Energy Efficiency Report for Secretary's Environmental Assessment Requirements

UNSW Electrical Engineering Capital Renewal and Modernisation Project

UNSW Australia

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Contents

1. Executive Summary

This report has been prepared to outline the proposed energy efficiency and Ecologically Sustainable Design (ESD) initiatives being considered for implementation into the UNSW Electrical Engineering Capital Renewal and Modernisation (EEB_CRM) project. This document demonstrates compliance with the Secretary's Environmental Assessment Requirements (SEARS) that apply to the project and has been prepared behalf of Root Projects Australia.

This report is to be submitted as part of the State Significant Development Application to the NSW Department of Planning and Environment.

Ecologically Sustainable Design

An ecologically sustainable design initiatives schedule (Appendix A) has been developed for the EEB_CRM development. Section 3 of this document describes each of the initiatives in detail. These initiatives relate to building fabric design, services design, waste management and renewable energy generation. The initiatives are based on a number of recognised certification schemes including National Construction Code Building Code of Australia 2015 and the Green Star Design & As built v1.1 environmental rating tool.

The initiatives referenced in this document respond to the SEARS requirements and are expected to satisfy the UNSW environmental policies.

2. Introduction

This report has been prepared to outline the proposed energy efficiency and sustainable design initiatives being investigated for the UNSW Electrical Engineering Capital Renewal and Modernisation (EEB_CRM) project. This document demonstrates compliance with the Secretary's Environmental Assessment Requirements (SEARS) that apply to the project.

This report has been prepared on behalf of Root Projects Australia to accompany a State Significant Development Application to the NSW Department of Planning and Environment for the refurbishment of the Electrical Engineering Building and Rex Vowels Theatre.

This document is to be read in conjunction with Architectural design drawings and other consultant design reports for the application. This document outlines the ESD objectives to be met for the development and the initiatives that are to be considered and documented during the design development stage of the project.

2.1 Project Description

The project involves the upgrade of the existing G17 Electrical Engineering Building and Rex Vowels Theatre at the UNSW Australia located in Kensington, NSW.

The building is located along the main university walkway and is to include the following space types:

- Informal learning spaces;
- Active learning spaces;
- Lecture theatres;
- Specialty laboratories;
- Workshops;
- Student service centre & school office;
- Breakout spaces;
- Anechoic chambers;
- Meeting rooms;
- Open plan workspaces; and
- Offices.

2.2 Secretary's Environmental Assessment Requirements General Requirements

This report acknowledges the SEARS prepared by the Secretary dated 27 November 2015 which notes the following in Section 6 of the document:

"The EIS shall address the following specific matters:

6. Ecologically Sustainable Development (ESD)

- *Detail how 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 and ongoing operation phases of the development.*
- *Demonstrate that the development has been assessed against a suitably accredited rating scheme to meet industry best practice.*
- *Include a description of the measures that would be implemented to minimise consumption of resources, water (including water sensitive urban design) and energy.*

The requirement for an Energy Efficiency Report to be submitted with the Environmental Impact Statement (EIS) is outlined in the 'Plans and Documents' section of the SEARS.

We understand Clause 7(4) of Schedule 2 of the Environmental Planning and Assessment Regulation 2000 to state:

"The principles of ecologically sustainable development are as follows:

*(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,

*(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,*

*(c) **conservation of biological diversity and ecological integrity**, namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration,*

*(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."

The ESD Initiatives Schedule developed for the EEB_CRM project considers the above principles of ecologically sustainable development.

2.3 Project Response

Energy Efficiency Report

This report has been prepared in reference to the above details and defines the ecologically sustainable design initiatives to be adopted for the project to satisfy the SEARS requirement for an Energy Efficiency Report. Due to the nature of this refurbishment project there has been emphasis on building fabric upgrade initiatives, services building design initiatives relating to water and energy efficiency and possible incorporation of on-site renewable energy generation.

The principles of ESD as outlined in clause 7(4) of Schedule 2 of the Environmental Planning and Assessment Regulation 2000 have been addressed through the incorporation of the initiatives outlined in the project ESD Initiatives Schedule.

ESD Initiatives Schedule

A project-specific Ecologically Sustainable Design Initiatives Schedule has been developed to outline the targeted initiatives to be considered for the development.

The initiatives are described in detail in Section 3 of this report and are based on a number of recognised certification schemes including NCC BCA 2015, Green Star Design & As Built v1.1 rating tool and Green Star Performance tool. Section 4 of this document provides a comparative assessment of the proposed initiatives against these industry best practice tools.

We refer to Appendix A for the project-specific ESD Initiatives Schedule.

UNSW Sustainability Requirements

The UNSW has outlined ecologically sustainable design initiatives to be targeted for the project in line with their Environmental Control Plan and UNSW 2025 Strategy. These include initiatives to minimise energy, water and resource consumption in construction and operation of the building.

2.4 Reference Documents

The following documents and planning provisions have been used in preparation of this report:

Reference	Title	Revision
A_1101	General Arrangement Floor Plans – Lower Ground	G
A_1102	General Arrangement Floor Plans – Ground	H
A_1103	General Arrangement Floor Plans – L01	G
A_1104	General Arrangement Floor Plans – L02	G
A_1105	General Arrangement Floor Plans – L03	G
A_1106	General Arrangement Floor Plans – L04	G
A_1107	General Arrangement Floor Plans – Roof L01	F
A_1108	General Arrangement Floor Plans – Roof L02	G
A_2001	External Elevations - Proposed	D
A_2002	External Elevations – Proposed	D
A_3001	Sections	A
A_3002	Sections	A
-	Green Star Design & As Built	v1.1
-	Green Star Performance	-
-	G17 Electrical Engineering Building – Sustainability and Operations	-
-	UNSW Development Control Plan	27 March 2007
-	UNSW Environmental Management Plan	20 June 2005
-	Secretary's Environmental Assessment Requirements	27 November 2015
Steve Watson & Partners	Electrical Engineering Building, University of NSW Preliminary BCA Assessment	14 December 2015

2.5 Acronyms & Definitions

AFS	Australian Forestry Standard – Not-for-profit company and the PEFC National Governing Body for Australia and endorsed by the PEFC
BCA	Building Code of Australia
EEB_CRM	Electrical Engineering Capital Renewal and Modernisation
EMS	Environmental Management System
ESD	Ecologically Sustainable Design
FSC	Forest Stewardship Council – International not-for-profit organisation promoting environmentally appropriate, socially beneficial and economically viable management of the world's forests
Green Star	Australia's only national, voluntary, rating system for buildings and communities
HVAC	Heating, Ventilation and Air-Conditioning
ISO	International Organisation for Standardisation
LED	Light Emitting Diode
NCC	National Construction Code
ODP	Ozone Depleting Potential – provides a measure of the potential damage to the ozone layer that a chemical has relative to that of refrigerant type CFC11
PEFC	Program for Endorsement of Forest Certification – International, non-profit, non-governmental organisation dedicated to promoting sustainable forest management
SEARS	Secretary's Environmental Assessment Requirements
SSDA	State Significant Development Application
UNSW	University of New South Wales
VOC	Volatile Organic Compounds (VOCs) – VOCs are organic compounds that produce vapours readily at room temperature and normal atmospheric pressure
WELS	Water Efficiency Labelling Standards (WELS) scheme – Australia's water efficiency labelling Scheme that requires certain products to be registered and labelled with their water efficiency in accordance with the standard set under the national Water Efficiency Labelling and Standards Act 2005

3. Ecologically Sustainable Design

3.1 Building Fabric Design – Initiatives 1, 2 & 4

The building is targeting a 15% improvement on BCA NCC 2015 deemed-to-satisfy Parts J1, J2 and J3 energy efficiency provisions which will assist in reducing the overall energy consumption associated with building operations.

A combination of high performance glazing, building constructions and building services are to be included to target the 15% improvement in energy consumption against BCA NCC Energy Efficiency provisions that are deemed to apply to the project. Refer to Section 4.1 for a detailed compliance methodology.

Initiatives to be included into the EEB_CRM design to meet the 15% improvement target include:

- Upgrades to existing façade to include bulk insulation or reflective insulation;
- Replacement of windows to meet AS 2047 2014 and control solar gain into the building; and
- Specification of roof and ceiling insulation where appropriate.

3.2 Building Sealing – Initiatives 3 & 5

The building is to be designed and constructed to comply with the NCC BCA 2015 Part J3 requirements to minimise air infiltration and loss of conditioned air. This is to be achieved through self-closing doors and replacement of windows to meet AS 2047 2014 Windows and external glazed doors in buildings.

3.3 Solar Shading – Initiative 6

The location and proximity of the building within the UNSW Kensington campus provides shading to the east, north and west façades from existing buildings. Fixed shading systems are to be investigated during design development for incorporation onto the façade to control solar gain and reduce glare into the building. Direct solar gain from the east, north & west is to be minimised during building operational hours from 1 September to 31 March.

3.4 Natural Light – Initiative 7

The project is targeting a daylight factor of 2% or above for a minimum of 45% of the total useable floor area. The internal layouts of office spaces and open areas within the building are to be designed to ensure natural light is optimised within these spaces to reduce reliance on artificial lighting systems and provide increased amenity for staff and students.

3.5 Lift Energy Efficiency – Initiatives 8 & 9

Where possible, energy recovery mechanisms for new lifts are to be incorporated. Students and staff shall be encouraged to use the stairs instead of lifts through the retention and refurbishment of stairs in the building. The stairs are to be highly visible and within line of sight from major entrances.

3.6 Lighting Efficiency – Initiatives 10, 11, 12

Lighting is to be designed to achieve improved energy power density when compared to BCA NCC J6 requirements.

Where possible, internal lighting is to meet the following provisions to reduce energy consumption:

- All light fittings are to be efficient and limited to LED or compact fluorescent fittings;
- Appropriate zoning, switching and controls are to be installed to reduce consumption when unoccupied. A combination of the following controls are to be provided:
  - Daylight sensors;
  - Motion sensors; and
  - Timed switching
- Back of house areas are to be provided with push button timers;
- Closed spaces (e.g. offices and cleaners cupboards) shall be provided with wall switches;

- Voltage controllers are to be installed where appropriate;
- Spaces with 24/7 lighting requirements (e.g. for security / fire regulation reasons) shall be fitted with dimmers and motion sensors

Facilities management is to have access to a master lighting controller used to monitor and make adjustments to lighting controls as necessary.

3.7 Renewable Energy Contribution – Initiative 13

A photovoltaic system is to be provided to the development to generate renewable energy on site. The system capacity of 100kW is proposed with an energy contribution target of 10% on base building loads. The current proposed location of the photovoltaics is the roof of the proposed new plantroom above level 4.

3.8 Voltage Control – Initiative 14

The project is to include voltage control where possible to optimise the electricity supply condition. Voltage control shall help to minimise power consumption by reducing the voltage supplied and thereby reduces losses in electrical equipment.

3.9 Power Factor Correction – Initiative 15

Power Factor Correction equipment is to be specified to the project to ensure power factor is maintained above 0.95 to ensure operational efficiencies of all equipment.

3.10 Standby Generator Demand Management – Initiative 16

A standby generator is to be provided to the project to allow for demand management during peak periods. The Building Management System and interface with generator controls shall be designed to allow for the required demand based system.

3.11 Heating & Cooling Systems – Initiatives 17, 18, 19, 20 & 21

It is proposed that hot and chilled water is to be provided by high efficiency gas boilers and electric chillers with a coefficient of performance of minimum 4 for conditioning spaces within the development. High efficiency motors are to be specified for all pumps and fans.

HVAC set-point conditions to general space areas are to be to the following design parameters:

- Cooling 24°C (+1)
- Heating 21°C (+1)

Laboratories and other rooms with special conditioning requirements are to be designed to meet their specific requirements.

Spaces are to be grouped according to HVAC demand requirements to optimise the energy efficiency of the system. Economy cycles and night time set back strategies are to be further developed during design development stage.

3.12 Metering – Initiative 22

Energy metering is to be provided throughout the building for all major building plant and equipment and space use.

Water metering for all major uses within the building is to be provided to but not limited to the following uses:

- Potable water use;
- Bore water use;
- Cooling towers;
- Irrigation;
- Toilets; and

- Process water for labs.

All meters are to be connected to the UNSW BACNet – EMACS System to allow for monitoring and recording of electricity and water consumption. This is to assist in the identification of the location of leaks or equipment malfunction to facilities management.

3.13 Hot water system – Initiatives 23 & 24

The development is to include the provision of high efficiency gas boilers for domestic hot water. All boilers are to have an efficiency exceeding 90% to minimise gas consumption and greenhouse gas emissions.

Minimum R0.45 insulation is to be provided to all new hot water pipework within the building to reduce heat losses and improve energy performance.

Domestic hot water is to be supplied to spaces only if required to minimise energy consumption associated with hot water production. Toilet hand basins will not be supplied with hot water in order to reduce energy consumption within the building.

3.14 Water Efficiency – Initiatives 25, 26 & 27

Bore water is to be used for the following applications to minimise potable water consumption:

- WC flushing;
- Urinals;
- Irrigation;
- Laboratory non-potable water; and
- Cooling towers if possible.

Fixtures and appliances are to meet the following Water Efficiency Labelling and Standards (WELS) ratings to avoid excessive water use:

- Shower roses – 3 star WELS (>6 but ≤ 7.5 L/s)
- Taps – 6 star WELS
- Toilets – 5 star WELS
- Urinals – 6 star WELS (maximum 1L/flush with sensor controls)

Rainwater is to be collected from minimum 90% of roof surfaces and returned to the UNSW aquifer recharge system to ensure the longevity of the aquifer.

3.15 Construction & Demolition Waste – Initiative 28

A minimum of 80% by weight of demolition and construction waste (excluding contaminated materials) is to be reused or recycled. The Head Contractor shall prepare and implement a Waste Management Plan and all waste records are to be retained for the project including relevant receipts, dockets, statements and the like.

3.16 Material Specifications – Initiatives 29, 30 & 31

Material specifications for the project shall consider elements of sustainability that relate to the following factors when determining products / equipment to be adopted:

- recycled content, post and pre-consumer;
- durability;
- local manufacturing;
- embodied energy;
- ability to be recycled / reused / reconditioned;
- use of AFS/PEFC or FSC certified timber;
- VOC content and testing;
- ease of manufacturing;
- maintenance;

- affordability;
- avoids the use of toxic materials in manufacturing; and
- life cycle cost.

A comparison between different product types and manufacturers shall be undertaken (where possible) in developing the final selections / schedules list for the project.

The project target is for 50% by cost of furniture, flooring, finishes, engineered wood products and timber to be certified to one of the following schemes where possible:

- Carpet Institute of Australia ECS;
- Ecospecifer GreenTag Green Rate;
- Australasian Furnishing Research and Development Institute Green Tick;
- Good Environmental Choice Australia;
- The Institute for Market Transformation to Sustainability – Sustainable Materials Rating Technology 4.0;
- Resilient Floor Covering Institute (RFCI) Floor Score;
- Business + Institutional Furniture Manufacturers Association (BIFMA);
- Forest Certification Scheme (FSC); or
- Program for the Endorsement of Forest Certification (PEFC)

3.17 Energy Efficient Appliances – Initiative 32

Appliances are to be specified to meet the following Energy Rating criteria where possible to minimise electricity consumption:

- Dishwashers: 4.5 star Energy Star Rating
- Fridges: 3 Energy Star Rating
- Computer monitors: 5 star Energy Star Rating
- TVs: 5 star Energy Star Rating

3.18 Waste in Operation – Initiative 33

General waste and recycling facilities are to be provided to the building in accordance with existing UNSW requirements. The separation of the following waste streams is expected:

- General waste;
- Cardboard; and
- Plastic & aluminium.

Facilities are to be highly visible and signage is to be provided to facilitate ease of recycling.

3.19 Volatile Organic Compounds – Initiative 34

A minimum of 95% by cost of all new paints, adhesives, sealants and carpets are to meet volatile organic compound (VOC) limits below. More information can be found within the Green Star Design & As-built v1.1 tool.

Paints, adhesives, sealants

Product Category	Max TVOC content (g/l of ready-to-use product)
General purpose adhesives	50
Interior wall and ceiling paint, all sheen levels	16
Trim, varnishes and wood stains	75
Primers, sealers and prep coats	65
One and two pack performance coatings for floors	140

Acoustic sealants, architectural sealant, waterproofing membranes and sealant, fire retardant sealants and adhesives	250
Structural glazing adhesive, wood flooring and laminate adhesives and sealants	100

Carpets

Testing	Test Protocol Limit
ASTM D5116 - Total VOC limit	0.5mg/m^2 per hour
ASTM D5116 – 4 - PC (4 - Phenylcyclohexene)	0.05mg/m^2 per hour
ISO 16000 / EN 13419 - TVOC at three days	0.5mg/m^2 per hour
ISO 10580 / ISO/TC 219 (Document N238) - TVOC at 24 hours	0.5mg/m^2 per hour

3.20 Insulation – Initiative 35

All thermal insulation products are to be specified and to contain zero Ozone Depleting Potential (ODP) in composition and manufacture to reduce the environmental impacts of these products.

3.21 Cyclist Facilities – Initiative 36

Cyclist facilities are to be provided to the building in accordance with UNSW Cycling Master Plan requirements. Bicycle racks will be provided within close proximity to the building and showers are to be provided for cyclists.

3.22 Life Cycle Costing – Initiative 37

Life cycle costing of key major plant and equipment is to be carried out to inform equipment selections. This shall ensure selections are made with operational energy and maintenance requirements in mind. It is anticipated that life cycle costing of the following key plant is to be carried out:

- Chillers;
- Boilers; and
- Air handling units

3.23 Product Stewardship – Initiative 38

Where possible, product stewardship agreements are to be sought with furniture and equipment suppliers to minimise end of life environmental impacts. Product stewardship programs encourage projects and suppliers to share responsibility for the effective reduction, reuse, recycling or recovery of products to manage environmental impacts arising from the products when they become waste.

3.24 External Views – Initiative 39

The project is targeting to provide high quality external views to a minimum of 60% of the useable floor area. Façade and internal layout design are to be considered during design development to provide students and staff with external views.

3.25 HVAC Monitoring & Shutdown – Initiatives 40 & 41

The following initiatives are to be considered during design development:

- Carbon dioxide sensors are to be provided to all return air points on each floor to ensure occupants are provided with quality air; and
- HVAC is to be linked to occupancy sensors to shut down when areas are unoccupied. Master switches are to be provided at the entrance of each room.

3.26 Educational Initiatives – Initiative 42

Educational displays, boards and signage are to be provided to common areas within the building to inform occupants of ESD initiatives that have been incorporated into the building design and provide guidance on the usage of facilities. It is estimated that energy and water initiatives will be reported on an ongoing basis to staff and students with savings in greenhouse gas emissions (kg carbon dioxide), energy savings (kWh) and water savings (kL) reported.

3.27 Concrete – Initiative 43

Portland cement content in all concrete used in the project is to be reduced by 40% measured by mass across all concrete and mix water for all concrete used in the project is to contain at least 50% captured or reclaimed water. At least 25% of fine aggregate inputs in the concrete are to be manufactured sands or other alternative materials.

3.28 Steel – Initiative 44

Minimum 95% of all new steel to the project is to be sourced from a Responsible Steel Maker and at least 60% of fabricated structural steelwork to be supplied by a steel fabricator accredited to the Environmental Sustainability Charter of the Australian Steel Institute.

A steel manufacturer or steel maker is considered a responsible source of steel if they comply with both of the following:

- The steel making facilities where the structural and/or reinforcing steel for the project is sourced have a currently valid and certified ISO 14001 Environmental Management System (EMS) in place; and
- The steel maker supplying the steel is a member of the World Steel Association's (WSA) Climate Action Programme (CAP)

4. Review to Accredited Rating Schemes

An evaluation of the proposed initiative sustainable design initiatives has been completed for this building against industry benchmark tools of Green Star. A comparison has been made against the Green Stat Design & As-built tool and Green Star Performance tool. Given the nature of this refurbishment project some Green Star initiatives are not viable however the project is making conscious effort to reduce the life cycle impacts of this refurbishment project.

4.1 Green Star Design & As-built tool

The **Green Star Design & As-built tool** rates the design and construction of new buildings and major refurbishments with respect to nine impact categories of management, indoor environment quality, water, energy, materials transport, emissions and ecology. The initiatives within each category contain set criterion which describe the targets that a project must meet to earn points within the category. It is intended that project teams prepare formal Design Review and As-Built submissions to obtain a Green Star Design & As-built rating certified by the Green Building Council of Australia.

The Green Star Design & As-built tool has been used to identify design and construction environmental initiatives suitable for the EEB_CRM project. Although the project is not targeting a formal Green Star Design & As-built certification, a number of the initiatives from the tool have been included in the project ESD Initiatives Schedule to demonstrate the project's commitment to sustainability.

4.2 Green Star Performance tool

The **Green Star – Performance tool** assesses the operational performance of existing buildings across nine impact categories of management, indoor environment quality, water, energy, materials transport, emissions and ecology. The tool is an online rating tool developed by the Green Building Council of Australia and it is intended that participants interact with the rating tool by answering a series of questionnaires designed to obtain information on the building's operational and maintenance practices.

Projects can use the Green Star – Performance rating tool to assess the environmental achievement of a non-rated building, track improvements and set targets for environmental initiatives. For this project this tool has been used to identify operational initiatives that would be suitable for an education building of this nature whilst recognising the limitations that may exist as this is a refurbishment project only.

The EEB_CRM project cannot undertake a formal assessment against this tool until it has been operational for a minimum of three (3) years post the refurbishment works.

4.3 Project Comparison

The table below defines where the Project Sustainable Design initiatives directly or indirectly are recognised within each of the rating schemes described above.

No.	Project Sustainable Design Initiative	Included/Recognised in rating scheme	
		Green Star Design & As-built	Green Star Performance
1	Roof - Thermal transmission	✓	✓
2	External walls - Thermal transmission	✓	✓
3	Building sealing	✓	✓
4	Thermal breaks	✓	✓
5	Building sealing - External doors	✓	✓
6	Solar shading	✓	✓
7	Natural light	✓	✓
8	Lift energy recovery	✓	✓
9	Lift energy saving	✓	✓
10	Control of lighting to non-laboratory spaces	✓	✓

11	Energy saving lighting to non-laboratory spaces	✓	✓
12	Lighting illumination power density to non-laboratory spaces	✓	✓
13	Renewable energy contribution	✓	✓
14	Voltage control		✓
15	Power factor correction		✓
16	Demand management		
17	HVAC Control set points	✓	✓
18	Electric chiller efficiency	✓	✓
19	HVAC motors	✓	✓
20	HVAC system efficiency to non-laboratory spaces	✓	✓
21	HVAC efficiency to 24/7 spaces	✓	✓
22	Electricity metering	✓	✓
23	Boiler efficiency	✓	✓
24	Hot water efficiency	✓	✓
25	Non-potable water usage	✓	✓
26	Rainwater percolation		
27	Water efficiency	✓	✓
28	Recovery / reuse of demolition & construction waste	✓	
29	Materials selection - toxicity	✓	
30	Materials selection - recycled content	✓	
31	Embodied energy	✓	
32	Energy efficient appliances	✓	✓
33	Operational waste	✓	✓
34	Low VOC products	✓	
35	Thermal insulation	✓	
36	Cyclist facilities	✓	✓
37	Life cycle costing for major plant		
38	Product stewardship	✓	
39	External views	✓	✓
40	CO2 sensors	✓	
41	Automated shutdown of HVAC	✓	✓
42	Education	✓	
43	Concrete	✓	
44	Steel	✓	

The above comparison does not confirm what star rating the project would be expected to achieve under either of these rating schemes, as a detailed assessment of the project against these tools would be required.

5. Regulatory Compliance – Building Code of Australia

5.1 Section J Verification

The project is targeting a 15% improvement on NCC BCA 2015 Sections J1 and J2 through the use of the Verification methodology. The following models are to be developed for the development:

- Model 1: Proposed building with deemed-to-satisfy fabric and deemed-to-satisfy services
- Model 2: Proposed building with proposed fabric and deemed-to-satisfy services
- Model 3: Proposed building with proposed fabric and proposed services

Model 3, which represents the proposed building is to be compared to models 1 and 2 and be minimum 15% more energy efficient overall compared to model 1 to meet the proposed UNSW energy efficiency target.

5.2 Thermal Constructions and Insulation

The building fabric constructions are to be designed to meet the NCC 2015 Section J Verification requirements. The main construction to the existing building is predominantly single brick construction with operable windows. Upgrades to the existing façade are to be made to include bulk or reflective insulation.

It is expected that a minimum R2.80 insulation is required to external walls and a minimum R3.20 roof insulation to exposed areas to meet the Section J Verification requirements.

All insulation products to be used on the project are to contain zero ozone depleting potential in both manufacturing process and product composition. This is considered an important environmental factor in reducing the emission impacts of the associated construction materials.

5.3 Glazing

The glazing systems are to meet the requirements outlined NCC Section J Verification requirements. Any glazing specification is subject to further design development.

6. Conclusion

The proposed energy efficiency and ecologically sustainable design initiatives to be incorporated into the EEB_CRM project are presented in Section 3 of this document. The initiatives demonstrate compliance with the Secretary's Environmental Assessment Requirements (SEARS) that apply to the project.

The project aims to incorporate best practice ecologically sustainable design initiatives and meet appropriate environmental benchmark standards set out by the UNSW and from a number of recognised certification schemes including NCC BCA 2015 and Green Star Design & As-built. Project-specific objectives outlined in a project specific ESD Initiatives Schedule.

The initiatives outlined in this document relate to energy and potable water consumption reduction, waste management, materials specification and renewable energy. These initiatives are to be incorporated during design and ongoing operation of the project and are considered to meet the requirements outlined in the SEARS that apply to the project.

Appendix A

UNSW EEB_CRM ESD Initiatives Schedule

ESD Initiatives Schedule

Surface Design

UNSW Electrical Engineering Building Capital Renewal & Modernisation Project

Date: 03/02/2015

No.	Initiative	Initiative Description	Project team response
1	Roof - Thermal transmission	To meet BCA NCC Section J1 + 15%	BCA NCC + 15% To be demonstrated via JV3 model: *Model 1: DTS fabric + DTS Services* *Model 2: Proposed fabric + DTS Services* *Model 3: Proposed fabric + Proposed fabric* Annual energy consumption of Model 3 to be minimum 15% less than Model 1
2	External walls - Thermal transmission	To meet BCA NCC Section J1 + 15%	
3	Building sealing	To meet BCA NCC Section J3 + 15%	Existing windows and seals to be replaced. The project team believes the BCA NCC J3 + 15% requirement
4	Thermal breaks	Thermal breaks to be incorporated into façade	Thermal breaks to be incorporated into façade design
5	Building sealing - External doors	Main entrance doors and receptions designed to minimise infiltration and loss of conditioned air - revolving doors / airlocks / reduced areas and volumes for receptions	No conditioning to be provided within 3m of entrances to minimise loss of conditioned air
6	Solar shading	Fixed shading systems to be incorporated into façade Direct solar gain from east, north & west to be minimised from 1 Sept to 31 March	Shading device options to be analysed for exclusion of direct solar gain from 1 Sept to 31 March
7	Natural light	Natural lighting to offices & open areas to be maximised	Project target: 45% UFA to achieve >2% DF under uniform design sky
8	Lift energy recovery	Lifts to incorporate energy recovery mechanism	New lifts 35 and 36 to be VVVF gearless Energy recovery to be advised during design development
9	Lift energy saving	Discourage use between fewer than 3 floors	Stairs are highly visible and have close proximity to entrances to encourage use of stairs by students and staff
10	Control of lighting to non-laboratory spaces	Use of PD and PE to control lighting. Lighting control to have FM accessible "master" controller to adjust system parameters globally and zone by zone. Closed spaces (e.g. offices and cleaners cupboards) should also have a wall switch	Lighting design to include daylight sensors, time clocks, occupancy sensors and manual switching where possible. Master controller to be provided to adjust system parameters.
11	Energy saving lighting to non-laboratory spaces	Lighting to have voltage control units where appropriate	Lighting design to incorporate voltage control units
12	Lighting illumination power density to non-laboratory spaces	Lighting illumination power density to be 15% less than BCA NCC J6 If lights are to be 24/7 in specific area e.g. for security/fire regulation reasons, they are to be high efficient LED/CFL	Lighting to be designed to achieve 15% lower power density than BCA NCC J6 24/7 lighting to be LEDs
13	Renewable energy contribution	10% of forecast annual use to be met by renewables	100kW PV targeted
14	Voltage control	Use of voltage control to optimise electricity supply condition	To be incorporated where possible
15	Power factor correction	Power factor correction, PF > 0.95 to non-laboratory spaces	>0.95 power factor to be targeted
16	Demand management	Generator and BMS configured to permit generator to be called for demand management	New generator to be located on roof of north block
17	HVAC Control set points	Cooling 24C +1 Heating 21C -1 Chilled water 8C	Targeted in mechanical design
18	Electric chiller efficiency	COP at any phase of operation not lower than 4 with system optimised to achieve majority of running time at 6+ COP	COP 4-6 targeted in mechanical design
19	HVAC motors	High efficiency and EC motors to be used for pump and fan applications. Low noise VSD's to be provided where appropriate	High efficiency motors to be specified
20	HVAC system efficiency to non-laboratory spaces	Evaluate passive HVAC techniques. Incorporate economy cycle and night time set-back strategies	Economy cycles to be specified to mechanical systems
21	HVAC efficiency to 24/7 spaces	Evaluate provision of dedicated 24/7 plant for 24/7 areas to allow out-of-hours shutdown of other HVAC plant	Dedicated plant to be confirmed by Mechanical subject to plant & spatial limitations

22	Electricity metering	Metering to be provided in line with BCA and UNSW guidelines Meters to be connected to UNSW BACNet - EMACS System	All significant energy use to be metered including but not limited to: - Lifts - Mechanical plant - General light and power
23	Boiler efficiency	Water boiler efficiency >90% with flue gas heat recovery	Boiler efficiency to be >90% with flue gas heat recovery
24	Hot water efficiency	No hot water supply to toilet hand basins unless required in laboratory spaces or showers	No hot water supply to toilet hand basins
25	Non-potable water usage	Bore water to be used for WC and urinals, laboratory non-potable water and cooling towers if applicable	Bore water to be used for WC and urinals, laboratory non-potable water and cooling towers if applicable
26	Rainwater percolation	Rainwater to be collected & returned to UNSW aquifer recharge system	Rainwater to be collected & returned to UNSW aquifer recharge system
27	Water efficiency	WELS Ratings to be met for plumbing equipment: Toilets: 4 star Urinals: 4 star Taps: 6 star Showers: 3 star (<7.5l /min)	FF&E to meet WELS ratings
28	Recovery / reuse of demolition & construction waste	Minimum 80% by weight of demolition and construction waste to be reused / recycled (excluding contaminated materials)	80% demolition & construction waste reused & recycled and included in head contract
29	Materials selection - toxicity	Comparable and low-toxicity alternatives to be considered and justification provided for the use of more toxic products (Examples include preferential use of low-VOC products including paints, adhesives, sealants, carpets, flooring and fit-out items, and low/zero formaldehyde content of engineered wood	50% by cost of furniture, flooring, finishes, engineered wood products, timber to be accredited to a suitable rating scheme: - GECA - Ecospecifier Green Tag - Carpet Institute of Australia - ARFDI Green Tick - FSC - PEFC - Floor Score - BIFMA
30	Materials selection - recycled content	Where comparable, cost-effective materials with a recycled material content to be used	
31	Embodied energy	Where comparable, cost-effective materials with low embodied energy content to be used	
32	Energy efficient appliances	Energy ratings to be achieved for new equipment: Dishwashers: 4.5 star TVs: 6 star Computer monitors: 5 star	Appliances to meet energy ratings
33	Operational waste	Recycling facilities provided to teaching and learning areas for ease of recycling	Appropriate waste facilities to be provided. Calculations to be carried out to determine number of general waste & recycling bins required
34	Low VOC products	95% of internal paints, adhesives, sealants, carpets and flooring to meet VOC limits outlined in Green Star Education v1.1 tool	95% of paints, adhesives, sealants, carpets and flooring to meet VOC limits
35	Thermal insulation	All thermal insulation to have zero ozone depletion potential	Thermal insulation to have zero ozone depletion potential
36	Cyclist facilities	Provide cyclist facilities for staff and students	Adequate cyclist facilities to be provided in line with UNSW Cycling Master Plan requirements
37	Life cycle costing for major plant	Life cycle costing to be carried out for all major plant and equipment to inform selections	Life cycle costing to be carried out for major plant
38	Product stewardship	Product stewardship agreements to be sought with furniture & equipment suppliers where possible	Product stewardship agreements to be sought where possible
39	External views	Indoor spaces to be provided with high quality external views	60% of UFA to have views to external environment
40	CO2 sensors	CO2 monitoring to all return air points on each floor	CO2 sensors to all return points on each floor to be included if possible
41	Automated shutdown of HVAC	Link HVAC to occupancy sensors to shut down when areas are unoccupied. Provide master switch at entrance to each room	To be included into mechanical design if possible
42	Education	Provide educational displays & boards to educate students of environmental initiatives	Display boards & labelling to be provided to common areas to provide education of waste management & building environmental initiatives

43	Concrete	Reduce emissions associated with the production of concrete	Reduction of Portland cement content by 40% measured by mass across all concrete; Mix water for all concrete used in the project to contain at least 50% captured or reclaimed water; and At least 25% of fine aggregates to be manufactured sands or other alternative materials
44	Steel	Utilise environmentally responsible steel	Minimum 95% of new steel to be sourced from a Responsible Steel Maker; and At least 60% of fabricated structural steelwork to be supplied by a steel fabricator accredited to the Environmental Sustainability Charter of the Australian Steel Institute