

ESD Energy & GHG Assessment Report

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BROCK DRIVE, EASTERN
CREEK**

Client:
NineZero DC Management Pty Ltd

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CONTENTS

Executive Summary	4
1 Introduction	7
1.1 Background.....	7
1.2 Project Location	7
1.3 Project Overview.....	8
1.4 Planning Requirements.....	9
2 Energy Assessment	12
2.1 Energy Rating System	12
2.2 Energy Minimisation Strategies	13
3 Greenhouse Gas Assessment	15
3.1 Methods for Estimation of GHG Emissions	15
3.2 Emissions Sources Across Scopes	15
3.3 GHG Mitigation Measures	16
3.4 Calculation of Annual Major Emissions	17
3.5 State and National Emissions Impact	21
3.6 Total Lifecycle Emissions Forecast.....	21
4 Sustainable Measures beyond Energy & GHG	24
Appendix A Energy Performance Statement	26

Executive Summary

This report has been prepared to support the modification for the State Significant Development Application of the proposed facility located on the existing site at 90 Peter Brock Drive, Eastern Creek.

An assessment of the energy efficiency, greenhouse gas emissions and other sustainable design measures has been undertaken to address the relevant planning requirements, as specified under the SEARs, Raceway Precinct Plan and Sustainable Buildings SEPP.

Energy Assessment

An assessment of energy efficiency for the proposed facility has been completed to identify an appropriate performance metric to pursue, target performance rating and energy minimisation measures for implementation in support of the set targets.

The National Australian Built Environment Rating System (NABERS) Energy for Data Centre rating tool considering the Infrastructure (non-IT) scope has been identified as the most applicable to the development.

The following targets for operational energy efficiency have been set for the proposed facility that are in line with the highest performing data centres across Australia, per the performance data available on the NABERS website:

- Power Usage Effectiveness (PUE) ≤ 1.3 (1.55 approximate national average per NABERS data)
- NABERS Energy for Data Centre Infrastructure rating ≥ 5 Stars (4 star approximate national average per NABERS data)

In support of the energy performance targets, the following design features considered best-practice are being pursued for the proposed facility design

- Elevated data hall temperatures and relaxed humidity setpoints.
- Direct to chip liquid cooling capability combined with rack air cooling.
- Hybrid coolers for main data hall cooling bypassing chiller operation that have:
 - Free cooling air source mode in cooler ambient conditions.
 - Evaporative cooling mode in elevated ambient conditions to improve energy efficiency.
- High efficiency trim chiller plant for use in high to peak ambient conditions.
- Dedicated ventilation units to decouple loads from main hall plant maximising free cooling potential.
- Loss energy loss static UPS (battery type) for backup power in lieu of rotary flywheel style.
- High efficiency LED lighting coupled with occupant responsive controls.
- Heat recovery variable refrigerant volume/flow (VRV/VRF) air conditioning units to serve the offices spaces.
- Strategic energy metering connected to management system for monitoring and system tuning.
- Low absorptivity / high Solar Reflective Index (SRI) building external finishes to reduce radiant heat gains.
- High performance fabric / glazing to the office spaces and glazing shading to reduce thermal loads.

Greenhouse Gas Assessment

The greenhouse gas emissions associated with the proposed facility have been estimated, utilising the framework laid out by the National Greenhouse Accounts Factors. The GHG assessment considered the various sources of emissions for the proposed facility across the emissions scopes.

GHG emissions estimations were based on the mitigation measures being pursued for the development. This includes the energy efficiency initiatives and DCI's commitment to 50% renewable electricity from day one operation, progressively increased to 100% in support of DCI's target net-zero by 2050.

The following table provides a summary of the estimated annual GHG emissions across proposed facility sources.

Table 1: Summary of Estimated Annual GHG Emissions per Source and Scope

Emissions Source	Emissions Scope	Annual Emissions (tCO ₂ -e/yr)	Percentage of Total
Liquid Fuel - Stationary	Scope 1	7,135	4.6%
Refrigerant	Scope 1	33	0.0%
Electricity Generation	Scope 2	127,876	82.1%
Electricity Transmission Losses	Scope 3	15,500	10.0%
Liquid Fuel - Production	Scope 3	1,758	1.1%
Liquid Fuel - Transport	Scope 3	420	0.3%
Miscellaneous	Scope 1,2,3	3,054	2.0%
Total Annual Emissions	Scope 1,2,3	155,777	100.0%

The annual assessment identified electrical energy consumption to be the greatest contributor to GHG emissions, accounting for over 80% of the total figure. The significance of power consumption on total emissions highlights the importance of the energy minimisation strategies being pursued for the project and also the importance of DCI's commitment to 50% renewable energy sources from the start of operation and all renewable sources by 2050.

The total annual GHG emissions were compared with the state and national figures to contextualise the impact of the development. The facility is predicted to contribute only a relatively small portion of total emissions, at 0.14% of the state figure and 0.03% of the national figure, current at the time of writing.

A trajectory of GHG emissions was estimated considering the proposed facility delivery staging and an operational life of 50 years as shown in the following figure. Electricity emissions were assumed to reduce linearly to zero at 2050 in line with DCI's targets, amongst some other listed assumptions. Note the trajectory may differ in reality.

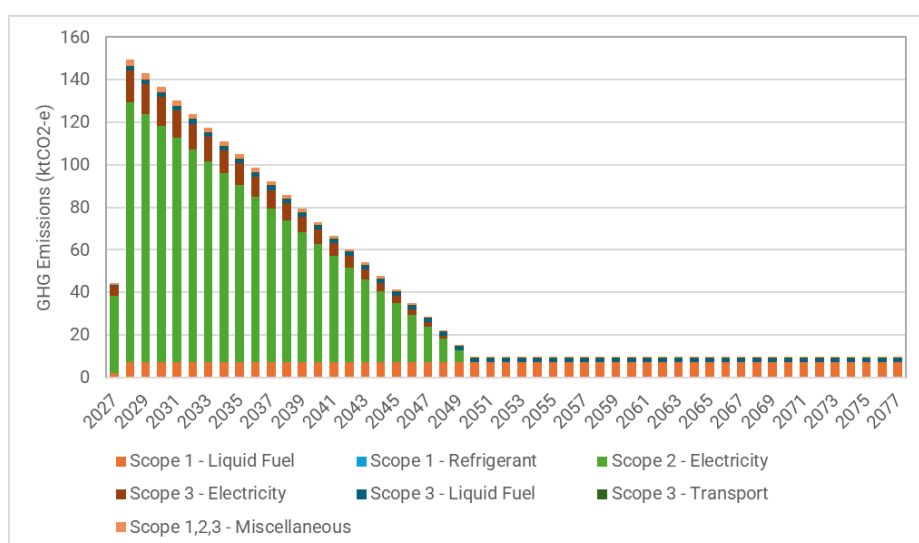


Figure 1: Estimated Lifecycle Projection of GHG Emissions per Source for the Proposed Facility

A comparison of the total life cycle emissions was made of the estimates for proposed facility to that of the same facility performing in line with the industry average performance ratings. The following table provides the comparison figures and demonstrates the value of the GHG mitigation measures being pursued including energy efficiency initiatives adopted in the design. Average NABERS and PUE figures is based on data available from the NABERS website at the time of writing.

Table 2: Estimated Lifetime GHG Emissions comparison to Industry Average Benchmark

Performance Level	NABERS Energy Rating	PUE	Total Emissions (tCO ₂ -e)	Difference (tCO ₂ -e)	Percentage Difference
Industry Average	4	1.55	4,160,952	-	-
Proposed Facility	5	1.3	2,128,719	-2,032,234	-48.8%

The proposed facility is seen to support a substantial reduction in GHG emissions compared to an Industry Average facility over the life cycle of operation.

Sustainable Measures beyond Energy & GHG

Further sustainable design initiatives are being pursued for the proposed facility across water, waste and materials in addition to the energy and GHG initiatives as detailed below:

- Low annual water consumption supported through:
 - Hybrid coolers used for heat rejection able to operate in air cooling only mode in lieu of evaporative mode when ambient conditions allow.
 - Cooling loads minimisation from elevated temperatures & direct to chip liquid cooling reducing heat rejection requirements and associated water consumption.
 - Rainwater reuse system serving all toilets, urinals, washdown taps and mechanical services for heat rejection when available.
 - Low or zero irrigation demand through selection of drought tolerant planting for landscaping such as endemic native vegetation.
 - Strategic water metering connected to management system for monitoring and system tuning.
 - Use of 100% recycled water supply for mechanical services evaporative heat rejection currently under investigation with implementation if viable to further offset potable water consumption.
- Waste Management Plan developed to minimise construction and demolition waste and maximise diversion from landfill.
- Materials initiatives to reduce embodied emissions and associated environmental impact including:
 - Supplementary cementitious materials use in concrete such as fly ash and granulated blast furnace slag to reduce Portland Cement content and the associated production greenhouse gas emissions.
 - Use of steel products with high recycled material content to reduce the quantity of virgin material sourcing.
 - Selection of low maintenance and high durability materials will be selected where practical for extended service life to minimise replacement needs and additional materials usage over the development lifetime.

1 Introduction

1.1 Background

DCI Data Centres is proposing to expand its existing data centre located at 90 Peter Brock Drive, Eastern Creek. The existing data centre is known as SYD01. The proposed new data centre is known as SYD02.

On 1 September 2023, the Department of Planning, Housing and Infrastructure (the Department), as delegate of the then Minister for Planning and Public Spaces (the Minister), approved a State significant development application from NineZero DC Sub TC I Pty Limited (trading as DCI Data Centres, or DCI) for the expansion of DCI's Eastern Creek Data Centre located at 90 Peter Brock Drive, Eastern Creek in the Blacktown local government area (LGA).

The project was determined to be State Significant Development (SSD-21342738) and Development Consent was granted on 01/09/2023.

During detailed design for the project, DCI has identified the need for revision to the approved design. Modification 1 (SSD-21342738 Mod 1), relating to rainwater and process water storage tank arrangements on the site for enabling works and planning for future works, was approved 18/09/2025.

DCI has continued design progression for the data centre, including a revised data centre design of 63MW IT capacity with a mixed cooling strategy. DCI is proposing a Modification 2 to the development consent to accommodate revised design. This report has been prepared to support Modification 2.

To support the original application for development consent, an Environmental Impact Statement (EIS) was prepared in August 2022 (Eastern Creek Data Centre Expansion, Environmental Impact Statement, PJEP, Aug, 2022). This EIS included information on the Energy & GHG Emissions strategy.

This report provides an update to the ESD, Energy & GHG Emissions considerations of the project.

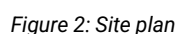
1.2 Project Location

The project site is located at 90 Peter Brock Drive, Eastern Creek within Blacktown City Council.

Lot references are:

- Lot 34 DP 1131779
- Lots 32 & 33 PD 1140168
- Lot 25 DP 1122038

The existing data centre site has a total area of approximately 3.5 hectares. The expanded site has a total area of 4.1 hectares. The project site and majority of adjacent land is zoned IN1 General Industrial. To the south east of the project is Prospect Nature Reserve. An overview map is shown in Figure 2.



The Project involves the construction, fit out and operation of a multi story, 63MW Data Centre building (SYD02) comprising:

- 2 low levels of plant, office, storage areas and 3 levels of Data Halls.
 - Lvl 1 – 4 off 4.5 MW Air Cooled
 - Lvl 2 – 4 off 9 MW Liquid Cooled
 - Lvl 3 – 2 off 4.5 MW Air Cooled + plant
- Ancillary office spaces and amenities.
- Carparking, loading docks, access roadways and landscaping.
- Zone Substation Support Works

1.4 Planning Requirements

1.4.1 Secretary's Environmental Assessment Requirements

The following table details the Secretary's Environmental Assessment Requirements (SEARs) provided for the original SSDA. The original SEARs have been used to guide the modification as addressed by this technical report.

Table 3: Applicable SEARs Issues and Responses

SEARs Item	Response location in report
Greenhouse gas and energy efficiency – including an assessment of the energy use of the proposal and all reasonable feasible measures that would be implemented on site to minimise the proposals greenhouse gas emissions (reflecting the Government's goal of net zero emissions by 2050).	Assessment of the energy efficiency and greenhouse gas emissions are provided in Section 2 and Section 3 respectively.
Ecologically sustainable development – including: - A description of how the proposal will incorporate the principles of ecologically sustainable development in the design, construction and ongoing operation of the development. - Consideration of the use of green walls, green roofs and/or cool roofs in the design of the development. - A description of the measures to be implemented to minimise consumption of resources, especially energy and water.	Addressed within the Environmental Impact Statement (EIS) submission. Requirements are not directly dealt with in this report, however description of the measures implemented to minimise consumption of energy are covered in Section 2.2 and the consumption of water in Section 4.1.1.

1.4.2 State Environmental Planning Policy (Sustainable Buildings) 2022

The NSW State Environmental Planning Policy (Sustainable Buildings) 2022 came into effect in August 2022 and applies to relevant projects lodged for State Significant DA after 1 October 2023. Although the Sustainable Buildings SEPP requirements are not applicable to the proposed development, as it is a modification not the original SSDA that was lodged and approved prior to 1 October 2023, a response to the requirements has been provided.

The Sustainable Buildings SEPP encourages the design and delivery of more sustainable buildings across NSW. It sets sustainability standards for residential and non-residential development and starts the process of measuring and reporting on the embodied emissions of construction materials.

The NSW Government's objectives for the Sustainable Buildings SEPP are to:

- minimise the consumption of energy and potable water
- reduce greenhouse gas emissions from energy use
- monitor the embodied emissions of building materials
- deliver buildings that are comfortable in summer and winter
- provide household bill savings to families, especially for heating and cooling.

Chapter 3 of the Sustainable Building SEPP outlines standards to be met for non-residential development and the elements relevant to the proposed development are outlined below.

- Clause 3.2 (1) requires non-residential development be designed to enable the following:
 - a) the minimisation of waste from associated demolition and construction, including by the choice and reuse of building materials,

- b) a reduction in peak demand for electricity, including through the use of energy efficient technology,
 - c) a reduction in the reliance on artificial lighting and mechanical heating and cooling through passive design,
 - d) the generation and storage of renewable energy,
 - e) the metering and monitoring of energy consumption,
 - f) the minimisation of the consumption of potable water.
- Clause 3.2 (2) requires quantification of embodied emissions attributable to the development through the disclosure of materials quantities that is completed through the NABERS Embodied Emissions Materials Form.

Project Response

The proposed development includes design considerations that will meet or exceed the applicable requirements of the Sustainable Buildings SEPP as detailed below (project specific responses referenced):

- a) The project will minimise waste from associated demolition and construction, including the use of recycled materials where possible – refer Section 4.1.2.
- b) The project will have a reduction in peak demand for electricity, including through the use of energy efficient equipment – refer to Section 2 generally and specifically Section 2.2.
- c) The project will have a reduction of the dependence of cooling through passive design features – refer Section 2.2.
- d) The project will procure renewable energy in operation – refer Section 3.3.
- e) The project will provide metering and monitoring of energy consumption – refer Section 2.2.
- f) The project will minimise the consumption of potable water – refer Section 4.1.1.

The NABERS Embodied Emissions Materials form provides for the collection of key development construction materials across the substructure, superstructure and facade of the proposed facility. The NABERS Embodied Emissions Materials form excel file has been completed and submitted separately from this report with the development modification submission.

1.4.3 Development Control Plan Requirements

The proposal is to be located in the Raceway Precinct, within Blacktown City Council. The relevant local planning requirements are outlined within the Raceway Precinct Plan prepared under the former State Environmental Planning Policy No.59 (SEPP 59) – Central Western Sydney Economic and Employment Area.

The following table identifies the controls relating to energy and greenhouse gas emissions that are responded to in this report.

Table 4: DCP Requirements to be addressed

Raceway Precinct Plan Control	Response location in report
5.1.a.vii - Implementing energy conservation measures that include reducing energy consumption and increasing inherent energy efficiency through design and materials selection, and adopting energy management plans.	Addressed in Section 2.
5.3.a - Appropriate use of energy efficient materials during construction is to be demonstrated.	Addressed in Section 2.2.
5.3.b - Development should incorporate energy efficient hot water systems, air-conditioning, lighting and lighting control systems.	Addressed in Section 2.2.

Raceway Precinct Plan Control	Response location in report
5.3.c - An Energy Performance Statement (EPS) is to be lodged with all Development Applications. The EPS shall provide justification for the proposed energy efficiency measures by addressing: (i) solar access; (ii) building form and construction; (iii) heating/cooling and ventilation; (iv) lighting, water usage and appliances; and (v) solar boosted hot water systems.	See Appendix A for the Energy Performance Statement (EPS).
5.3.d - Consideration should be given to the feasibility of any measures to substitute grid-source power with environmentally sustainable alternatives such as co-generation (i.e., recovery of waste energy) or photovoltaics.	See Section 3.3 for details on the substitution of grid-sourced power with renewable electricity and Section 2.2 for photovoltaic considerations.

2 Energy Assessment

The following section details an operational energy assessment, including selection of an energy efficiency performance metric, target performance rating and description of energy minimisation strategies to be implemented throughout the design, construction, and operation of the proposed development.

2.1 Energy Rating System

The National Australian Built Environment Rating System (NABERS) provides reliable tools for evaluating operational sustainability performance across several metrics including energy and across several building sectors, including data centres. NABERS evaluates performance for a particular metric on a star rating scale allowing comparison to the performance of other developments across Australia.

NABERS Energy for Data Centres provides an indication of the operational energy efficiency and environmental impact due to greenhouse gas emissions of data centres in Australia. There are three rating scope types within the data centre tool covering the categories of IT energy, Infrastructure energy and the Whole Building energy. The Infrastructure energy scope rating, that is most applicable to the development proposal, gives data centres a rating from one to six stars, to half star increments, per the following figure based on the annual average Power Usage Effectiveness (PUE), a globally accepted metric.

NABERS STAR RATING GUIDE	PUE
★☆☆☆☆	2.42
★★☆☆☆	2.15
★★★☆☆	1.88
★★★★☆	1.61
★★★★★	1.34
★★★★★	1.07

Figure 3: How NABERS Energy for Data Centre Infrastructure scope star ratings correspond to PUE values (Source: Data Centres | NABERS)

Power Usage Effectiveness (PUE) is defined as the ratio of Total Facility Energy to the IT Equipment Energy:

$$\text{PUE} = \text{Total Facility Energy} / \text{IT Equipment Energy}$$

Where:

Total Facility Energy is the total power consumption of the entire data centre facility including IT equipment, cooling systems, lighting, backup power and power delivery systems, and

IT Equipment Energy is the power consumption of the computing, storage and networking hardware equipment within the data centre.

Table 5 below provides a summary of rating performance under NABERS Energy for Data Centre Infrastructure scope and PUE for facilities currently operating in Australia. This is based on the data available on the NABERS website at the time of writing for all eleven rated facilities in Australia with 7 rated facilities in NSW.

Table 5: Summary of Current Ratings and associated PUE under NABERS Energy for Data Centres Infrastructure Scope

	Formal NABERS Level	Rating Progress Metric ^[1]	PUE
Worst	3	3.2	1.80
Average	4	4.14	1.55
Best	5	5.4	1.22

Note: 1. The rating progress metric provides a more precise indication of performance on the rating scale however actual ratings are only awarded in half star increments (e.g. 3, 3.5, 4, etc.)

2.1.1 Target Rating

The following minimum energy performance targets have been set for the proposed development:

- PUE ≤ 1.3
- NABERS Energy for Data Centre Infrastructure rating ≥ 5 Stars

The targeted NABERS Energy rated performance aligns to that of the current best/highest rated data centre facilities, reflecting the commitment of DCI to industry leading performance for energy efficiency.

The following table details a predictive energy assessment of the proposed development estimating the energy consumption and associated PUE and NABERS Energy for Data Centres position.

Table 6: Estimated Energy Consumption, PUE and NABERS Energy for Data Centres Infrastructure Scope Performance

Parameter for Estimating NABERS Energy for Data Centres Performance Infrastructure Scope	Project Output
Postcode	2766
Total IT Capacity	63 MW
IT Occupied Capacity	90%
IT Load Capacity Average Utilisation	60%
Estimated energy consumed by the IT equipment load (MWh/yr)	298,015
Metered Heat Rejection Rate	100%
Estimated Data Centre Infrastructure electrical energy use (MWh/yr)	89,366
Estimated Backup Generator Testing diesel energy use (kL/yr)	3,625
Estimated PUE	1.3
Potential Infrastructure NABERS Energy for Data Centres Rating	5

Note the estimate calculations have been based on various assumptions that includes operational diversity that may not be reflective of actual performance in operation.

2.2 Energy Minimisation Strategies

The following energy efficient design features considered best-practice are being pursued for the proposed facility design to support the Power Usage Effectiveness (PUE) target of 1.3 annual average. These measures will also

contribute to reducing the peak demand of the development on the electricity grid in addition to minimising energy consumption.

Passive Design Measures

- Data hall free cooling operation maximised through modern optimised IT equipment that allows operation in elevated data hall temperatures and relaxed humidity setpoints.
- Low absorptivity / high Solar Reflective Index (SRI) building external finishes to reduce radiant heat gains.
- High performance fabric / glazing to the office spaces and glazing shading to reduce thermal loads.

Active System Measures

- Minimised active system cooling loads due to relaxed air temperature and humidity setpoints combined with direct to chip liquid cooling capability to maximise efficiency of mechanical plant.
- Hybrid coolers used for main general data hall cooling that bypasses chiller operation to reduce associated energy consumption through:
 - Free cooling air source mode in cooler ambient conditions allow providing cooling and heat rejection with minimal energy input required.
 - Evaporative cooling mode in elevated ambient conditions, providing enhanced heat rejection and energy efficiency when compared to air source mode at the associated ambient temperatures.
- Trim chiller plant for use in high to peak ambient conditions incorporating modern compressor technology that coupled with elevated operational chilled water temperatures, due to relaxed hall conditions, and direct to chip liquid cooling maximises energy efficiency
- Dedicated pressurisation/ dehumidification units, divorcing the pressurisation and dehumidification process from the main data hall air conditioning, allowing elevated data hall air temperature at all times, providing energy savings main air conditioning plant and increased access to the free cooling cycle.
- Utilisation of static UPS (battery type) for backup power in lieu of rotary flywheel style backup, providing a significant reduction of standby losses and associated energy consumption in comparison to rotary units.
- High efficiency LED lighting selections throughout to minimise demand coupled with occupant responsive controls to minimise operational time and associated energy consumption.
- Heat recovery variable refrigerant volume/flow (VRV/VRF) air conditioning units to serve the offices spaces, that reclaim energy when spaces require simultaneous heating and cooling (often the case in winter), providing energy savings.
- Energy Management System (EMS) – Strategically placed energy metering connected to a monitoring system provides analytics on all energy consuming equipment, allowing identification of where systems are underperforming and enabling building tuning and optimisation.

Consideration was given to the inclusion of roof mounted solar photovoltaic (PV) panels as a means of offsetting some site energy consumption. Due to the extensive roof top spatial requirements for data hall heat rejection mechanical plant, minimal space remains for the potential inclusion of solar PV. As the available space for roof top panels limits potential system output that would at most produce less than 0.01% of the proposed facility electrical needs, it was therefore not considered viable initiative to pursue for the proposed facility.

3 Greenhouse Gas Assessment

The following section details a greenhouse gas (GHG) assessment, including methodology and calculation procedure along with inputs and assumptions. The results are compiled for annual operation and the full lifecycle, as well as discussion of the state impact and energy minimisation strategies.

3.1 Methods for Estimation of GHG Emissions

Assessment of the GHG emissions attributed to the proposed facility has been conducted according to the methodology detailed within the National Greenhouse Accounts Factors (2024).

The National Greenhouse Accounts Factors provides a framework for evaluating greenhouse gas emissions with all emissions factors expressed in terms of equivalent carbon dioxide. This enables like-for-like comparison between emissions sources, informing as to where mitigation efforts can be best focused, and allowing for comparison of facilities between industries.

The document provides guidance on identifying and defining the various sources for emissions. These are categorised into the following:

- **Scope 1** relates to the direct emissions from sources under the proponent's operational control within the boundary of the project that includes
- **Scope 2** relates to the indirect emissions resulting from the burning fossil fuels at the power station to generate electricity, supplied on the local electricity grid, that is imported and consumed by the project
- **Scope 3** relates to the indirect emissions (other than scope 2) that are generated in the wider economy that are attributable to the project

The GHG emissions calculations have utilised emissions factors sourced from the latest National Greenhouse Accounts Factors (2024) and Australia's Emissions Projections (2024) documents both published by the Australian Government Department of Climate Change, Energy, the Environment and Water (DCCEEW).

3.2 Emissions Sources Across Scopes

The National Greenhouse Accounts Factors document provides the framework for which to define the scope of the emissions sources for the project.

3.2.1 Major Emissions Sources

The major sources to be considered in this assessment the context of the proposed facility are outlined below, categorised by scope for the context of this project proposal.

- **Scope 1:**
 - **Liquid Fuel – Stationary:** refers to direct emissions generated by the burning of diesel oil by the backup power generators.
 - **Refrigerant:** refers to direct emissions associated with the leakage of refrigerants from air conditioning plant.
- **Scope 2:**

- **Electricity Generation:** refers to indirect emissions released at the point of power production for the power purchased and consumed by the operation of the facility.
- **Scope 3:**
 - **Electricity Transmission Loss:** refers to indirect emissions from losses during the transmission of electricity from the power source across the grid to the facility.
 - **Liquid Fuel – Production:** refers to indirect emissions from extraction, refining and distribution of diesel oil to the facility used in the backup power generators.
 - **Liquid Fuel – Transport:** refers to emissions generated by the burning of gasoline and diesel oil by vehicles of project staff commuting to work and to vehicles making deliveries to the site.

3.2.2 Minor Emissions Sources

Beyond major emissions sources relevant to the proposed facility, there are some additional minor sources that based on previous project experience are generally considered a negligible portion of the development's total lifetime emissions in the order of 1-2%. These minor emissions sources have not been directly quantified and include:

- Scope 1: Loss of sequestration due to vegetation clearance.
- Scope 3: Emissions related to the construction of the facility.
- Scope 3: Indirect waste emissions.
- Scope 3: Indirect emissions from water use.
- Scope 3: End-of-life decommissioning and demolition.

An allowance of an additional 2% of the total major emissions sources has been included to account for the above minor emissions sources.

3.3 GHG Mitigation Measures

Measures for the mitigation of emissions have been pursued for the proposed facility according to a hierarchy as follows:

1. Avoid and reduce emissions through design measures
2. Substitute high-emission energy sources with low-emission ones
3. Offset residual emissions

Energy efficient design features considered best-practice are being pursued for the proposed facility design to support the Power Usage Effectiveness (PUE) target of 1.3 annual average. These features are detailed in Section 3.2.

In addition to the energy efficiency design features, emissions are further avoided through the proposed main data hall chiller plant that utilises 4th generation refrigerants with very low global warming potential (GWP) of 1 compared to GWP 1300+ for previous generation refrigerants scheduled for phase out.

Beyond the emissions avoidance and reduction measures, DCI is committed to the following measures of energy substitution to low emission sources:

- Procuring 50% renewable electricity from the start of operation; and

- Pursuing net-zero emissions from energy use by 2050 through consideration of the following measures:
 - Progressive increase in renewable electricity from 50% as operational commencement to 100% by 2050.
 - Utilisation of renewable bio-diesel for backup generators subject to availability of a viable source and suitability of operation in selected equipment.

3.4 Calculation of Annual Major Emissions

The following section provides the estimation calculations for the major Scope 1, 2 and 3 GHG emissions sources identified above for a typical year of annual operation.

For each section of emissions estimation, emissions calculations have been completed in accordance with the formulae described in the National Greenhouse Accounts Factors (2024). Inputs to the equations have been derived from the proposed facility documentation or estimated based on data from comparable existing projects. Further details relating to assumptions and sources for the input information are provided throughout.

The following calculations are for the annual emissions corresponding to the proposed facility at full capacity operation across all stages, that for the purpose of assessment is taken to occur in line with the start of Stage 1 operation anticipated Q1 2028 and associated emissions factors. A forecast of the total emissions for the operational life of the proposed facility, considering delivery staging impacts an predicted change in electricity emissions factors published by the government, is estimated in Section 3.6.

3.4.1 Scope 1 Emissions – Liquid Fuel – Stationary

The project is proposed to include 52 backup generators powered by diesel engines with an output in the order of 2,400kW (standby). To ensure proper operation and readiness for backup power provision, the generators undergo regular testing both on monthly and annual cycles. The on-site diesel consumption produces Scope 1 GHG emissions.

The following relevant factors taken from the National Greenhouse Accounts Factors (2024) have been utilised for this emissions calculation:

- Diesel Oil Energy Content Factor: 38.6 GJ/kL
- Scope 1 Diesel Oil Emissions Factor: 70.2 kg CO₂-e/GJ

The following table details the calculation estimate of diesel fuel consumed per year for the proposed facility due to regular testing of all backup generators. This is based on the testing types, loads and estimated testing run times provided by the project team and diesel fuel consumption at the test loads per the nominal generator unit selection.

Table 7: Estimated Annual Diesel Consumption from Backup Generator Testing and Associated Scope 1 GHG Emissions

Test Type	Test Load	Diesel Consumption at load (L/hr)	Test Run Time per Genset (min)	Annual Run Time across all Generators (hrs)	Annual Testing Diesel Consumption (kL)
Monthly Service Test	No load	75	15	9,360	702
Annual Load Test	100% load	619	60	3,120	1,931
Total Diesel Consumption (kL/yr)					2,633
<i>Annual Diesel Energy Consumption (GJ/yr)</i>					<i>101,645</i>
Annual Diesel Use Scope 1 Emissions (tCO₂-e/yr)					7,135

3.4.2 Scope 1 Emissions – Refrigerant

The proposed facility includes various items of equipment that contain refrigerants. Over the equipment life and usage the refrigerant charge leaks that is a source of Scope 1 GHG emissions.

The following table details the proposed facility cooling and air conditioning plant details and a calculation estimate of emissions associated with annual refrigerant loss. The relevant factors for refrigerant Global Warming Potential (GWP) and leakage rates for equipment types were taken from the National Greenhouse Accounts Factors (2024) document as the first source. Chiller refrigerant data was sourced from AIRAH and Green Star publications due to the National Greenhouse Accounts Factors not covering such equipment.

Table 8: Proposed Facility Air Conditioning Equipment Refrigerant Details and Estimate of Associated Scope 1 GHG Emissions

Equipment Type	Trim Chillers	Ducted Split & VRF Systems	Comms & Switch Room Splits	CRACs
Total Cooling Capacity for Unit Type (kW _r)	24,000	327.5	560.4	327.5
Total Refrigerant Quantity (kg)	8,880	197	336	197
Refrigerant Type	R1234ze	R410A	R32	R410A
Refrigerant GWP (kgCO ₂ -e)	1	1,924	677	1,924
Annual Leakage Rate	5.0%	3.5%	3.5%	2.5%
Emissions from Refrigerant Leakage (tCO₂-e/yr)	0.4	13.2	8.0	11.1
Total Annual Refrigerant Scope 1 Emissions (tCO₂-e/yr)	32.7			

3.4.3 Scope 2 Emissions – Electricity Generation

The following table details the estimate of electricity consumed for the proposed facility per year and calculation of Scope 2 GHG emissions. Data Centre electricity consumption is based on full capacity operation following delivery of all stages considering the operational assumptions as detailed in Section 2.1.1. Office electricity is based on the floor area proposed and typical electricity consumption for a code compliant space.

Scope 2 emissions have been calculated based on the emissions factor from the National Greenhouse Accounts Factors (2024) document of 0.66 kg CO₂-e/kWh for electricity supplied in NSW. This has been combined with the proponents renewable energy procurement commitment of 50% from day 1 operation for an overall Scope 2 emissions factor of 0.17 kg CO₂-e/kWh.

Table 9: Estimated Annual Electricity Consumption and Associated Scope 2 GHG Emissions

Electricity Item	Value
Data Centre Infrastructure (non-IT) (MWh/yr)	89,376
IT Equipment (MWh/yr)	298,015
Office Area (MWh/yr)	111
Total Proposed Facility Electricity Use (MWh/yr)	387,503
Scope 2 Emissions Factor - NGAF NSW x 50% (kg CO ₂ -e/kWh)	0.33 (0.66 x 50%)
Total Electricity Scope 2 Emissions (tCO₂-e/yr)	127,876

3.4.4 Scope 3 Emissions – Electricity Transmission Losses

The following table details the estimate of electricity consumed for the proposed facility per year and calculation of associated Scope 3 GHG emissions. Electricity consumption total reflects the breakdown details previously shown in Table 9.

Scope 3 emissions have been calculated based on the emissions factor from the National Greenhouse Accounts Factors (2024) document of 0.04 kg CO₂-e/kWh for electricity supplied in NSW.

Table 10: Estimated Annual Diesel Consumption from Backup Generator Testing and Associated Scope 3 GHG Emissions

Electricity Item	Value
Total Proposed Facility Electricity Use (MWh/yr)	387,492
Scope 3 Emissions Factor - NGA NSW (kg CO ₂ -e/kWh)	0.04
Total Electricity Scope 3 Emissions (tCO₂-e/yr)	15,500

3.4.5 Scope 3 Emissions – Liquid Fuel – Production

The following table details the estimate of diesel fuel consumed for the proposed facility per year and calculation of associated Scope 3 GHG emissions. Diesel consumption total reflects the calculation details previously shown in Table 7.

Scope 3 emissions have been calculated based on the emissions factor from the National Greenhouse Accounts Factors (2024) document of 17.3 kg CO₂-e/GJ for diesel oil.

Table 11: Estimated Annual Electricity Consumption and Associated Scope 3 GHG Emissions

Generator Testing Parameter	Value
Annual Diesel Consumption (L/yr)	2,633
Annual Diesel Energy Consumption (GJ/yr)	101,645
Annual Scope 3 Emissions (tCO₂-e/yr)	1,758

3.4.6 Scope 3 Emissions – Liquid Fuel – Transport

The following table details an estimate calculation of annual fuel consumption from vehicle use for staff and deliveries associated with the facility operation and associated calculation assumptions.

Table 12: Estimate of Vehicle Travel and Fuel Consumption associated with Proposed Facility

Vehicle Type	Staff Vehicles	Delivery Vehicles	Comments
Daily Project Travel Distance (km)	50	50	Distance estimation for round trip between origin and facility.
Annual Daily Trips	365	365	Considers constant operation due to critical nature of facility and one round trip per vehicle type per day.
Number of Vehicles	76	10	Staff based on number of new car parks being provided for the proposed facility with 2 shift uses per day, and deliveries estimated.

Annual Distance Travelled (km)	1,387,000	182,500	
Fuel Type	Petrol	Diesel	Based on majority of use per Australian Bureau of Statistics
Average Consumption Rate (L/100km)	11.1	12.8	Per Australian Bureau of Statistics reporting for passenger vehicles used for staff and light commercial vehicles use for delivery.
Annual Fuel Consumption (kL)	154.0	23.4	

The following table details the estimate of Scope 3 GHG emissions for the transport fuel use associated with the facility. Energy content and emissions factors have been sourced from the National Greenhouse Accounts Factors (2024) document according to the fuel type.

Table 13: Estimate of Scope 3 Emissions for Vehicle Travel associated with Proposed Facility

Item	Petrol Fuel	Diesel Fuel
Annual Fuel Consumption (kL)	154.0	23.4
Energy Content (GJ/kL)	34.2	38.6
Annual Fuel Energy (GJ/yr)	5,265	902
Emissions Factor (kg CO ₂ -e/GJ)	67.8	70.2
Emissions Per Fuel Type (tCO ₂ -e/yr)	357.0	63.3
Total Annual Scope 3 Transport Emissions (tCO₂-e/yr)	420.3	

3.4.7 Summary

The following table provides a summary of the annual estimated GHG emissions per source and emissions scope associated with the facility.

Table 14: Summary of Estimated Annual GHG Emissions per Source and Scope

Emissions Source	Emissions Scope	Annual Emissions (tCO ₂ -e/yr)	Percentage of Total
Liquid Fuel - Stationary	Scope 1	7,135	4.6%
Refrigerant	Scope 1	33	0.0%
Electricity Generation	Scope 2	127,876	82.1%
Electricity Transmission Losses	Scope 3	15,500	10.0%
Liquid Fuel - Production	Scope 3	1,758	1.1%
Liquid Fuel - Transport	Scope 3	420	0.3%
Miscellaneous	Scope 1,2,3	3,054	2.0%
Total Annual Emissions	Scope 1,2,3	155,777	100.0%
Total Annual Scope 1 Emissions (tCO ₂ -e/yr)		7,312	4.7%
Total Annual Scope 2 Emissions (tCO ₂ -e/yr)		130,433	83.7%
Total Annual Scope 3 Emissions (tCO ₂ -e/yr)		18,032	11.6%

3.5 State and National Emissions Impact

The following table provides a comparison of the estimated total annual GHG emissions at the start of full facility operation to the NSW state and national emissions figures. NSW state and national emissions values were sourced from the Department of Climate Change, Energy, the Environment and Water website and is the latest data available.

Table 15: Estimated Impact of GHG Emissions on the State and National Inventories

Item	Annual GHG Emissions (MtCO ₂ -e/yr)	National Proportion	State Proportion
Total National Emissions (2022-2023)	453.45	-	-
NSW Total Emissions (2022-2023)	114.45	25.24%	-
Proposed Facility Emissions	0.16	0.03%	0.14%

From above it is seen that the GHG emissions estimates of the proposed facility represents only a small portion of the state and national annual emissions figures. Furthermore, the predicted emissions for the proposed facility have been based on conservative estimates and do not take into account the declining emissions as the company shifts towards its renewable energy targets or the declining emissions of the NSW grid in general due to the state's targets.

3.6 Total Lifecycle Emissions Forecast

The annual GHG emissions estimates outlined in the previous sections have been extrapolated for the lifecycle of the facility to provide a more complete picture of the proposed facilities overall GHG emissions impact.

The lifecycle emissions projection has been based on the following assumptions:

- The facility has an expected life span of 50 years.
- Emissions factors associated with the consumption and transmission of electricity shall be reduced on a linear interpolation from the start of operation down to zero in the year 2050. This is an estimation of the uptake of renewable electricity sourced by DCI, based on the commitment by DCI to source 50% of electricity from day 1 operation, and to achieve net zero emissions by 2050. As emissions are directly related to the means of energy generation, the transition to renewable energy sources and carbon offsetting shall see the associated emissions factors fall accordingly.
- Emissions factors associated with burning diesel fuel for the generators assumed not to change. This is a conservative estimate, as the emergence of local biodiesel supplies will likely see a reduction in the associated emissions factor.
- Emissions factors associated with refrigerants assumed not to change. This is a conservative estimate, with the current phase down of hydrofluorocarbon-based refrigerants set to reduce usage by 85% in 2036. It is anticipated the refrigeration plant will be updated midway through the lifecycle of the facility, based on an operational life expectancy of 25 years. New technology is expected to use refrigerants with reduced or zero global warming potential, as well as making advancements in the prevention of refrigerant leaks.
- Emissions factors associated with transport assumed not to change. This is a conservative estimate, as with the current move to electric vehicles, emissions associated with transport are expected to fall.

- The delivery of the proposed 63MW total IT capacity facility will be completed in stages that are estimated to have the following timings. Emissions projection estimates assumes generation of emissions from all sources stage in, according to the ratio of each stage to the total facility capacity. Staging will be dependent on customer uptake. Utilisation of IT capacity may extend past these dates:
 - Stage 1 9MW – Operational Q3 2027
 - Stage 2 +54MW – Operational Q4 2027

The proposed facility lifecycle GHG emissions estimates are detailed below in Figure 4 and Table 16.

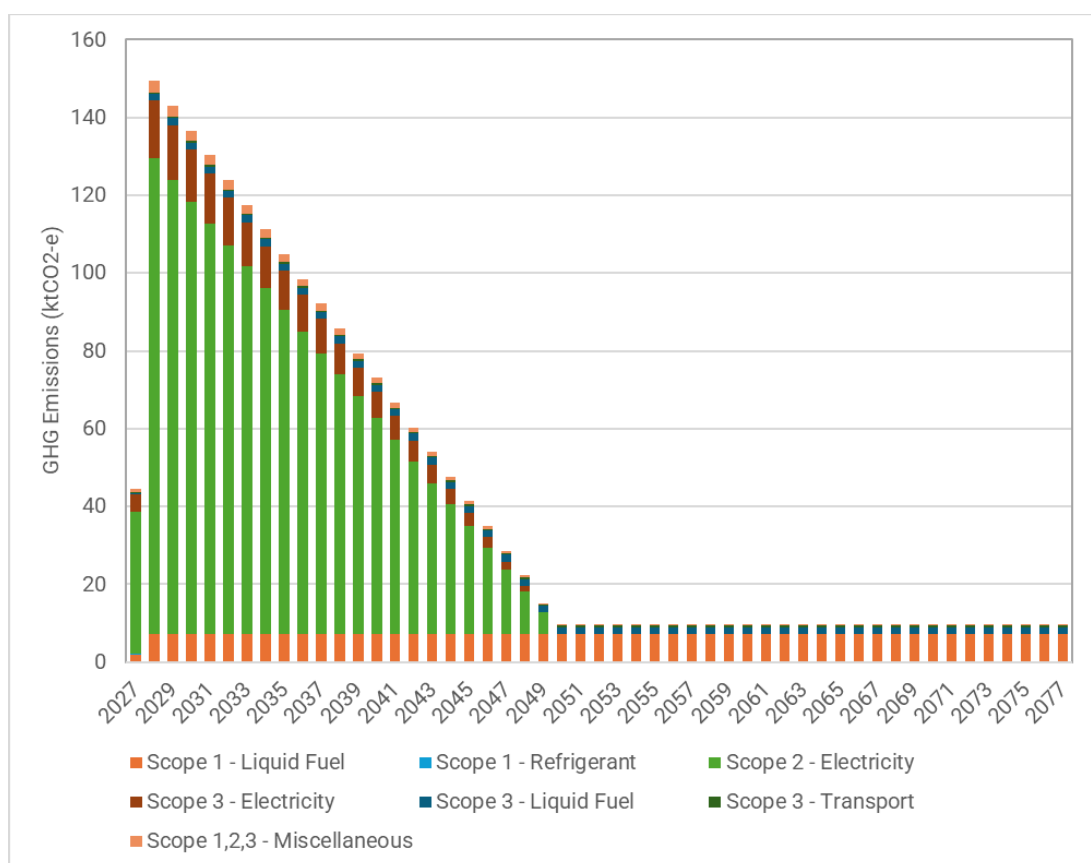


Figure 4: Estimated Lifecycle Projection of GHG Emissions per Source for the Proposed Facility

Table 16: Summary of Estimated Lifetime GHG Emissions per Source and Scope

Emissions Source	Emissions Scope	Annual Emissions (tCO ₂ -e/yr)	Percentage of Total
Liquid Fuel - Stationary	Scope 1	358,811	16.9%
Refrigerant	Scope 1	1,646	0.1%
Electricity Generation	Scope 2	1,442,757	67.8%
Electricity Transmission Losses	Scope 3	174,206	8.2%
Liquid Fuel - Production	Scope 3	88,425	4.2%
Liquid Fuel - Transport	Scope 3	21,135	1.0%
Miscellaneous	Scope 1,2,3	41,740	2.0%

Total Annual Emissions	Scope 1,2,3	2,128,719	100.0%
<i>Total Annual Scope 1 Emissions (tCO₂-e/yr)</i>		367,666	17.3%
<i>Total Annual Scope 2 Emissions (tCO₂-e/yr)</i>		1,471,612	69.1%
<i>Total Annual Scope 3 Emissions (tCO₂-e/yr)</i>		289,441	13.6%

From the figures above, the largest contributor to GHG emissions is the electricity consumption being the source of approximately 76% of the overall lifetime Scope 1 to 3 emissions. This estimation demonstrates that focus on electricity consumption is key to minimising environmental impact, hence the focus for the proposed development design to maximise energy efficiency and DCI's commitments to renewable energy procurement being pursued.

The following table provides a comparison of the proposed facility estimated lifecycle GHG emissions to that of an Industry Average facility. The Industry Average facility supports the average performance of a NABERS Energy rating of 4 star and PUE of 1.55 (see Section 2.1). Further the Industry Average facility is not considered to procure 50% of all electricity from renewable sources like the DCI commitment and it assumed to have a linear reduction in electricity associated emissions to zero at 2050 in line with government targets. All other sources of emissions are assumed equal between the facilities.

Table 17: Estimated Lifetime GHG Emissions comparison to Industry Average Benchmark

Performance Level	NABERS Energy Rating	PUE	Total Emissions (tCO₂-e)	Difference (tCO₂-e)	Percentage Difference
Industry Average	4	1.55	4,160,952	-	-
Proposed Facility	5	1.3	2,128,719	-2,032,234	-48.8%

The proposed facility is seen to support a substantial reduction in GHG emissions compared to an Industry Average facility over the lifecycle of operation.

4 Sustainable Measures beyond Energy & GHG

In addition to the initiatives being pursued for the proposed facility to minimise energy consumption and associated greenhouse gas emissions, the following section describes further sustainable design initiatives pursued across water, waste and materials.

4.1.1 Water Use

Water efficient initiatives are being pursued for the design as described in this section.

Mechanical Plant Water Consumption

Hybrid coolers to be utilised for heat rejection that are able to operate both in an evaporative cooling mode and a dry air cooling only mode that consumes no water. For evaporative mode, the heat rejection air passed through the coolers is pre-cooled evaporatively using wetted pads needed during for high loads and high ambient conditions. Dry air cooling mode is used during lower loads and cooler ambient conditions leading to significant savings in water consumption.

The elevated data hall temperature and humidity setpoints and capability for direct to chip cooling reduces the cooling load density handled by the mechanical plant, relative to IT load density. The reduced cooling system heat loads further reduces evaporative water consumption for heat rejection.

Water for mechanical services evaporative heat rejection is sourced from the potable water supply for reliability but when available water collected rainwater is utilised to reduce potable water consumption.

The use of recycled water for mechanical services evaporative heat rejection is currently being investigated. Should use be found viable, this will also be implemented to further reduce potable water consumption.

Rainwater Reuse System

The project facility is proposed to include a rainwater harvesting system, storage tank and reuse network for minimising the use of potable mains water. All rainwater that falls on the facility roof is proposed to be discharged to an underground rainwater harvesting tank. The collected rainwater is to be filtered and pumped around the facility in a rainwater reuse system. Reuse rainwater will be provided for non-potable uses including all toilet and urinal flush fittings, washdown taps provided in the waste storage room and washdown/maintenance areas plus external hose taps for irrigation if required. Collected rainwater will also be used in mechanical services for evaporative heat rejection when available.

Fittings and Fixtures

All fittings and fixtures selections will be made for the design with water efficiency and consumption minimisation in mind. Where appropriate, selections will be made toward the highest efficiency available. This will lead to minimised water demand from building occupants.

Low-Irrigation Demand Plant Selection

Plants with low or zero ongoing irrigation demands such as endemic native vegetation are being considered for the development to reduce watering requirements. The potential for plants that require low or no ongoing irrigation will contribute strongly towards water usage minimisation.

Strategic Water Metering

Building-level and sub-metering will be provided to monitor and record the water consumption of the overall development, as well as irrigation systems, water fixtures and water use for the mechanical systems. This will enable ongoing tracking for identification of targeted strategies to minimise operational water consumption.

4.1.2 Waste Minimisation and Materials

Construction and Demolition Waste Reduction

A construction and demolition Waste Management Plan has been prepared for the proposed development and has been provided with the submission. In summary, the WMP outlines the management practices that will be followed to minimise construction and demolition waste in general and maximise waste diversion from landfill. The WMP outlines how a waste hierarchy will be used as follows in order of priority as the guiding principle:

- Avoid and reduce (most preferable) – Through design process, material selection and procurement select options that will result in the least amount of resultant waste for processing.
- Reuse – Wherever possible, utilise reuse materials and reuse leftover / waste materials on site or offsite.
- Recycling – Identify all recyclable waste materials, separate for collection and send to recycling centres.
- Disposal (least preferable) – As the last resort, anything that cannot be reused/recycled will be disposed of.

Following the WMP will enable identification of all potential waste streams and their expected quantities, collection and diversion methods for each waste stream, roles and responsibilities, and the waste haulers to be engaged. Targets will be set for waste diversion from landfill with ongoing monitoring throughout construction to ensure project is on track.

Materials Selection

Initiatives are being pursued for major materials elements of the development to minimise the embodied emissions footprint and environmental impact including:

- Use of concrete mixes with supplementary cementitious materials from recycled byproduct sources such as fly ash and granulated blast furnace slag to reduce Portland Cement content and the associated production greenhouse gas emissions.
- Use of structural steel and reinforcement products with high recycled material content to reduce the quantity of virgin material sourcing.
- Selection of low maintenance and high durability materials will be selected where practical for extended service life to minimise replacement needs and additional materials usage over the development lifetime.

Appendix A Energy Performance Statement

The proposed facility shall incorporate energy efficiency measures in consideration of the Energy Performance Statement categories identified in the Blacktown Council Raceway Precinct Plan as detailed below:

Solar access

The proposed facility is inherently designed to minimise solar gains by optimising building orientation, minimising/eliminating windows where not required for natural lighting, using shading devices and high-performance glazing and using low absorptivity / high Solar Reflective Index (SRI) building external finishes to reduce radiant heat gains.

Building form and construction

The proposed facility shall be designed and constructed to comply fully with all aspects of the NCC Section J Energy Efficiency that includes Part J4 Building Fabric which outlines provisions for high thermal performance fabric and glazing.

Heating/cooling and ventilation

The facility shall utilise highly efficient heating and ventilation systems, targeting industry high energy efficiency ratings. For details relating to the target energy ratings and building services design, refer to Section 2.2 above.

Lighting, water usage and appliances

The facility shall utilise high efficiency LED lights and lighting control systems, and low water flow fixtures and appliances. The proposal shall comply fully with all aspects of the NCC Section J.

Solar boosted hot water systems

Due to the nature of the facility and the relatively minor hot water requirements, the use of a solar boosted hot water system is not considered viable.

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