighting energy efficiency initiatives will be investigated for Project Archimedes:

- Provide natural light to as many occupied spaces as possible
- High efficiency LED and fluorescent lighting
- Automated lighting control, including occupant detection and daylight adjustment which are linked to the BMCS
- Allow for separate sub-metering of the lighting to monitor consumption

3.1.3 Renewable / Low Carbon Energy

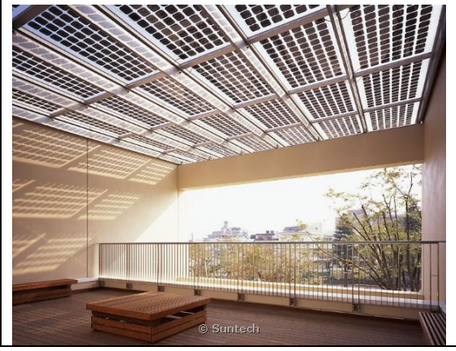
Renewable technologies use free natural resources, such as the sun and the earth, as a fuel to generate energy. They typically have high capital costs compared to conventional generation technologies but low operational cost. The cost effectiveness of renewable technologies is, therefore, directly related to the effective utilisation of the equipment as well as any associated 'added value" benefits. Such systems not only reduce energy use and greenhouse gas emissions , they can also contribute to reducing capacity and sizing of site infrastructure and can also reduce peak load which leads to further cost savings.

3.1.3.1 Photovoltaic

Photovoltaic (PV) and Building integrated PV (BIPV) shall be considered to produce electricity from sunlight for internal use or battery/energy storage within the building.

PV cells produce electricity from sunlight for internal use or battery/energy storage. PV cells are now increasingly cost effective and come in a variety of applications from traditional panel or through building integrated (BIPV) technology such as roof panel and glazing. BIPV in the outer façade skin would provide solar shading and produce electricity

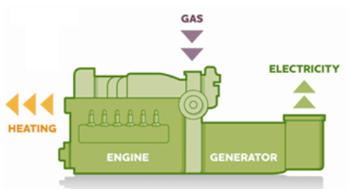
A detailed feasibility study shall be conducted to determine the amount of solar panels that can be installed and solar energy that can be captured at the detailed design stage. The use of PV is part of the Wenona renewable energy strategy.

Photovoltaic Panels	Building Integrated Photovoltaic
	

3.1.3.2 Other Renewable / Low Carbon Energy Consideration

Other renewable / low carbon technologies that were considered but are unfeasible at this stage include:

- Wind / Solar powered external lighting systems; standalone LED lighting systems that utilises wind and or solar energy to provide external lighting
- Co-generation (Combined Heat and Power – CHP); the simultaneous production of electricity and heat. The waste heat is used to heat the pool water and domestic hot water.
- Kinetic energy; production of kinetic energy through energy generating exercise equipment

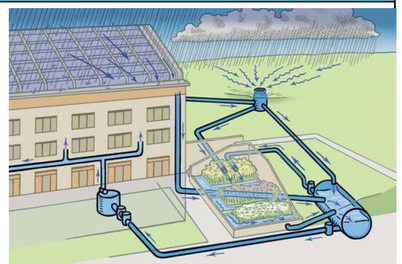
Wind/Solar powered external lights	Co-generation	Kinetic energy exercise equipment
		

3.2 Water conservation

A water strategy has been developed using hierarchal sustainable design process to first minimise water consumption through design and selection of fixtures, fittings and through using xeriscaping to reduce landscape irrigation demand. To minimise use of potable water, measures to harvest and re-use rainwater will also considered.

The following water conservation opportunities are considered for Project Archimedes:

- Efficient Water Fixtures; recommend that all water fixtures and appliances to be at least 5 stars WELS rating except for showers
- Water sub-metering and connection to BMCS; provide real time monitoring and leakage detection of water consumption for all major water uses via BMCS
- Rainwater reuse system; Harvest rainwater which will be used for irrigation and flushing of toilets. This will be highly dependent on the water catchment area and annual rainfall.

WELS Water Rating	Water sub-metering	Rainwater Reuse System
		

3.3 Environmental Quality + Wellbeing

The building will be designed to have exceptional indoor quality which will provide a healthy and comfortable internal environment for building occupants. The indoor environment initiatives will deliver thermal, visual and acoustic comfort as well as providing high levels of fresh air supply to maintain indoor air quality. The environmental comfort systems shall be characterised by:

- Indoor air quality initiatives
- Thermal Comfort
- Acoustic Comfort
- Visual Amenity

The following Environmental Quality +Wellbeing initiatives are considered for Project Archimedes:

- Provide higher outdoor fresh air rates than the minimum rates required
- Procurement of low VOC and formaldehyde materials
- Maximise natural daylight and views to the outside
- Provide lighting levels appropriate to the task/activity and include user controlled/adjustable lighting
- Design the building envelope, plant & equipment to maintain appropriate internal noise levels

Appropriate lighting levels and controllability	Maximise daylight and outdoor views
	

3.4 Materials

The proposed materials strategy aims to limit the broader environmental impact of the development through selection and use of lower impact materials. They key aspects to the materials strategy is to:

- Consider Life Cycle Impacts of material selections and choose materials that are durable and long lasting;
- Select materials that are certified, reused, recycled content or have chain of custody agreements

3.4.1 Embodied Energy

The embodied energy of materials is defined as the sum of all the energy required to produce a product. It encompasses the energy required to extract the raw materials and the various processes needed to convert the materials into a finished product. Embodied energy can form a significant component of the energy intensity of a building through its lifecycle. Typical figures for the embodied energy in Australian concrete, steel, aluminium, glass, timber and clay brick are illustrated in Figure 6 for comparative purposes, per kilogram of material. Embodied energy of materials will be considered during the detailed design process/

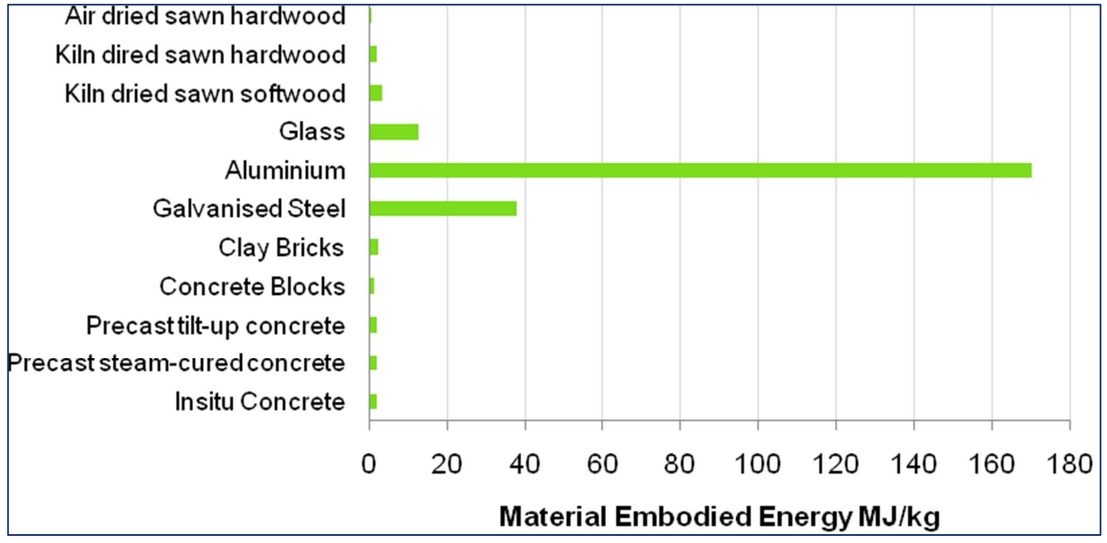


Figure 6: Typical material embodied energy values

3.4.2 Recycling

The benefits of using recycled materials will be reduced capital and embodied energy costs. It is anticipated that crushed aggregate can be recycled and used on site where possible.

Consider the use of recycled materials, or materials with recycled content, including:

- Concrete, steel, aluminium, insulation with recycled content
- “eco-materials” and fit-out products, such as recycled bricks and fabrics

3.4.3 Sustainable timber

Forest Stewardship Council certified timber should be considered for use within the facility and recycled formwork use during construction. No timber will be specified from rainforest or old growth forests.

3.4.4 Toxicity

Materials should be selected with minimal toxicity effects. Materials such as paint finishes, adhesives, carpets or wall cladding with Volatile Organic Compounds (VOC) should be avoided or minimised. Polychlorinated biphenyl's (PCB) will be avoided where possible. The benefits of reducing these products include improved occupant health with the potential for reduced sick building syndrome and a reduced impact on the environment through toxic chemical reduction.

3.5 Waste

A sustainable waste management plan will be developed to address Construction and Demolition waste, and Operational waste. The waste initiatives and opportunities considered for Project Archimedes are:

- Provide facilities for collection and separation of distinct operational waste streams. It is recommended that the following waste streams to be separated:
  - General waste;
  - Paper and cardboard;
  - Glass;
  - Plastic; and
  - Food waste.
- Kitchen waste and vegetation collected and converted into compost for ongoing landscaping maintenance.
- A proportion of construction and demolition waste should be diverted from landfill

Separation of waste stream	Kitchen waste and vegetation converted to compost	Diversion of construction and demolition waste from landfill
		

3.6 Transport

A sustainable transport strategy is proposed to encourage and promote alternatives to car use for accessing the site where possible. These include walking, cycling and public transport. The site benefits from excellent access to public transport and local amenities in walking distance. The following additional transport initiatives are recommended:

3.6.1 Active Transport and End of Trip

Cycling will be encouraged through provision of storage and end of trip facilities:

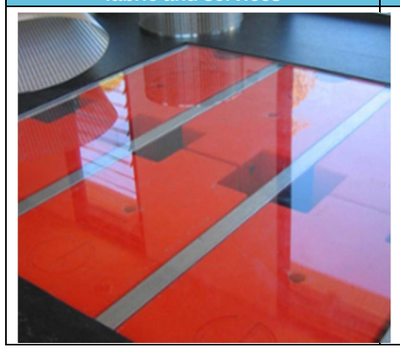
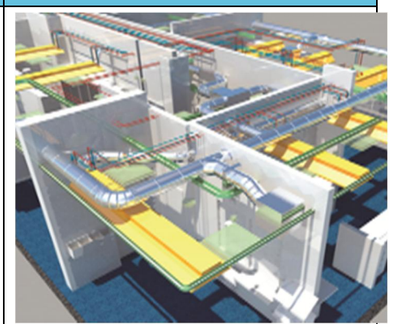
- Secure bicycle parking to be provided for a proportion of the building occupants;
- Secure bicycle parking for visitors is to be provided;
- Locker and showers to be provided;
- Provision of information around local area cycle ways and cycle safety.

3.7 Educational Initiatives

Project Archimedes will not only provide a building to house students, moreover the building itself will be an active space containing a number of features and initiatives that will be used to contribute to the education of students and visitors. Potential educational initiatives to be considered are as follows:

- Provide educational and interactive material within the building to communicate to occupants about sustainable design and performance
- Provide real time displays of energy and water usage
- "Peeled back" fabric and services to expose aspects of the building to showcase the sustainability features:
  - Plant room;
  - Rainwater tanks
  - Thermal insulation; and
  - Ductwork.
- Vertical kitchen garden to support the food tech teaching space – provide a source of locally produced food for the students' activities.
- Provide students access to the building's 3-dimensional BIM model to provide further insight into how a green building goes together.

Educational and Interactive materials within the building	Real time display of energy and water usage
	

"Peeled back" display of building fabric and services	School kitchen garden	3D BIM model
		

APPENDIX A – Department of Planning and Environment – ENVIRONMENTAL PLANNING AND ASSESSMENT REGULATION 2000 - SCHEDULE 2

SCHEDULE 2 – Environmental impact statements

Part 7(4) Content of Environmental Impact Statement Clauses	ESD Approach for Project Archimedes
(a) the "precautionary principle" , namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decisions should be guided by: (i) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and (ii) an assessment of the risk-weighted consequences of various options,	- Sustainability designs and initiatives employed for Project Archimedes are based on scientific research, engineering compliance requirements, statutory requirements and industry best practice initiatives. - The building design and initiatives aims to reduce environmental impact during construction and building operation, and maintain existing environmental amenity
(b) "inter-generational equity" , namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations,	- The building design and initiatives aims to minimise environmental impact during construction and building operation, and maintain existing environmental amenity for students and surrounding residents - Conservation initiatives will enable future generations to enjoy the diversity and productivity of the local environment
(c) "conservation of biological diversity and ecological integrity" , namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration,	Project Archimedes aims to improve the biological diversity and ecological integrity through: - Planting of native species and gardens where possible - Aim to reduce and reuse materials where possible (e.g. construction materials) - Sustainable procurement of materials from certified source where possible - Provision of recycling waste storage - Aim for a reduction in waste going to landfill - Use kitchen waste and vegetation for compost
(d) "improved valuation, pricing and incentive mechanisms" , namely, that environmental factors should be included in the valuation of assets and services, such as: (i) polluter pays, that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement, (ii) the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste, (iii) Environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.	- Life cycle analysis may be provided which will help assess the environmental impact for the sustainability designs and initiatives considered - Adhere to Wenona's Sustainability Policy which sets out environmental goals for the school - Passive methods to reduce energy consumption and thus greenhouse gas emissions (e.g. natural ventilation and natural daylight) - Consideration of renewable energy to reduce the need of conventional coal generated energy - Sub-metering of energy and water uses to monitor and control resource consumption

APPENDIX B – GREEN STAR DESIGN AND AS BUILT RATING TOOL BENCHMARK

Green Star - Design & As Built Scorecard

Project:	**Project Archimedes**
Targeted Rating:	5 Star - Australian Excellence

Total Points Available	Total Points Targeted
110	61.4

CATEGORY / CREDIT	AIM OF THE CREDIT / SELECTION	CODE	CREDIT CRITERIA	POINTS AVAILABLE	POINTS TARGETED
Management				14	
Green Star Accredited Professional	To recognise the appointment and active involvement of a Green Star Accredited Professional in order to ensure that the rating tool is applied effectively and as intended.	1.1	Accredited Professional	1	1
Commissioning and Tuning	To encourage and recognise commissioning, handover and tuning initiatives that ensure all building services operate to their full potential.	2.0	Environmental Modelled Targets	-	Complies
		2.1	Services and Maintainability Review	1	1
		2.2	Building Commissioning	1	1
		2.3	Building Systems Tuning	1	1
		2.4	Independent Commissioning Agent	1	1
Adaptation and Resilience	To encourage and recognise projects that are resilient to the impacts of a changing climate and natural disasters.	3.1	Implementation of a Climate Adaptation Plan	2	
Building Information	To recognise the development and provision of building information that facilitates understanding of a building's systems, operation and maintenance requirements, and environmental targets to enable the optimised performance.	4.1	Building Operations and Maintenance Information	1	1
		4.2	Building User Information	1	1
Commitment to Performance	To recognise practices that encourage building owners, building occupants and facilities management teams to set targets and monitor environmental performance in a collaborative way.	5.1	Environmental Building Reporting	1	1
		5.2	End of Life Waste Management	1	1

Metering and Monitoring	To recognise the implementation of effective energy and water metering and monitoring systems.	6.0	Metering Strategy	-	Complies
		6.1	Monitoring Strategy	1	1
Construction Environmental Management	To reward projects that use best practice formal environmental management procedures during construction.	7.0	Environmental Management Plan	-	Complies
		7.1	Formalised Environmental Management System	1	1
Operational Waste	To recognise projects that implement waste management plans that facilitate the re-use, upcycling, or conversion of waste into energy and stewardship of items to reduce the	8.1	Waste in Operations	1	1
Total				**14**	**12**

Indoor Environment Quality				**17**	
Quality of Indoor Air	To recognise projects that provide high air quality to occupants.	9.1	Ventilation System Attributes	1	1
		9.2	Provision of Outside Air	2	2
		9.3	Exhaust or Elimination of Pollutants	1	1
Acoustic Comfort	To reward projects that provide appropriate and comfortable acoustic conditions for occupants.	10.1	Internal Noise Levels	1	1
		10.2	Reverberation	1	1
		10.3	Enclosed Spaces	1	1
Lighting Comfort	To encourage and recognise well-lit spaces that provide a	11.0	Minimum Lighting Comfort	-	Complies
		11.1	General Illuminance and Glare Reduction	1	1

Lighting Comfort	high degree of comfort to users.	11.2	Localised control	1	1
		11.3	Surface Illuminance	1	
Visual Comfort	To recognise the delivery of well-lit spaces that provide high levels of visual comfort to building occupants.	12.0	Glare Reduction	-	Complies
		12.1	Daylight	2	1
		12.2	Views	1	1
Reduced Exposure to Pollutants	To recognise projects that safeguard occupant health through the reduction in internal air pollutant levels.	13.1	Paints, adhesives, sealants and carpets	1	1
		13.2	Engineered wood products	1	1
Thermal Comfort	To encourage and recognise projects that achieve high levels of thermal comfort.	14.1	Thermal Comfort	1	1
		14.2	Advanced Thermal Comfort	1	
Total				**17**	**14**

Energy				**22**	
		15-A.0	Conditional Requirement: Performance Pathway	-	Complies
		15-A.1	Performance Pathway: Comparison to a Reference Buildir	20	6.4
		15-B.0	Conditional Requirement: NABERS Commitment Agreeme	-	Does not comply
		15-B.1	NABERS Commitment Agreement Pathway	0	

Greenhouse Gas Emissions	A. Performance Pathway	15-C.0	Conditional Requirement: NatHERS Pathway	-	
		15-C.1	NatHERS Pathway	0	
		15-D.0	Conditional Requirement: Prescriptive Pathway	-	
		15-D.1	Prescriptive: Building Envelope	0	
		15-D.2	Prescriptive: Glazing	0	
		15-D.3	Prescriptive: Lighting	0	
		15-D.4	Prescriptive: HVAC	0	
		15-D.5	Prescriptive: Building Sealing	0	
Peak Electricity Demand Reduction	Reference Building Pathway	16.1-A	Deemed to Satisfy Pathway	0	
		16.1-B	Reference Building Pathway	2	
Total				**22**	**6.4**

Transport				**10**	
Sustainable Transport	Deemed-to-Satisfy Pathway	17-A.1	Modelled Pathway	0	
		17-B.1	Access by Public Transport	3	3
		17-B.2	Reduced Car Parking Provision	1	1

Sustainable Transport	Deemed-to-Satisfy Pathway	17-B.3	Low Emission Vehicle Infrastructure	1	0
		17-B.4	Active Transport Facilities	1	0
		17-B.5	Walkable Neighbourhood	1	1
Total				**7**	**5**

Water				**12**	
Potable Water	Deemed-to-Satisfy Pathway	18-A.1	Potable Water - Modelled Pathway	0	
		18-B.1	Sanitary Fixture Efficiency	1	1
		18-B.2	Rainwater Reuse	1	1
		18-B.3	Heat Rejection	2	2
		18-B.4	Landscape Irrigation	1	1
		18-B.5	Fire System Test Water	1	
Total				**6**	**5**

Materials				**14**	
		19.A.1	Comparative Life Cycle Assessment	0	

Life Cycle Impacts	Material Use	19.A.2	Additional Life Cycle Impact Reporting	0	
		19.B.1	Concrete	3	2
		19.B.2	Steel	1	1
		19.B.3	Building Reuse	4	
Responsible Building Materials	To reward projects that include materials that are responsibly sourced or have a sustainable supply chain.	20.1	Responsible Steel Maker and Fabricator	1	1
		20.2	Timber	1	1
		20.3	Cables, pipes, floors and blinds	1	1
Sustainable Products	To encourage sustainability and transparency in product specification.	21.1	Sustainable Products	3	
Construction and Demolition Waste	To reward projects that reduce construction waste going to landfill by reusing or recycling building materials	22.1	Reduction of Construction and Demolition Waste	1	1
Total				**12**	**7**

Land Use & Ecology				**6**	
Ecological Value	To reward projects that improve the ecological value of their site.	23.0	Endangered, Threatened or Vulnerable Species	-	Complies
		23.1	Ecological Value	3	
Sustainable Sites	To reward projects that choose to develop sites that have limited ecological value, re-use previously developed land and remediate contaminate land.	24.0	Conditional Requirement	-	Complies
		24.1	Reuse of Land	1	1

		24.2	Best Practice Site Remediation	1	1
Heat Island Effect	To encourage and recognise projects that reduce the contribution of the project site to the heat island effect.	25.1	Heat Island Effect Reduction	1	1
Total				**6**	**3**

Emissions				**5**	
Stormwater	To reward projects that minimise peak stormwater flows and reduce pollutants entering public sewer infrastructure.	26.1	Peak Discharge To Sewer	1	1
		26.2	Pollution Targets	1	
Light Pollution	To reward projects that minimise light pollution.	27.0	Light Pollution to Neighbouring Properties	-	Complies
		27.1	Light Pollution to Night Sky	1	1
Microbial Control	To recognise projects that implement systems to minimise the impacts associated with harmful microbes in building systems.	28.1	Microbial Control	1	1
Refrigerant Impacts	To encourage operational practices that minimise the environmental impacts of refrigeration equipment.	29.1	Refrigerant Impacts	1	1
Total				**5**	**4**

Innovation				**10**	
Innovative Technology or Process	The project meets the aims of an existing credit using a technology or process that is considered innovative in Australia or the world.	30.A	Innovative Technology or Process		
Market Transformation	The project has undertaken a sustainability initiative that substantially contributes to the broader market transformation towards sustainable development in	30.B	Market Transformation		

Improving on Green Star Benchmarks	The project has achieved full points in a Green Star credit and demonstrates a substantial improvement on the benchmark required to achieve full points.	30.C	Improving on Green Star Benchmarks	10	2
Innovation Challenge	Where the project addresses an sustainability issue not included within any of the Credits in the existing Green Star rating tools.	30.D	Innovation Challenge		3
Global Sustainability	Project teams may adopt an approved credit from a Global Green Building Rating tool that addresses a sustainability issue that is currently outside the scope of this Green Star	30.E	Global Sustainability		
Total				**10**	**5**

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Level 21, 420 George Street, Sydney, NSW 2000
PO Box Q410, QVB PO, Sydney, NSW, 1230
T +61 2 8934 0000 F +61 2 8934 0001
www.aecom.com