CN1.2 2030 Transition Plan for NUS Yusof Ishak House

1. Introduction

This report outlines the strategies and actions for NUS Yusof Ishak House to achieve the objectives of the CN1.2 2030 Transition Plan under the BCA Green Mark 2021 framework.

Sustainability is a core principle driving the renovation efforts, and this transition plan leverages the renovation to position Yusof Ishak House as a model for energy efficiency and carbon neutrality. The building's strategies will focus on reducing both Scope 1 (direct emissions) and Scope 2 (indirect emissions from purchased electricity) emissions, as part of a Whole Life Carbon (WLC) approach.

2. Overview of NUS Yusof Ishak House

The Equatorial Student Commons, Yusof Ishak House, at the National University of Singapore (NUS), is a NetZero Energy adaptive reuse project that revitalizes a key icon from the original 1970s campus master plan. Named after Singapore's first President, Yusof Ishak, the building serves as a vibrant social and cultural hub for students, staff, and visitors.

Nestled among the lush, jungle-like slopes of Kent Ridge, the building's terraced form harmonizes with the natural landscape. The adaptive reuse and redesign project, from 2020 to 2025, places a strong emphasis on preserving the original heritage structure while incorporating sustainable architectural strategies to meet net-zero energy goals through conservation, sustainability, and decarbonization.

One of the standout features of the redesign is the transformation of the six original vaulted arches into climatic devices that channel hot air through the building, creating a naturally ventilated atrium at the core. This atrium's porous screened clerestory and perforated sunscreen act as a thermodynamic "lung," facilitating natural airflow through the stack effect, low-speed fans, and thermal buoyancy—thereby reducing the need for mechanical ventilation.

The vault motif extends beyond the atrium, influencing the design of the student dining area, and enhancing the connection between interior study spaces and the surrounding natural environment. The building's external facade features fluted precast panels and perforated vertical fins, which reinterpret the original horizontal striations, providing both solar shading and privacy, and helping to unify the expanded architectural form.

By preserving and enhancing the original concrete structure, the project exemplifies the concept of "carbon heritage," a dynamic process that aligns conservation with modern decarbonization goals. This approach ensures the preservation of the building's legacy while extending its carbon investment, making the architecture climate-resilient and responsive to the needs of future generations.

The design has already received accolades, winning the Holcim Foundation Award for Sustainable Construction (bronze) in 2023. The building obtained TOP in March 2025 and is

operational since October 2025, showcasing a balanced integration of heritage conservation and sustainable architecture.

3. Carbon Baseline and Renovation Insights

A baseline carbon inventory will be conducted to assess the building's carbon footprint across the following three key phases:

- **Embodied Carbon:** Carbon emissions associated with the materials and construction processes used during the renovation.
- **Operational Carbon:** Carbon emissions associated with energy consumption during the building's day-to-day operations (e.g., electricity, cooling).
- **End-of-Life Carbon:** Projections for emissions related to future demolition or repurposing of the building.

This baseline assessment will provide crucial data for guiding the transition plan, ensuring specific, measurable carbon reduction targets are set as the building works towards achieving net-zero carbon operations by 2030.

Energy Consumption Before Renovation

Before renovation, the annual energy consumption of Yusof Ishak House was 2,216,000 kWh in 2017, which decreased over the subsequent years to 2,084,428 kWh in 2019. This historical data below provides the foundation for the transition plan and will allow for a comprehensive comparison between past energy use and the anticipated energy savings post-renovation.

Year	Energy Consumption (kWh/year)	EUI (kWh/m²/year)
2017	2,216,000	185
2018	2,142,174	179
2019	2,084,428	174

In addition to the building's energy consumption, the canteen at Yusof Ishak House uses LPG (Liquefied Petroleum Gas), which contributes to the building's carbon emissions (Scope 3). The estimated LPG consumption is 240.36 m^3/month withan annual carbon emissions output of approximately 4,560 kg CO2e. Since the canteen operates within tenanted spaces[1], emissions associated with LPG consumption are typically categorized as Scope 3 emissions under GRI (Global Reporting Initiative) standards, as the tenant controls the LPG usage. This classification is in alignment with GRI reporting requirements for tenant-controlled activities.

Energy Consumption After Renovation

The estimated energy consumption after renovation is based on energy efficiency improvements, integration of renewable energy (solar power), and reduced reliance on mechanical systems. The reduction in Energy Use Intensity (EUI) is outlined in Section 5.

4. Transition Plan Strategy (Achieving Net-Zero Carbon by 2030)

The transition plan will focus on achieving net-zero carbon emissions by 2030 through the following strategies, implemented during and immediately after the renovation process:

Scope 1 and Scope 2 Emissions:

It is important to clarify that the building does not incur Scope 1 emissions. Any gas consumption from the canteen is managed and supplied by the tenants, and therefore falls under Scope 3 emissions, outside the direct control of the building management.

In contrast, Scope 2 emissions are associated with the electricity consumed by the building, which remains the primary source of indirect carbon emissions in the building's operations. This distinction will guide the development of the transition plan, ensuring that efforts are focused on reducing Scope 2 emissions, primarily through energy efficiency improvements and the integration of renewable energy sources.

Phase 1: Immediate Actions (2022-2025) – During Renovations

- **Energy Efficiency Enhancements:**
    - The renovation prioritized the installation of energy-efficient systems, such as high-performance LED lighting, hybrid cooling and energy-efficient appliances.
    - Building management system have been integrated to monitor and optimize energy usage in real-time, ensuring optimal performance.
- **Renewable Energy Integration:**
    - Solar panels have been installed on all available roof space[2] to provide renewable energy for the building's operations. The goal is to cover the building's energy demand from renewable sources.
    - The estimated on-site solar power generation was calculated to determine how much of the building's electricity consumption would be offset by this renewable source. This will reduce reliance on grid electricity and minimize the building's carbon footprint.
- **Low-Carbon Materials and Construction Techniques:**
    - Sustainable, low-carbon materials were incorporated throughout the renovation process to minimise emissions associated with the construction phase. These materials have been carefully selected based on their profiles.

Phase 2: Operational Optimization and Net-Zero Carbon Achievement (2026 onward)

- **Improving Energy Efficiency:**
    - Operational energy systems will be optimized for net-zero performance. This includes advanced insulation, high-efficiency building systems, and continued integration of renewable energy.
    - All energy-consuming systems will be configured to minimize operational energy use, ensuring that the building meets its net-zero carbon target.

- **Tenant Engagement and 100% REC offset programs**
    - Strict enforcement of Green Lease Agreements and initiate 100% REC offset programs through qualified electricity retailer during the new lease agreement negotiation
    - Target Benchmark: Offset total tenant electricity consumption through 100% REC program: EUI reduction target ~ 40 kWh/m²/year.

Phase 3: Continuous Improvement and Long-term Sustainability (2029 and beyond)

- **Continuous Monitoring:**
    - A robust monitoring system will be implemented to track real-time energy consumption, operational carbon emissions, and renewable energy generation.
    - The building will undergo annual sustainability audits to ensure continued progress toward maintaining net-zero carbon status.
- **Increase renewable generation**
    - **Increase onsite generation of solar photovoltaic with the deployment of high efficiency BIPV panels and semi transparent panels**

5. Estimated Energy Consumption and Carbon Offsetting

The following table summarizes the estimated energy consumption for Yusof Ishak House (YIH) post-renovation, including energy consumption for various building systems and the expected energy offset from on-site solar power generation. This projection demonstrates how solar energy will offset the building's electricity demand and help achieve net-zero carbon status.

End Use	2026 Consumption (kWh)	EUI (kWh/m2/year)
Total Building Consumption	1,324,919	105.10
Tenanted Space	501,924	39.82
Other CS Spaces	46,672	3.70
Canteen (Lighting, Ventilation, Cooling)	126,404	10.03
Offices	197,418	15.66
Students Club Room	46,250	3.67
EMSB (WC, lift, Fire)	124,929	9.91
Rest of Spaces (common & MPR etc)	281,322	22.32
Solar PV generation (used within)	-591,868	-46.95
Solar PV generation (exported)	-79,592	-6.31
Main Meter Consumption (imported)	**-812,643**	**64.46**
Net Consumption	733,051	58.15

The total annual energy consumption for the building for 2026 is 1,324,919 kWh/year. The solar PV generation is projected to be 591,868 kWh/year, which offsets the energy consumption of the building, leading to a Net energy consumption of 733,051 kWh/year. The Energy Use Intensity (EUI) without PV is 105 kWh/m²/year, while the EUI with PV reduces to

58.15 kWh/m²/year, reflecting a significant reduction in energy consumption due to renewable energy generation.

6. Implementation Timeline and Milestones

Milestone	Target Date	Action Plan
Carbon Inventory Completion	2025 (Completed)	Conduct baseline WLC carbon inventory after renovations
Energy Efficiency Installations	2023-2025 (Completed)	Upgraded air-conditioning system, lighting, and other systems during renovations
Solar Panel Installation	2023-2025 (Completed)	Install solar panels on building roof
Building Management System Implementation	2023-2025 (Completed)	Fully integrate system for energy monitoring and optimization
Operational Optimization and Audits	2027 – 2030	Optimize building systems and conduct annual sustainability audits
Stakeholder Engagement and Behavior Programs	2026 - 2030	Promote tenant participation in reducing reduce Scope 3 emissions
Carbon Offsetting Initiatives	2028 - 2030	Implement carbon offsetting programs for residual emissions
Net-Zero Energy Achievement	2030	Achieve net-zero energy status

7. Monitoring and Reporting

To ensure ongoing progress toward net-zero emissions, the following monitoring and reporting protocols will be implemented:

- **Real-Time Monitoring:** Continuous tracking of energy consumption and carbon emissions through the building management system.
- **Annual Progress Review:** A yearly review to assess the building's performance against net-zero targets, adjusting strategies if needed.
- **Public Reporting:** An annual sustainability report will be produced, detailing the building's progress toward achieving net-zero carbon emissions.

8. Conclusion

The NUS Yusof Ishak House 2030 Transition Plan outlines the whole life carbon strategy for the building to operate at net-zero carbon emissions by the 2030. The renovation efforts, which include energy-efficient systems, renewable energy integration, and the use of low-carbon materials, will position Yusof Ishak House as a leader in sustainable architecture.

This plan not only ensures that the building meets the BCA Green Mark 2021 CN1.2 requirements for net-zero carbon but also supports Singapore's broader environmental and sustainability goals. By incorporating innovative strategies during the renovation process and implementing a robust monitoring system, Yusof Ishak House will continue to serve as a model of adaptive sustainability for the NUS community and beyond.