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Macquarie Park Data Centre

The Trust Company Limited as custodian for Stockland Trust Management Limited as trustee for Advance Property Fund

16-Oct-2020

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Sustainability and Greenhouse Gas Emissions

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Client: The Trust Company Limited as custodian for Stockland Trust Management Limited as trustee for Advance Property Fund

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1.0 Introduction

Greenhouse gas (GHG) emissions attributable to the Project have been estimated over its lifecycle. Mitigation measures for reducing the GHG emissions and other environmental impacts have been identified. This report also outlines high-level sustainability initiatives for consideration beyond energy efficiency.

2.0 GHG Emissions Estimate

2.1 Emissions Scope and Coverage

Under this assessment, the following emissions scope has been assessed:

- Scope 1 related to direct emissions from sources within the boundary of the Project;
- Scope 2 related to the emissions resulting from the consumption of imported electricity from the local electricity grid;
- Scope 3 related to the indirect emissions attributable to losses through the electricity transmission and distribution network.

Sources of emissions estimated in this assessment include the following:

- Imported electricity consumed in the operation of the facility; and
- On-site diesel fuel consumption consumed in the monthly testing of backup diesel generators.

Emissions have been estimated on an annual basis under assumption of full and ultimate operational capacity and over a 50 year period.

2.2 Input Data

Data used for the estimation of GHG emissions has been taken from the *National Greenhouse Accounts Factors* (August 2019), published by the Australian Government Department of the Environment and Energy. At the time of writing, this was the latest revision of these accounts factors and it is assumed that they are applicable to the estimates at commencement of operation.

Emissions factors associated with relevant sources for the Project are outlined in Table 1.

Table 1 Emissions factors used in this assessment

Source	Emissions Factors
Grid imported electricity	Scope 2: 0.81 kgCO_2-e/kWh Scope 3: 0.09 kgCO_2-e/kWh
Diesel fuel	Scope 1: CO_2: 69.9 kgCO_2-e/GJ CH_4: 0.1 kgCO_2-e/GJ N_2O: 0.2 kgCO_2-e/GJ

With respect to estimating emissions of an assumed facility life of 50 years, the decarbonisation of the electricity grid has been estimated based on linear interpolation and extrapolation of publicly announced government commitments related to renewable energy targets. Emission for the generation of electricity are projected to decline with increased renewable energy supply while emissions for distribution losses are held constant (as a conservative assumption, although likely also to decline), and diesel emissions are also held constant. Figure 1 illustrates the assumed changes to these factors notionally between 2020 and 2070.

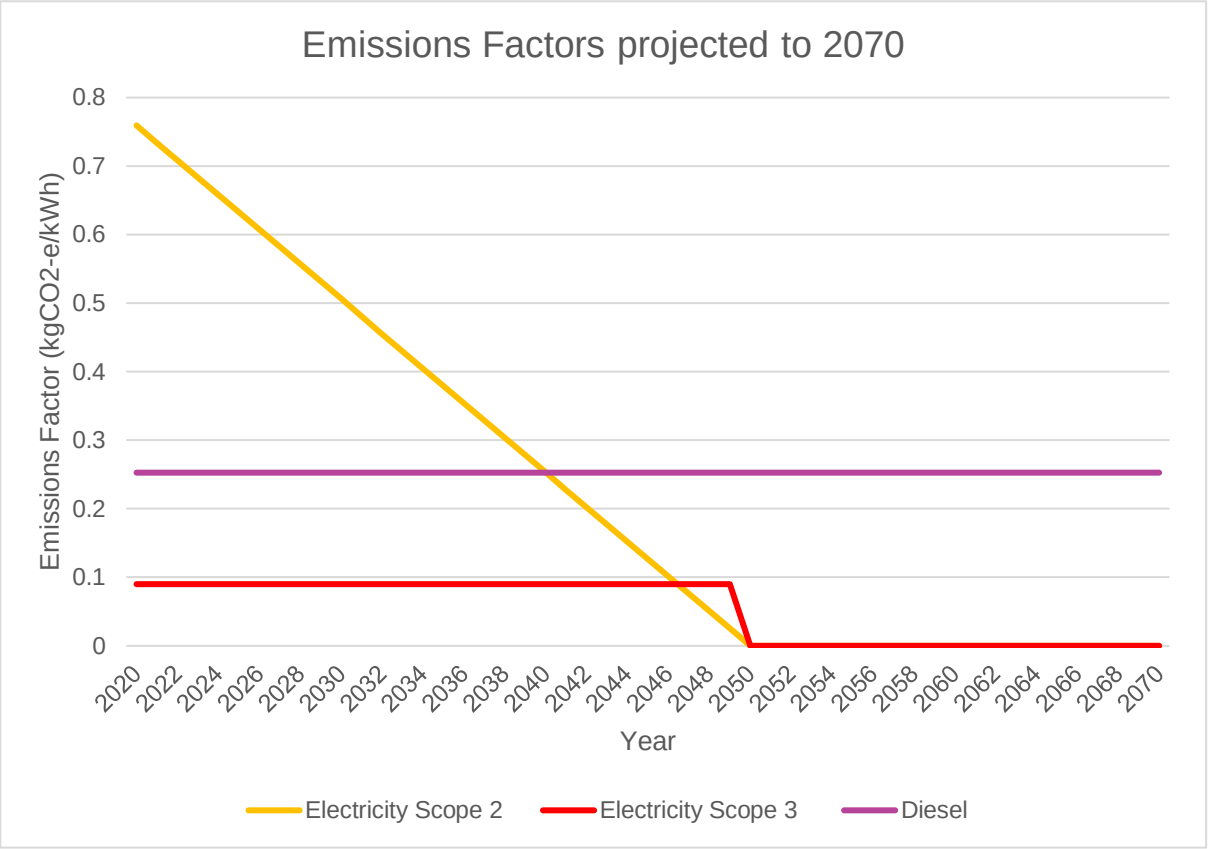

Figure 1 Projected decarbonisation of electricity grid and emissions factors adopted for asset lifetime GHG emissions

Other data has been taken from the *Annualized and Peak PUE Calculation Report* produced to assess the efficiency of the data centre in respect to energy used by IT equipment with respect to energy used to operate the facility (including lighting, cooling and so on).

2.3 Estimation Methods

GHG emissions associated with diesel fuel consumption were estimated based on design sizing of backup generators, fuel-burn rates and anticipated operational procedures.

Emissions associated with electricity consumption were estimated using a 3D dynamic thermal energy model of the facility.

2.4 GHG Emissions Estimates Details

2.4.1 Emissions arising from diesel fuel consumption

Source of scope 1 emissions within the facility are the diesel generators which provide a backup source of electricity for the facility. In total, 18 x 2400kW and 1 x 600kW generators will produce scope 1 emissions as a result of monthly generator testing. Generators are tested for operational readiness for 1 hour per month at an assumed load of 100% (as a conservative estimate of projected emissions). Each generator has a fuel-burn rate of 570L/hr resulting in 154 kL diesel fuel consumption annually.

2.4.2 Emissions arising from consumption of imported grid electricity

Scope 2 and 3 emissions are produced through the consumption of imported electricity from the national grid. Electrical energy consumption estimate is based on a detailed energy model created for the facility. This energy model is primarily produced to inform the likely Power Usage Effectiveness (PUE) ratio, a metric used to drive energy efficiency during design and operation and improve financial viability.

The energy model was created using a dynamic thermal energy simulation software product called Integrated Environment Solutions (IES). This industry recognised software meets necessary certification for use in simulating building energy consumption for the purposes of building code compliance under the National Construction Code and is therefore deemed appropriate for use in estimating associated GHG emissions.

A 3D geometric model of the facility, based on the architectural design, was created in IES to which the thermal performance parameters associated with the building fabric were applied. Each space was assigned profiles controlling internal artificial lighting and equipment loads, in addition to occupancy. Heating and cooling systems were added as per design documentation to satisfy internal comfort conditions for occupied areas such as offices, and functional conditions for data hall areas. Loads for the data hall are based on a full load for the ultimate facility construction at 100% loads on a 24 hour/7 day basis. In this way, a conservative estimate of annual emissions is yielded from the model.

Annual energy consumption is computed through an annual simulation of local weather conditions interacting with the simulation of building systems and building architectural systems. The building response is predicted in a time-marching simulation, stepping through a calendar year in 2min increments, reporting energy consumption on an hourly basis.

The resulting prediction for electrical energy consumption for the ultimate data centre capacity is estimated to be 311,315 MWh per annum, of which 280,320 MWh is attributed to IT equipment.

The emissions profile for the facility in its first year of operation has been derived from the energy consumption profile using the conversion factors published in the National Greenhouse Accounts Factors 2019. Following estimates of total emissions over 50 years have been estimated under the assumption of electricity grid decarbonisation based on published government policies related to renewable energy targets and commitments to be net zero emissions by 2050 for the NSW jurisdiction.

In the first year of operation, based on the 2019 emissions factors, approximate 281,000 tonnes CO2 will be produced of which 280,180 tonnes are attributable to imported grid electricity. Based on estimated decarbonisation of the NSW electricity grid over 50 years, the total GHG emissions are predicted to be 4,281,000 tonnes CO2 of which 4,240,400 tonnes are attributable to imported grid electricity.

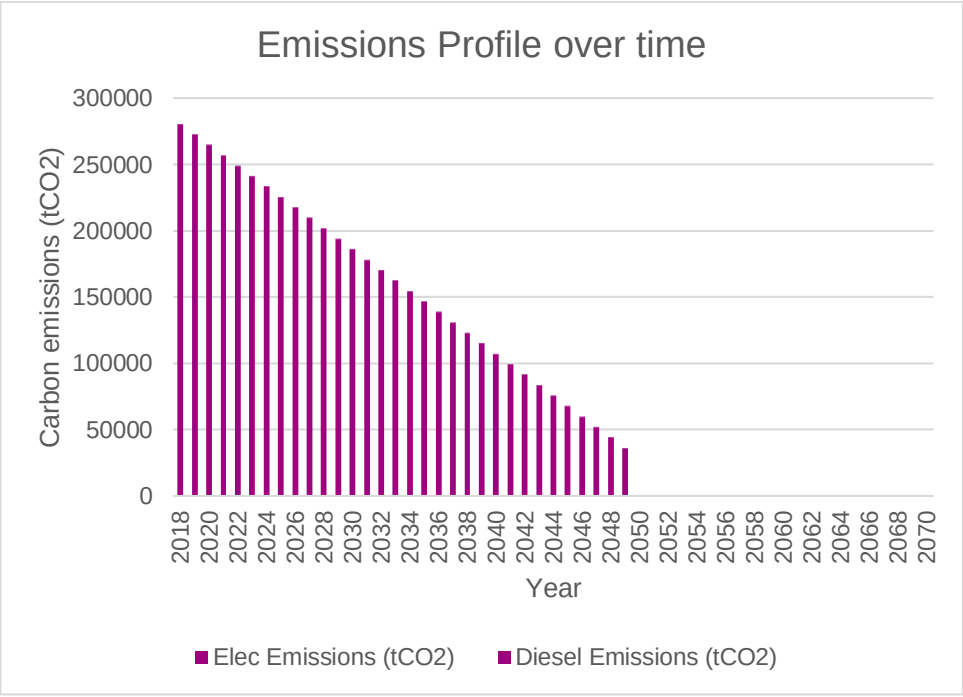

Figure 2 Emissions profile over asset life accounting for anticipated decarbonisation of NSW electricity grid

3.0 Sustainability Measures

The proposed development has incorporated Ecologically Sustainable Design (ESD) initiatives within its design, and proposed measures for construction and operation.

3.1 Resource Efficiency Measures

- Passive systems including high performance insulation to facility walls, ceilings and roofs, and high-performance glazing to occupied spaces
- High efficiency chilled water cooling system
- Variable speed drives on all chilled water and condenser water pumps
- Energy efficient LED lighting throughout the facility
- Sub-metering throughout the facility to help monitor and interpret energy consumption in operation and enable optimisation year-on-year
- Where practical, selection of materials with low embodied materials such as concrete with high proportion of substitute cementitious materials (SCM)
- Procurement of renewable energy supply agreements to provide a portion of total facility energy demands

3.2 NABERS Energy Rating

Based on the estimated design Power Usage Effectiveness (PUE) ratio, it is projected that the facility would be capable of achieving at least a 5 Star NABERS Energy rating for Data Centres.

3.3 Water

- High efficiency fixtures and fittings matching the highest WELS water efficiency labelling
- Sub-metering of major water uses and sources
- Collection of rainwater and treated stormwater with potential for reuse in cooling tower systems and/or toilet flushing and irrigation to be considered and added in the future. This is balanced against the economics of the phased fitout of datahalls as tenant demand increases over time.
- Collection of condensate from air handling systems to be considered

3.4 Landscape and Ecology

- For the main building green roofs were considered but not adopted due to risks related to water incursion which would compromise the security of IT and power equipment within the data halls. A green roof was however adopted for the elevated landscape structure over the driveway running along the northeastern face of the building. This structure would span the distance between the building itself and the retaining wall, but would not be attached to the building (to prevent water ingress).
- Limited opportunity for landscape exists onsite due to vehicular access requirements around the building

3.5 Management Practices

- Building commissioning and tuning undertaken against internationally recognised standards such as ASHRAE Standard 150 and CIBSE Code M
- Contractor requirements to implement a best practice environmental management plan and undertake all construction under an ISO14001 certified environmental management system

3.6 Transport

- Consider the inclusion of electric vehicle charging infrastructure with the inclusion of renewable supply to enable carbon neutral private transportation.