DECARBONISATION PATHWAY

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Canberra, ACT

1. EXECUTIVE SUMMARY

EG's Real Zero Strategy is targeting zero carbon by 2030 across the Delta portfolio. A Real Zero Carbon building matches all energy demand with the supply of carbon free renewable energy in accordance with the United Nations 24/7 Carbon Free Energy Compact, of which EG is a proud member.

EG worked with built environment experts Buildings Alive to create these bespoke decarbonisation pathways for each asset and has since partnered with EGX climtech Avani to deliver these ambitious, market leading pathways.

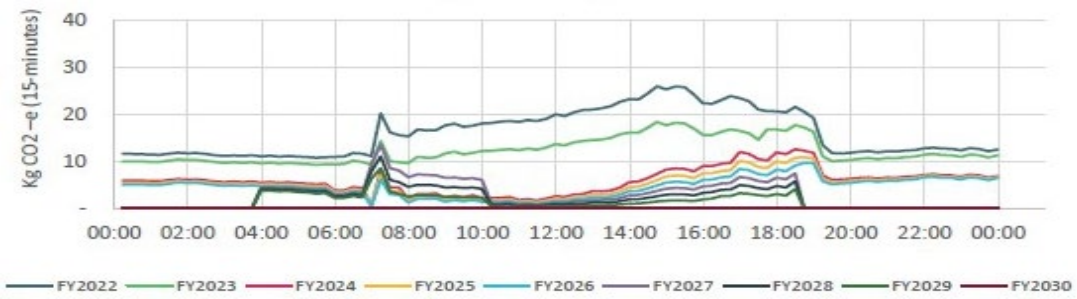
These pathways are;

- Credible - emissions reductions should be "real" and beyond question
- Accountable - progress should be measurable, measured and reported
- Commercial - maximise investment opportunity / minimise operating costs
- Future-ready - thinking ahead
- Recognised - aligned with emerging frameworks
- Practical - applied and in 'action' rather than theoretical
- Targeted - within the boundaries of organisational control
- Timely - this is the 'decisive decade' and EG can display leadership

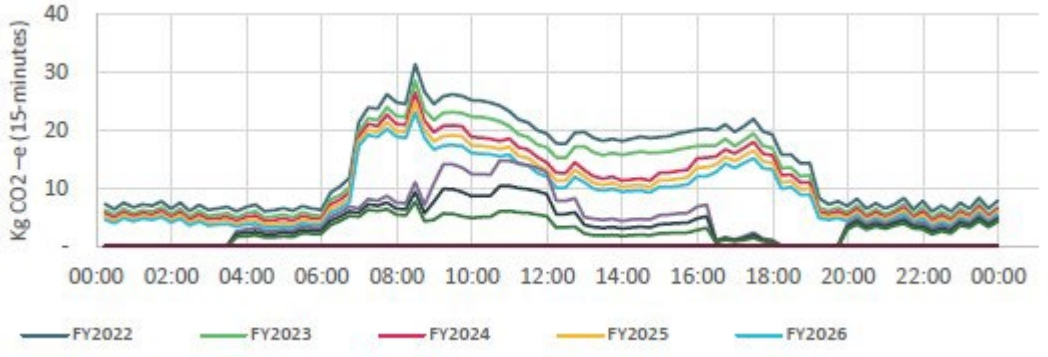
A high-level analysis was conducted to generate a potential decarbonisation pathway for East Block St based on near real-time grid carbon intensity. The below plots indicate potential decarbonisation pathways on a summer and winter's day targeting FY30 to achieve Real Zero for Scope 1 & 2 site energy emissions.

If measures on the following page were implemented, in FY30 around 4% of emissions remain to be addressed through time-matched electricity procurement.

Summer Day – Resulting Carbon Profile



Winter Day – Resulting Carbon Profile



1. EXECUTIVE SUMMARY SUMMARY OF MEASURES

Summary of Measures	Timing
Baseline Year Energy Carbon Emissions (NGA)	FY22
Undertake **Real-time Grid Carbon Measurement**. Emissions reduce in line with grid decarbonisation	FY23 onwards
Energy Efficiency • Optimisation of existing systems • BMS control optimisation for chilled water and hot water loop • Lighting upgrade	FY23 onwards FY23 FY24
Electrification Replacement of heating hot water gas boiler and domestic hot water systems with heat pumps	FY27
Demand Flexibility Implement automated demand / response strategies based on building / carbon profile forecasts	N/A
On-Site Renewal Energy Stage 1 - A 99.9 kW system to be installed	FY24
On-Site Battery Storage A 230kWh battery in 2027 could remove 12% of remaining emissions on a Summer's day, 16% on Winter's Day	FY27 (or sooner)
Off-Site Renewable Energy Energy procurement of time matched power purchase agreement for removal of remaining emissions	FY30 (or sooner)
Resulting Real Carbon Emissions	**0 kg CO_2 –e pa**

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2. SITE OVERVIEW EAST BLOCK, CANBERRA

This report is a "Real Zero" decarbonisation pathway document for East Block based on Buildings Alive's analysis conducted in Nov 2022. It assesses the potential contribution of various strategies to a FY30 Real Zero Carbon target for the building.

This assessment is based on documentation provided and various assumptions as stated. It follows procedures as set out in "220913 Zero Carbon Roadmap Methodology - EG Funds“

Basic Building Details

- NLA 4,958 sqm mixed use offices and houses the National Archives of Australia
- NABERS Rating - Currently targeting a 4.5 Energy Rating
- 97.5% occupied at time of report

Energy Source (Base Building)

- Grid Import (Electricity)
- Grid Import (Natural Gas)
- No diesel generator (There is no back up power generator at the site)

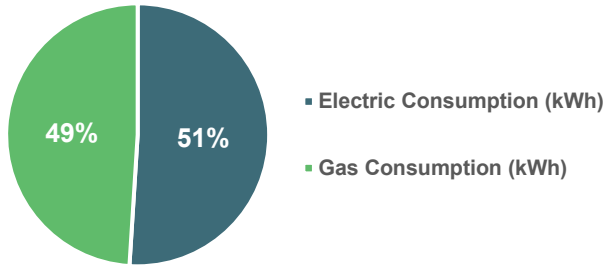
The scope of this assessment includes Scope 1 & 2 direct emissions. EG is committed to exploring collaborative opportunities with tenants to measure the carbon footprint of their energy use in real time and reducing it to Real Zero by 2030. It is EG's intent that these Scope 3 emissions (the carbon emissions resulting from tenant energy use) be included within EG's target in the future.

3. SITE ENERGY SOURCES / EMISSIONS

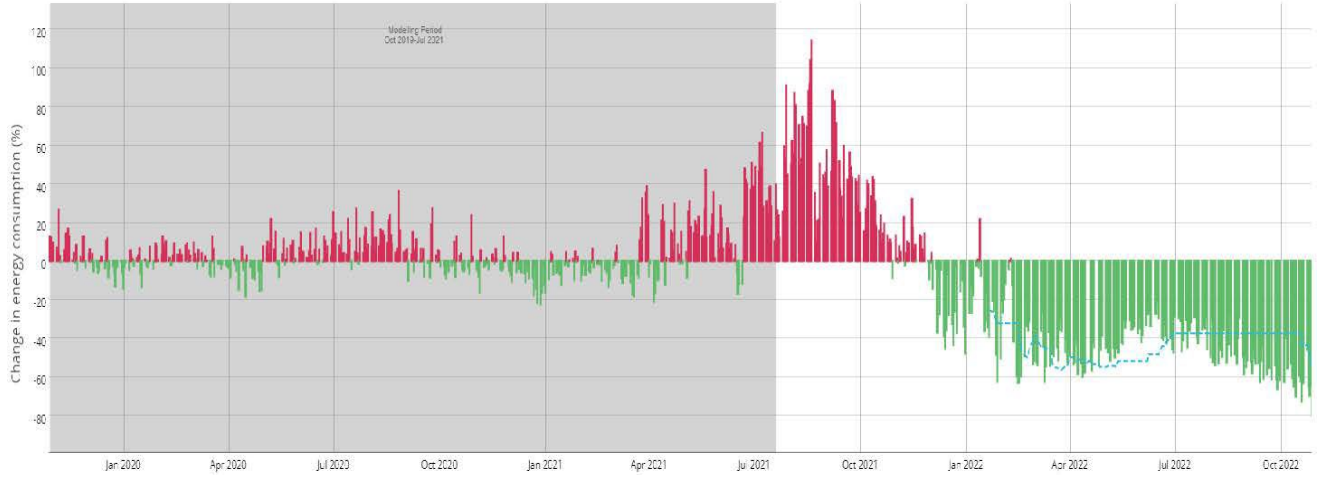
For this analysis, a baseline year of FY22 has been selected based on analysis of past several years of operation.

- Baseline year energy split is 49% gas (2,331,023 MJ)* and 51% electricity (676,454 kWh).
- Scope 1 & 2 energy emissions for the baseline year were 654,213kg as calculated using NGA factors.
- By measuring emissions utilising actual interval level carbon intensity of the electricity grid, baseline year emissions would have been 593,201 kg, 9.3% lower.

FY22 Baseline Year Energy Consumption



Buildings Alive REF Building Performance Tracker - Model baseline year in grey, baseline year for study in blue



FY22 Site Energy Emissions – NGA vs Measured

4. DECARBONISATION PATHWAY

4.1 ENERGY EFFICIENCY OPTIMISATION

Overview

Most buildings are not fully optimised based on the control systems and equipment currently in place. If these systems run at their optimum every day, significant savings can be made.

Initiative

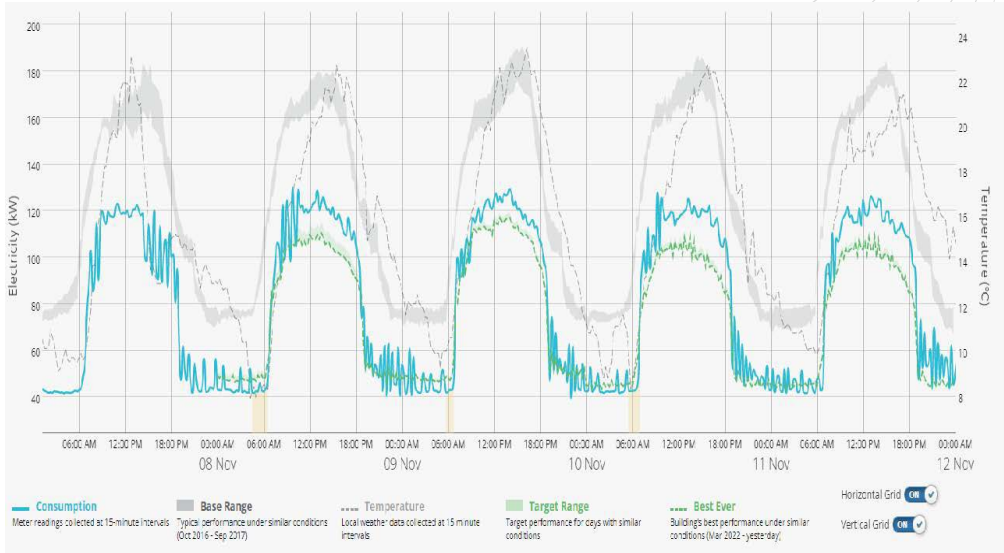
The Rapid Efficiency Feedback (REF) service provided on site by Buildings Alive provided estimated potential savings made from operating the building at its best every day and calculates a "Target" profile that the building should be striving to achieve. This feedback is utilised by the building operators to tune and optimise the existing control strategies on site.

EG continues to investigate further energy efficiency opportunities across the asset, striving to reach peak performance.

Results

Energy Savings of 10% on Summers Day and on Winters day are possible.

This figure shows an example week for this building where potential performance ("Best Ever") is compared to actual consumption



4.1 DECARBONISATION ENERGY CONSERVATION MEASURES

Overview

The review has found several Energy Conservation Measures (ECMs) which can be implemented to save further energy beyond optimization of existing systems.

With real-time carbon intensity measurement Energy Conservation Measures (ECM) will have different decarbonization impacts at different times.

This figure shows a summary of Energy Conservations measures assessed using traditional energy / cost methods.

ECM Description	Electricity Saving PA (kWh)	Energy Cost Savings PA ($)	Implementation Cost ($)	Simple Payback (Years)	Simple ROI (%)	Annual Energy Savings (%)
1. **BMS controls upgrade (replace old field contollers)**	13,191	$2,190	$10,000	4.57	22%	2%
2. **Lighting upgrade**	105,527	$17,517	$165,000	9.4	11%	16%

4.2 ELECTRIFICATION

In order to remove all Scope 1 emissions from site, all gas end uses need to be electrified.

Natural Gas Boilers

- Used to produce heating hot water distributed to hot water coils throughout the building.
- 2 x 468 kW capacity, 2400 MJ/HR consumption each.
- 13 years old, nearing end of life (assumed lifespan of 20 years)[1].

Consideration was given to existing equipment condition, current control strategy, occupancy rates and thermal comfort levels. To eliminate the gas usage for Heating Hot Water (HHW), decommissioning gas boilers has been considered.

Replace with heat pump (FY27)

- Significant capital spend required for project.
- Requires preliminary field testing to determine optimum supply temperature and subsequent additional equipment if any.
- Estimated required space for a replacement 260 kW heat pump is 6m^2.
- Most energy/carbon-efficient option.

Replacing gas boilers with a heat pump would add around 400 kWh electricity use to the example Winter day. In FY27, this would result in a real carbon reduction of around 219 kg of emissions daily. In FY30, due to continued grid decarbonisation, this saving is likely to increase to 297 kg.

Thermal storage tank to offset overnight heating load

The estimated electrical heating requirement between 7AM - 9AM is 445 kWh of electricity assuming a heat pump has been installed. If this load is offset completely by the hot water storage tanks and shifted to later in the day, then this will provide an emissions saving of 23 kg of carbon in 2030.

The estimated tank capacity required to allow for thermal shifting over night would be close to 12,000 litres. The tank would be charged during periods of low grid-intensity carbon and excess solar during the morning.

Natural Gas Domestic Hot Water (DHW) Heaters

Used to produce domestic hot water distributed to restrooms through the building.

- Annual gas usage of 60,000 MJ
- Opportunity to replace with heat pump hot water systems at end of lifecycle.

4.3 DEMAND RESPONSE LOAD FLEXIBILITY

Overview

The ability to shift building load from periods of high carbon intensity to adjacent periods of lower grid carbon intensity is key to delivering an optimised daily profile and minimising total emissions.

This will require controls optimisation based on a provided signal. If decided to go ahead with load flex, notable controls strategies which can be automated on the building-side to achieve this function have been identified here.

Significant emissions savings will be achieved through utilising the thermal hot water storage to offset the heating load in the morning in a process such as the one below:

Thermal Storage Tank Control Sequence

Between 7AM-9AM

- Switch to Discharge mode
- Operate pump in recirculating mode only utilizing stored hot water

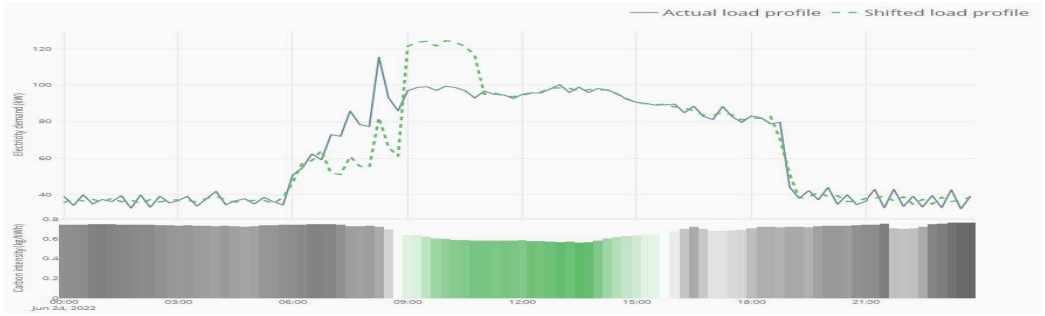
9AM – 11AM

- Switch to Charge mode
- Fully engage the heat pump to satisfy the heating requirement.

Discussion

However, due to sensitive nature of the building operation and as it houses the National Archives of Australia, load flexing needs to be carefully considered prior to implementation.

0.5% savings by shifting 30% load (24/6/2022)



4.8% savings by shifting 30% load (2030 grid)

4.4 ON-SITE RENEWABLE ENERGY SOLAR PV

Overview

On-site Solar PV is currently a very cost-effective form of energy. It has it's highest carbon impact the earlier it is implemented because as the grid decarbonises, its impact is lessened. Therefore, it is recommended to install it early in the decarbonisation journey.

Initiative

The site was assessed for potential rooftop Solar PV install.

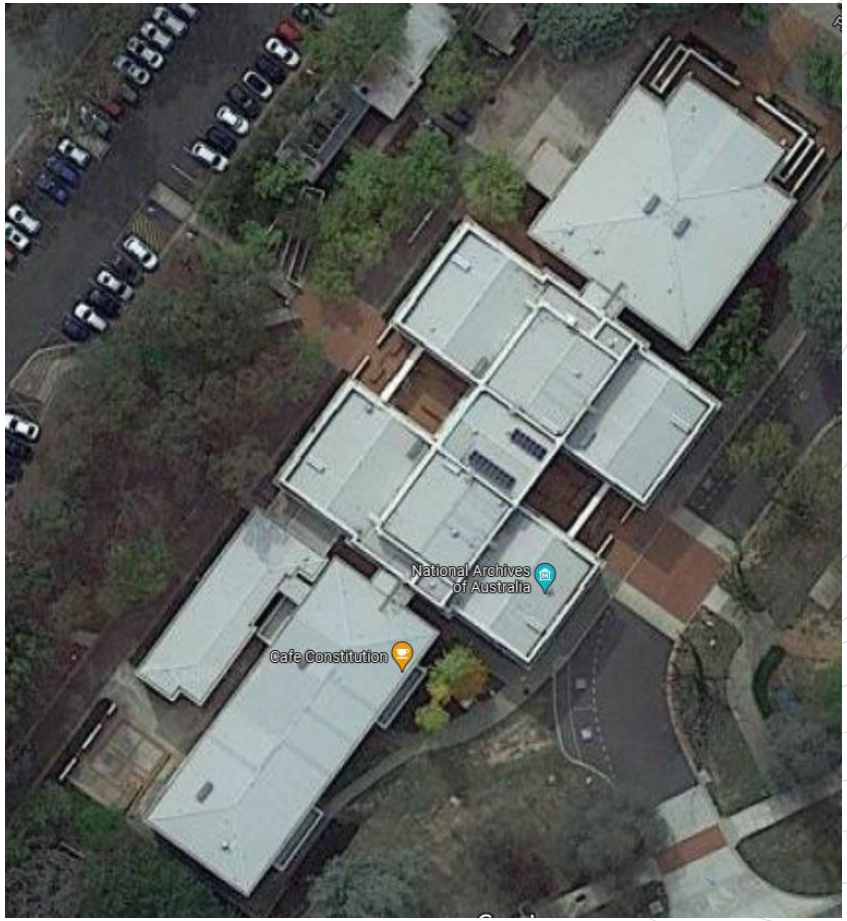
- There is ample roof space for Solar PV at this site. With a building footprint is approximately 2,600 sqm, it is likely that up to 75% of roof space suitable for Solar PV. Note that some roof space may be needed for plant associated with electrification.

Results

- Maximum installed Solar PV size would be 170 kW approx. This would yield approximately 236,300 kWh per annum or 35% of electricity consumption in the baseline year FY22.
- A 99.9 kW PV array is suggested at the initial stage that could be expanded to the maximum capacity later.
- The inspections show that there is minimal restrictions with shading for this site.

Rooftop view showing large potential for Solar

https://www.google.com/maps/place/Kings+Ave,+Canberra+ACT+2600/@-35.3049093,149.1304324,127m



4.5 ON-SITE ELECTRICAL STORAGE

Overview

An basic assessment of the potential for electric storage on site was conducted. Note that the ultimate mix between site-battery / electricity procurement / EVs will be determined later in the decarbonisation process.

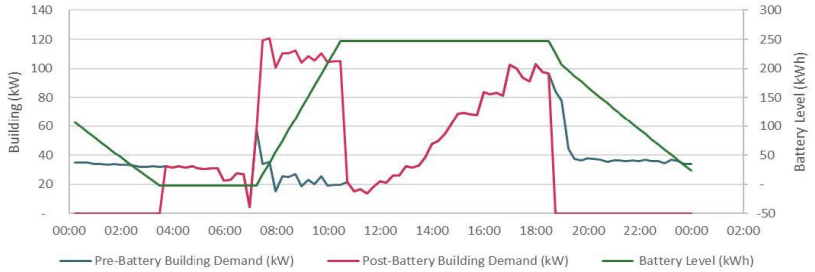
Battery Storage

- There is potential to integrate a sufficient battery system to enable greater demand flexibility include electrical peak demand reduction and load shifting for carbon optimisation.
- If a 230 kWh battery was installed, in FY30 it would likely be able to save 12 - 17% of the remaining emissions and would occupy approx. 6 m x 4 m space. This would be in the order of $220k at current battery prices.

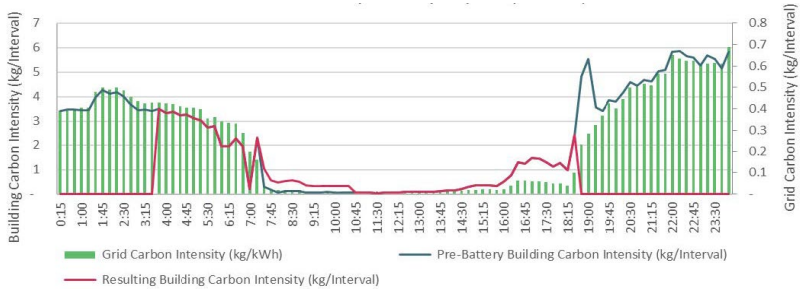
Electric Vehicles (EVs)

- Over coming years increasing amounts of EVs will be increasingly common. Evs will eventually be a potential resource to assist with decarbonisation if they are managed intelligently. Specific modelling of EV charging / discharging has not been included in this report, but eventually they may help reduce the size of onsite battery storage / off-site renewable energy procurement required.
- Consideration for charging infrastructure should be incorporated into building CapEx planning.

2030 Summer Day Battery Impact (Electrical)



2030 Summer Day Battery Impact (Carbon)



Example SOkWh battery installation

(https://www.teslaratj.com/tesla-largest-powerwallinstallatjon-goes-Hve/)

4.6 OFF-SITE RENEWABLE ENERGY

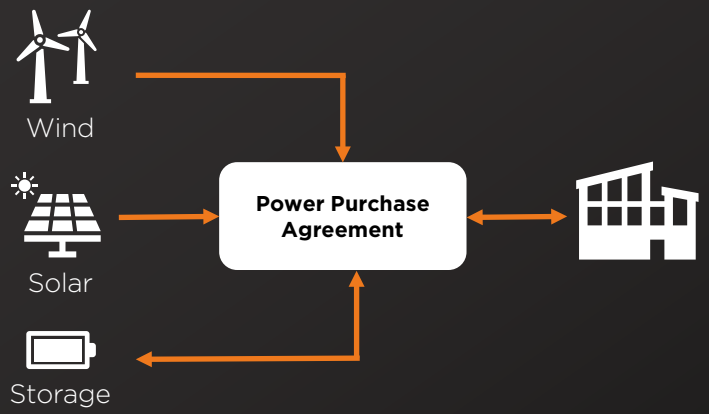
Remaining Scope 2 emissions which are not eliminated through any of the previous measures need to be removed through procurement of time-matched renewable energy.

The ultimate mix between on-site storage and timematched renewable energy procurement will be determined later in the pathway as the full impact of other decarbonisation measures are measured.

Power Purchase Agreements (PPAs) have been a common form of procuring renewable energy on a non-time-matched basis. Increasingly, time-matched PPAs are available and there are new purchasing models being rapidly developed to serve this emerging market[1].

Another potential approach is to measure / share excess energy (renewables / batteries) between sites within the fund and use this to help reduce overall emissions.

Power Purchase Agreement (PPA) representation needs to be time-matched



Peer-to-peer granular energy sharing

1 https://cloud.google.com/blog/topics/sustainability/a-new-clean-energy-purchasing-model-to-drive-decarbonization

4.7 OTHER SCOPE 1 EMISSIONS

Additional emission sources considered part of Scope 1 emissions.

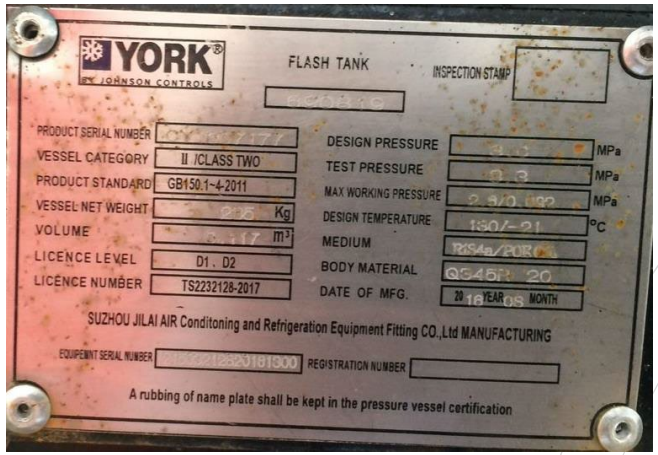
Refrigeration Equipment

- Minimal - a small amount of packaged HVAC units supply areas such as BMS office in plantroom, computer room in basement and lift motor room.
- It is recommended that existing standalone systems are replaced with lower Global Warming Potential (GWP) alternatives as they reach end of life.

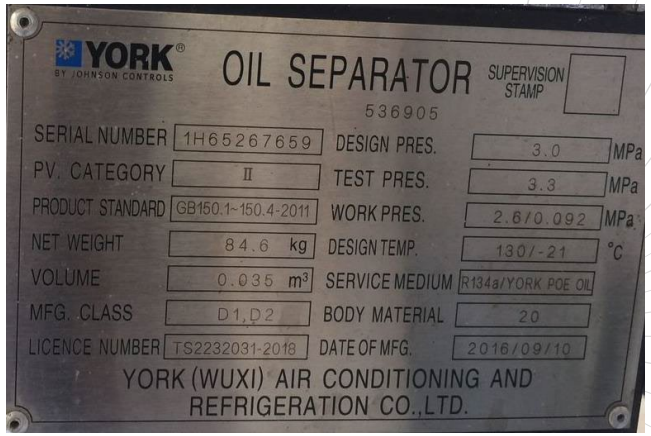
Chiller Refrigerant

- 2 x York air-cooled screw chillers producing chilled water for cooling.
- Refrigerant R134a in both chillers.
- R134a is a potent greenhouse has with a GWP of 1,430 x carbon dioxide.
- There may be the opportunity to retrofit these with a low GWP refrigerant alternative subject to manufacturers recommendations.

High Load Chiller



Low Load Chiller



5. CAPEX AND ADDITIONAL CONSIDERATIONS

For cost-effective decarbonisation, key building lifecycle milestones have been considered and these have been aligned with decarbonisation interventions where possible.

BMS controls upgrade

- Upgrading the controllers and optimising the controls and the strategies in the new BMS to maximise the benefit from the investment.
- Incorporate sub-metering capabilities to gain NABERS compliance.

Lighting upgrade

- There is a combination of fluorescent lights, LEDs and other lights used for exhibits in the building.
- It is recommended that an upgrade be undertaken to ensure all lights are efficient LEDs with appropriate controls (e.g. motion controlled where suitable).

Decommissioning of the domestic hot water tank

- This upgrade should include the addition of point-of-use heaters on the individual floors and the decommissioning of the central gas heater serving the domestic hot water requirement.
- This will eliminate the additional gas usage and realise marginal energy savings.
- Recommended to be included as part of the electrification in FY27.

Initiative	Included in Existing CapEx plan?	Included in ECMs identified	Planned works period
BMS controls upgrade (replace old field controllers)	Yes	Yes	FY23
Lighting Upgrade	Yes	Yes	FY24
Decommissioning of the domestic hot water tank (gas)	No	Yes	FY27

6. CONCLUSION

EG's Real Zero Strategy is an ambitious, market leading approach to realise real zero carbon across EG's Delta Portfolio

EG is proud to have worked with industry experts Buildings Alive and Avani along this pathway, and will report on progress in EG's annual ESG Report, as well as in Delta Fund Quarterly Reports.

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