

Sunway EcoSphere: The FET-Annex Net Zero Carbon Building

A Model for Sustainable and Effective Learning Environment

Welcome to Sunway EcoSphere — Sunway University’s flagship *Net Zero Carbon Building* initiative, a bold extension of the Faculty of Engineering and Technology (FET) building that redefines what a sustainable learning space can be. Designed to be more than just a building, EcoSphere represents a commitment to sustainability, innovation, and education.

Why it matters:

Although Malaysia contributes only 0.8% of global greenhouse gas emissions, the nation is steadfast in its pledge to achieve carbon neutrality by 2050 under the National Energy Transition Roadmap. Sunway Group, one of Southeast Asia’s leading conglomerates, has mirrored this commitment with its own Net Zero Carbon Emissions target by 2050, as outlined in the *Sunway Group Sustainability Report 2024 – Rising Beyond 50 Years*. At the academic forefront, Sunway University’s Sustainability Strategy 2030 aims to position the institution as a benchmark for sustainability among higher education institutions in the Asia-Pacific and developing world — with measurable targets to achieve *net zero by 2030*.

Spearheaded by the Faculty of Engineering and Technology (FET), the project is an embodiment of Sunway University’s integrated vision: uniting research, innovation, and sustainable construction to deliver a building that consumes less and *teaches* more.



About the Project

Sunway EcoSphere, is Sunway University's first Net Zero Carbon Building, purpose-built for academic and research excellence. Standing seven storeys tall and spanning over 60,000 square feet, EcoSphere expands the capacity of the university while serving as a *living laboratory* for the development and demonstration of sustainable technologies.

Designed with the guiding philosophy of “**decarbonization and achieving net zero through technology**,” EcoSphere exemplifies how innovative design, engineering and technology can creatively drive impactful environmental change. While the project recognizes the importance of proper architecture design, its true aim is to demonstrate that *any* modern building can potentially achieve net zero carbon through strategic integration of green technology.

EcoSphere houses a chemical engineering pilot plant, four civil engineering laboratories, two robotics labs, three cybersecurity and computer network labs, four architecture studios, and seventeen classrooms.

The project's approach is organized around three simple but powerful principles:

- **Sustainable material:** Green construction materials and methods that minimise construction carbon footprint (embodied carbon).
- **Passive Technologies:** Reduction of carbon emission through harvesting clean natural resources (rainwater and solar energy), utilising vertical surfaces as carbon sink, and pre-emptive thermal management using heat reflective paint.
- **Active Energy System:** Optimization of energy consumption through state-of-the-art energy recovery technologies, advanced chill water management, and AI-driven building automation system.

EcoSphere is a *development project* that brings together **12 dedicated work packages** headed by Dean of Faculty of Engineering and Technology, Prof Denny Ng Kok Sum. Each work packages led by faculty experts, researchers, students, and industrial partners working collaboratively toward one common goal: making net zero carbon a practical reality for future campuses and communities in tropical countries.



Vision and Objectives

The initiative proposes a framework for achieving Net Zero Carbon Building construction and operation in tropical climates, designed to prove that sustainability is not an ambitious dream, but an attainable reality through innovation, teamwork, and thoughtful engineering.

At its heart, the project carries a simple but profound message:

Net Zero Carbon is unlikely to be achieved by any single technology or individual — it takes collaboration across disciplines and stakeholders.

Architects, engineers, project managers, contractors, researchers, and end users all play a role in shaping a truly sustainable future.

The project follows a holistic approach, embedding a cascade of technologies and strategies across every layer of design, construction, and operation. While the challenge may seem complex, the initiative aims to demonstrate that when done correctly, achieving net zero is possible, replicable and scalable.

Core Objectives

1. **Achieve True Life-Cycle Net Zero Carbon:**

EcoSphere project targets complete life-cycle carbon neutrality within **18 years** by operating as a *net negative carbon building*, offsetting its embodied carbon through sustained low-carbon operations.

2. **Enable Research, Learning, and Teaching:**

Serving as the living lab for research and learning activities with collaboration with industries partners, it supports Sunway University's forward looking ecosystem of research, innovation, and education.

Long-Term Vision

Sunway EcoSphere leads the path toward Sunway University's Net Zero Campus 2030 target while aligning with both Sunway Group's Net Zero 2050 commitment and Malaysia's national Net Zero 2050 roadmap. Beyond campus borders, it aspires to inspire the wider region — demonstrating how tropical nations can adopt and adapt net zero principles effectively.

Work Packages

The framework comprised **12 Net Zero Carbon Work Packages (WPs)** led by professors, researchers, and students from across the **Faculty of Engineering and Technology** and other faculties at Sunway University.

Each work package addresses a specific dimension of the building's net zero journey — from materials and energy systems to digital innovation and social impact — reflecting the interdisciplinary nature of sustainability.

Sustainable Construction and Materials

– Green Concrete and Embodied Carbon Tracking (WP6)

Led by A/P Dr. Daniel Looi and Prof Ir. Mo Kim Hung, this work package focuses on the use of **low-carbon concrete** (60% GGBS blend) to reduce embodied carbon during construction. It integrates a **Level of Detail 500 BIM model** to track material usage and conduct detailed **life cycle assessments (LCA)** of the building's embodied carbon.

– Sustainable Construction Waste Management (WP8)

Led by Prof Ir. Ali Najah, this initiative implements an on-site **waste segregation and awareness program** among construction teams to ensure responsible disposal, material recovery, and overall waste reduction throughout the project.

– Construction Waste Upcycling (WP7)

Led by A/P Dr. Goh Yi Sheng, this team transforms construction waste into **upcycled furniture and fixtures**, demonstrating practical circular economy principles and minimizing landfill contribution.

– Sustainable Furnishing and Materials (WP12)

Led by Ts. Dr. Nicole and Ts. Wincen Foong, this package emphasizes the **selection of eco-friendly interior finishes, furnishings, and wayfinding materials**, reducing embodied carbon while maintaining function and aesthetics.

– Carbon Capture Coating (WP4)

Led by Dr. Mohd Azlan Kassim, in collaboration with Lancaster University, this innovative package explores **carbon-absorbing paints** that act as an indoor carbon sink, using vertical wall surfaces to passively remove CO₂ from indoor air.

Energy Efficiencies and Clean Energy Systems

– Cooling, Ventilation, and Water Systems (WP1)

Led by Prof Ir. Denny Ng, this team integrates **district cooling, rainwater harvesting**, and **air-conditioning heat recovery** to maximize resource efficiency. These systems work together to reduce water and energy waste while improving indoor comfort.

– Heat Reflective Coating (WP5)

Led by Dr. Kalidasan, this work focuses on applying **heat reflective paint** to external surfaces, lowering indoor temperatures and cutting cooling energy demand — a critical step in tropical net zero design, where cooling can represent up to **50% of a building's energy use**.

– Clean Energy and Battery Storage (WP2)

Led by Prof Hannan and Prof Ker Pin Jern, this package deploys **solar photovoltaic (PV) panels** with **battery energy storage systems (BESS)** to generate renewable electricity and maintain building power even during low sunlight periods.

AI Driven Intelligent Systems and Digital Innovation

– Building Energy Management System (WP3)

Led by Prof Ir. Ong Hwai Chyuan and Prof Ir. Rosdiadee Nordin, this team develops a **smart building automation system** integrating occupancy sensors, scheduling algorithms, and energy analytics to optimize power use, minimize waste, and enable autonomous environmental control.

– Digital Twin and Carbon Dashboard (WP10)

Led by Prof Angela Lee, this package creates a **Digital Twin platform** that visualizes the

building's real-time performance, combining data from the BEMS and BIM models. The dashboard serves both management and occupants — offering predictive maintenance, energy insights, and greater user engagement.

Carbon and Community Impact

– Total Carbon Life Cycle Assessment (LCA) (WP9)

Led by Ir. Dr. Ng Lik Yin, this team consolidates the project's embodied and operational data into a comprehensive **total carbon LCA**, establishing the foundation for verifying EcoSphere's long-term **net zero carbon performance**.

– Social Awareness and Behavioral Change (WP11)

Led by Prof Santha Vaithilingam, this work package studies how people **perceive and engage with the concept of net zero** — exploring awareness, behavior, and the social adoption of sustainable practices. The insights will help design educational programs and engagement strategies for future green developments.





Back row from left: Prof Nishanth Chemmangattuvalappil, Dr. Robert Lim, Dr. Daniel Looi, Ir Lewis Tee, Prof Kheireddien, Ir Dr. Ng Lik Yin, Dr. Azlan Kassim, Dr. Ali Najah. Front row from left: Dr. Dalila, Prof Ir Denny Ng, Prof Angela Lee, Ms Afifah, with some members absent.

Partners and Collaborators

This Net Zero Carbon initiative is an academic–industry partnership built on collaboration, innovation, and shared responsibility. Anchored by the **Faculty of Engineering and Technology (FET)** at **Sunway University**, the project brings together experts from multiple disciplines, working hand-in-hand with leading industry players to design, build, and operate Malaysia’s first *Net Zero Carbon academic building*.

Academic Collaboration

At the university level, EcoSphere represents a cross-faculty initiative where professors, engineers, and researchers collaborate under a unified Net Zero Carbon mission.

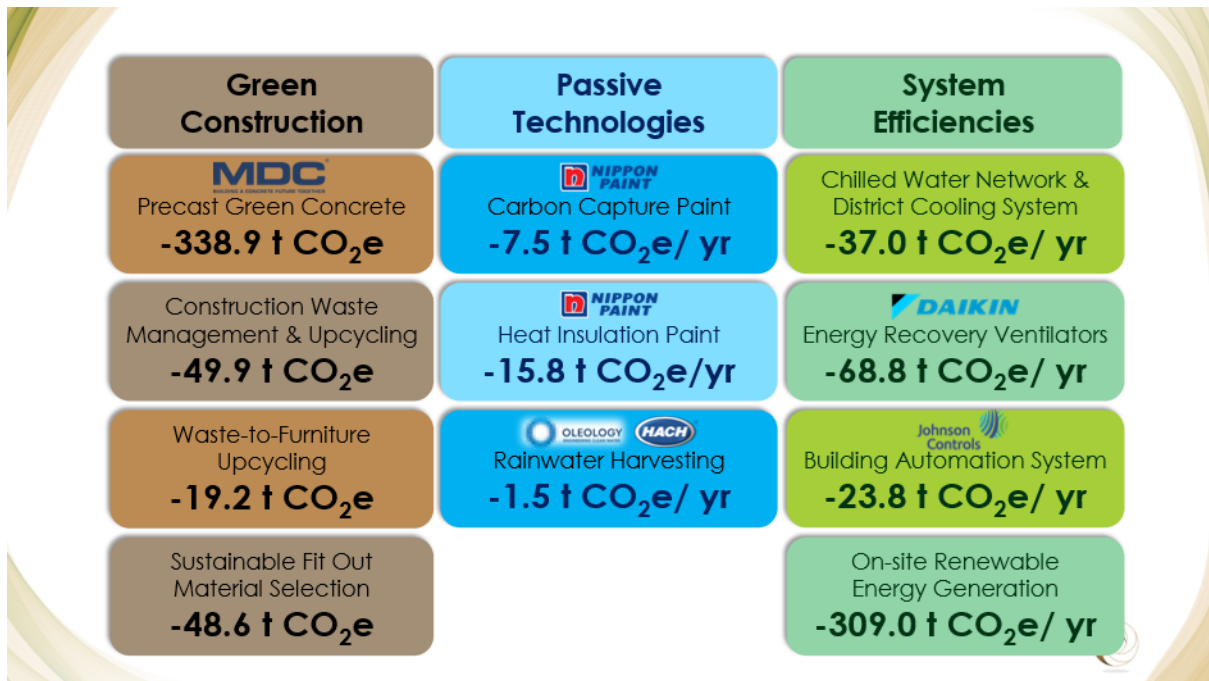
- **Faculty of Engineering and Technology (FET)** — Lead faculty overseeing building design, engineering integration, and project management.
- **Faculty of Arts and Social Sciences (FASS)** — Leading Work Packages 7 and 12 on **construction waste upcycling** and **sustainable furnishings**, infusing creative and human-centered design thinking into sustainability.

- **Institute of Global Strategy and Competitiveness (IGSC)** — Driving Work Package 10, studying **societal perception, policy implications, and strategic adoption** of Net Zero practices across industries and communities.
- **Lancaster University (United Kingdom)** — International collaborator for Work Package 4, advancing **carbon capture paint formulation** as viable carbon sinks.

Industry Partnerships

Each work package is strengthened by the participation of industrial partners who bring domain expertise and proven technology to the project:

- **WP1:** *Daikin Malaysia, Oleology* — advancing energy and water efficiency systems through district cooling, heat recovery, and water treatment innovation.
- **WP2:** *Industry partner in progress* — for solar PV and battery energy storage.
- **WP3:** *Johnson Controls* — implementing the Building Energy Management System (BEMS) for real-time monitoring, automation, and optimization.
- **WP4 & WP5:** *Nippon Paint* — supporting the development of carbon-capturing and heat-reflective coatings tailored for tropical applications.
- **WP6:** *MDC* — enabling low-carbon concrete innovation and embodied carbon tracking via advanced BIM modeling.
- **WP7:** *UPcycled Shack* — transforming construction waste into creative, functional furniture for reuse within the EcoSphere.
- **WP8, WP9, WP10, WP11, WP12:** *Partnerships in progress* — expanding to include emerging collaborators in digital systems, analytics, and sustainable design.



Shared Vision

EcoSphere demonstrates how collaboration between academia and industry can accelerate Malaysia’s journey toward Net Zero Carbon. By leveraging the strengths of diverse partners — from global technology providers to local innovators — the project showcases how integrated teamwork can deliver meaningful, measurable change.

Progress and Milestones

From concept to construction, **EcoSphere** has moved rapidly from research vision to physical reality. What began as an academic initiative to explore Net Zero technologies is now taking shape as a full-scale demonstration building — bringing Sunway University one step closer to a Net Zero Campus.

2024 – Concept and Foundation

Early 2024: The **Net Zero Carbon framework** was conceptualized by the Faculty of Engineering and Technology (FET), initiating research into materials, energy systems, and digital integration for tropical Net Zero construction.

August 2024: Groundbreaking marked the official start of construction for the **FET Annex Building**, setting in motion Malaysia’s first Net Zero Carbon academic facility.

2025 – Building the Framework

October 2025: Completion of **Phase 1 core and shell structure**, comprising the lower three floors that house the **Chemical Engineering Pilot Plant** and **Civil Engineering Laboratories**.

2026 – Integration and Operation

March 2026: Targeted completion of the **core and shell structure** for Phase 2, including the remaining upper floors, architecture studios, classrooms, and advanced technology laboratories.

Q2 2026: Scheduled **fitting-out and system commissioning** of renewable energy systems, building automation, and smart monitoring platforms.

June 2026: Targeted **operational launch** — FET-Annex begins active use as a living laboratory for research, teaching, and demonstration of Net Zero technologies.

Beyond 2026 – Toward Net Zero Campus 2030

The operation phase will serve as the benchmark for **Sunway University's Net Zero Campus 2030** initiative, providing measurable data, lessons learned, and replicable strategies to guide future campus developments.



Impact

EcoSphere represents more than a building. It was designed to advance Sunway University's commitment to sustainability, to demonstrate how research, education, and innovation can converge to achieve measurable impact in real-world contexts.

Environmental Impact

At its core, EcoSphere is built to **minimize carbon emissions** across its entire life cycle — from construction to operation.

- **Target:** Achieve *true life-cycle Net Zero Carbon* within **18 years**, using sustained net-negative operations to offset embodied carbon.
- **Embodied Carbon Reduction:** Through green concrete (60% GGBS) and upcycled materials, construction embodied carbon is expected to be **over 40% lower** than comparable conventional buildings.

- **Operational Efficiency:** Integration of district cooling, reflective coatings, and BEMS automation is projected to reduce energy use by **up to 50%**, supported by on-site solar generation and battery storage.
 - **Water Efficiency:** Rainwater harvesting and passive cooling systems reduce freshwater consumption and support sustainable thermal regulation.
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Academic and Research Impact

EcoSphere serves as a living laboratory for sustainability education and research.

- **12 interdisciplinary work packages** involve professors, researchers, and students from multiple faculties and international collaborators.
 - Enables real-time data collection for **Net Zero and Sustainability Engineering** studies, offering direct learning and research opportunities.
 - Provides a testbed for **digital twin, embodied carbon analytics, and predictive maintenance technologies**, connecting classroom theory with applied sustainability practice.
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Social and Institutional Impact

Beyond environmental performance, EcoSphere encourages a **cultural shift toward sustainability**.

- Strengthens collaboration between academia, industry, and government in the journey toward **Malaysia's Net Zero 2050** commitment.
 - Builds **awareness and literacy** about Net Zero principles among students, staff, and local communities.
 - Positions Sunway University as a **regional leader in sustainable campus development**, contributing to the broader national and global Net Zero discourse.
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Beyond Academics and Professionals: Students and Emerging Researchers

At the core of EcoSphere are also students — future engineers, architects, and sustainability professionals gaining firsthand experience in designing, monitoring, and optimizing a real Net Zero Carbon building.

Through active participation in research, data collection, and project implementation, they are learning not only *how* to build sustainably, but *why* it matters.

Join Sunway University as we revolutionize the local and regional construction industry to create a greener, cleaner, and more sustainable, net zero carbon planet.

Achievements

Brunei Crown Prince CIPTA Award 2025

The vision behind Sunway University's Net Zero Carbon Building is already inspiring real-world impact. At the Brunei Crown Prince CIPTA Award 2025, students from the Faculty of Engineering and Technology (FET) clinched the Silver Medal and 1st Special Mention Award in the ASEAN New Invention & Innovation Category.



The winning team at the Brunei Crown Prince CIPTA Award 2025

The winning team—Deaberniswarar Sharma A/L Ravindran, Andrea Tan Chiao Pin, and Ir. Lewis Tee Jen Looi—was mentored by Prof. Ir Denny Ng Kok Sum, Prof. Angela Lee Siew Hoong, Ts. Dr Nicole Fu Chew Xiang, and Ts. Wincen Foong Hock Kuen. Their project, inspired by the design and sustainability principles of Sunway’s Net Zero Carbon FET-LABS Annex Building, highlighted how “Green Innovations” can move from campus to community.

This achievement not only celebrates student creativity but also shows how the Net Zero Carbon Building serves as a springboard for innovation, empowering the next generation to turn sustainable ideas into award-winning solutions.

Net Zero Tech International Contest

The ripple effect of Sunway University’s Net Zero Carbon Building continues to inspire innovation beyond Malaysia. At the prestigious Net Zero Tech International Contest in Taiwan—organised by National Taiwan University, TECO Technology Foundation, and Taiwan’s Ministry of Education—Sunway University’s School of Engineering and Technology (SET) and School of Arts (SOA) team won the coveted Excellence Award.



Sunway University’s School of Engineering and Technology (SET) which now known as Faculty of Engineering and Technology (FET) and School of Arts (SOA) team at the prestigious Net Zero Tech International Contest in Taiwan

Competing against 64 teams from 13 countries, Sunway stood out as the only Malaysian team to reach the Top 20 Finalists. Their project, EcoSphere: A Model for Sustainable and Effective Learning Environment, drew inspiration from the sustainable design principles embedded in Sunway’s Net Zero Carbon Building. By translating these concepts into a holistic model for future-ready learning spaces, the team showed how sustainability can shape not only infrastructure but also education and community impact.

Led by advisors Prof. Ir Denny Ng Kok Sum, Prof. Angela Lee Siew Hoong, Dr Nicole Fu Chew Xiang, and Ts. Wincen Foong Hock Kuen, the project brought together students across PhD, Master’s, Bachelor’s, and Diploma programmes. Their success highlights how the Net Zero Carbon Building is more than a campus landmark—it is a catalyst for creativity, collaboration, and global recognition.

Project Team members:

Meet our leaders

SUNWAY ECOSPHERE: FET-ANNEX NET ZERO CARBON BUILDING



 <p>PROF DENNY NG Project Leader and WP1, Dean</p>			
 <p>IR LEWIS TEE Project Manager</p>	 <p>PROF M.A. HANNAN WP 2</p>	 <p>PROF ONG H.C. WP 3</p>	 <p>DRAZLAN KASSIM WP 4</p>
 <p>TS.DR. KALIDASAN B. WP 5</p>	 <p>A.P. DR DANIEL LOOI WP 6</p>	 <p>A.P. DR GOH YI SHENG WP 7</p>	 <p>A.P. DR ALI NAJAH WP 8</p>
 <p>IR DR NGLIK YIN WP 9</p>	 <p>PROF ANGELA LEE WP 10</p>	 <p>PROF SANTHA V WP 11</p>	 <p>TS. DR NICOLE FU WP 12</p>

Meet our team

SUNWAY ECOSPHERE: FET-ANNEX NET ZERO CARBON BUILDING



PROF NISHANTH. C
WP 1



PROF KER PIN JERN
WP 2



PROF ROSDIA DEE
WP 3



PROF MO K.H
WP 6



DR DALILA ALIAS
WP 1 & WP 3



DR KAREN KONG
WP 1 & WP 6



DR AKMAL ZAINI
WP 2 & WP 3



DR HAIZUM HANIM
WP 3



DR HAZIM KHIR
WP 5



DR ROBERT LIM
WP 6



TS. WINCEN FOONG
WP 12



NUR AFIFAH
WP 4



DINESHWARAN S.
WP 12