DRAFT

Universiti Malaya Net Zero Blueprint 2030

Prepared by:

UM Eco Campus & UM Sustainable Development Centre (UMSDC); 2024

CONTENTS

LIST OF FIGURES

ABBREVIATIONS

ABBREVIATION	TERM
ASPD	Academic Strategic and Planning Department
AVC (CS)	Associate Vice-Chancellor – Corporate Strategy Office
BEI	Building Energy Intensity
DVC (A&I)	Deputy Vice-Chancellor (Academic & International)
DVC (D)	Deputy Vice-Chancellor – Development Office
DVC (R&I)	Deputy Vice-Chancellor – Research & Innovation
DVC (SA)	Deputy Vice-Chancellor – Student Affairs
EPC	Energy Performance Contract
ESCO	Energy Service Company
EV	Electric Vehicle
FYP	Final Year Project
FSKTM	Faculty of Computer Science and Information Technology
GBI	Green Building Index
GHG	Greenhouse Gas
HEP	Student Affairs Department
ICT	Information Communication Technology
IRC	International Relations Centre
ILO	UM Industry Liaison Centre
JHB	Estates Department
JSM	Human Resources Department
JTM	Department of Information Technology
KIK	Innovative and Creative Group
KK	Residential College
KPI	Key Performance Indicator
MGBC	Malaysia Green Building Council
MPP	UM Student Council
PFI	Private Finance Initiative
RC	Responsibility Centres
PUE	Power Usage Effectiveness
RE	Renewable Energy
RFP	Request for Proposal
RU	Research University
SDG	Sustainability Development Goal
SEDA	Sustainable Energy Development Authority
SOP	Standard Operating Procedure
UM	Universiti Malaya
UMCIE	UM Centre of Innovation and Enterprise
UM SDC	UM Sustainable Development Centre
UM SVC	UM Sustainability Volunteers and Competencies Certification

WMP	Waste Management Plan

UM Net Zero Strategic Plan Vision & Mission

Genesis of UM-NZSP

Universiti Malaya main campus has grown over the past seven decades and matured into a thriving educational urban centre within Kuala Lumpur. Beyond the first decade of planned development following a winning master plan by BEP Architects & Planners, more buildings were added to the growing university campus to accommodate increasing number of students and staff. New faculties, research facilities and administrative offices were established and built. Save a few recently completed buildings, most buildings built in the 1970's, 80's and 90's were designed and built to fit practical purposes and did not consider aesthetics, as well long-term effects of building operations. Thus, it is more challenging now in maintaining buildings and infrastructures which not resource-efficient, straining the university financially while significantly contributing to the wider national carbon emissions. As per 2023, the yearly electricity bill stood at RM37,127,659, a hefty figure considering this is not inclusive of the Universiti Malaya Medical Centre's (UMMC) yearly electricity bill which is much higher than the main campus! This sizeable electricity bill has seen a marked increase from 2019 before the Covid-19 pandemic despite a substantial decrease during 2020 and 2021. Electricity consumption started to increase towards 2019 level in 2022 and surpassed it in 2023 (refer to Table 1).

Table 1: UM yearly electricity consumption

Year	Yearly electricity consumption (kWh/year)	Yearly electricity cost (RM)
2019	79,027,390	34,439,597
2020	57,405,050	24,311,328
2021	52,920,621	21,115,725
2022	67,533,428	30,493,936
2023	71,416,774	37,127,659

Similarly, water consumption grew in 2023 with a yearly bill of RM8,236,154.73 for 2,879,810 m^3 of consumed processed water[1]. Both resources amount to 55,705.08 kg/CO_2 MWh [2] of carbon emissions (electricity) and 1,618,453.56 kg/CO_2 m^3 [3] (water) without considering the amount of carbon emissions from sewerage treatment and municipal (and clinical) wastes processing outside the main campus. Determining the exact amounts will require close collaboration with external parties while UM strategizes to limit sewerage and wastes. Other uncontrolled carbon emitters are vehicles that use UM's main campus road network which conveniently connects Kuala Lumpur and Petaling Jaya.

The increase in student and staff numbers without having cleaner and efficient campus transportation system has exacerbated this situation over the past few decades. Disconnected clusters of buildings without proper shaded footpaths add to this conundrum that need urgent redevelopment strategies to curb carbon emissions from campus transport.

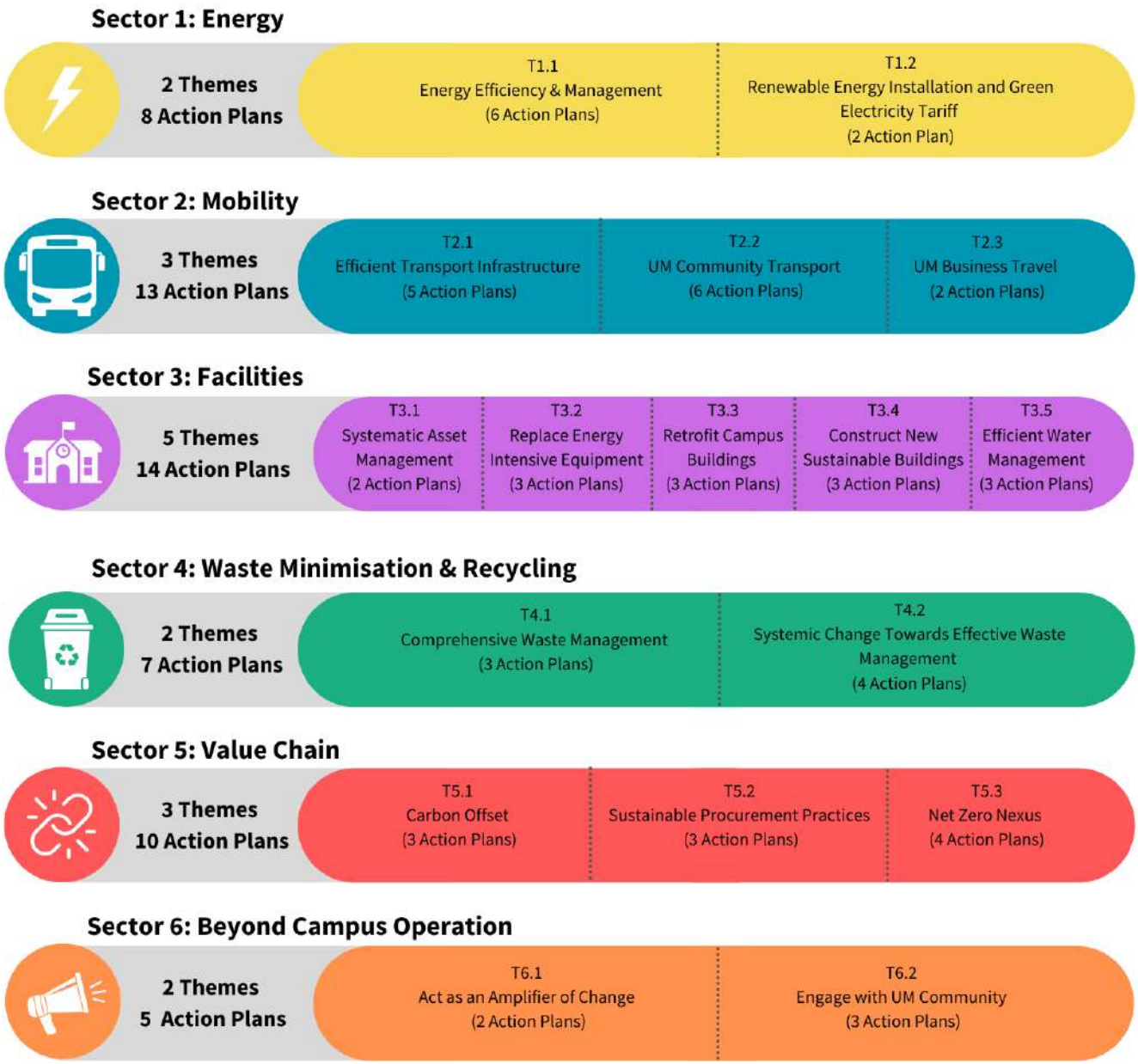


Figure 1: UM NZSP summary

At the same time, other universities within the Southeast Asian region have leapfrogged towards low carbon campuses through substantial capital investments and clever strategies for resource-efficiency. For instance, Universiti Teknikal Melaka (UTEM) received the National Energy Award 2021 and 2024 for its energy management system, while Universiti Sains Malaysia (USM) won a special award for its 'Advancing Sustainability with solar@USM' project[4]. Nanyang Technological University (NTU) has developed the largest PV development by a single entity in Singapore (9.8 MWp solar capacity) besides other remarkable achievements in resource efficiency[5]. Further, they constructed highly efficient state-of-the-art faculty buildings such as the Gaia and the Beehive by internationally renowned architects. The National University of Singapore also

strategized to limit their carbon emissions through a workable set of action plans covering physical developments and research[6], in line with internationally ranked institutions such as the Massachusetts Institute of Technology's (MIT)[7]. Thammasat University designed and built the largest urban rooftop farm in this region that not just provides shade, but a highly interactive and educational recreation space for the campus community and the wider public[8].

Therefore, in line with the Universiti Malaya Master Plan 2050, the 2015 Eco Campus Blueprint, the Malaysia Green Technology and Climate Change Corporation's Low Carbon Cities movement (which UM were one of the pioneering partners in 2011), the National Energy Policy 2022-2040, Kuala Lumpur Smart City Blueprint 2021-2025, Kuala Lumpur Low Carbon Society Blueprint 2030, the Universiti Malaya Net Zero Strategic Plan 2030 has been produced to face significant challenges that lie ahead. This document charts a defined direction towards a net zero and sustainable campus in line with the United Nations Sustainable Development Goals (UNSDG), thus excelling in the QS Sustainability Ranking and THE Impact Ranking. Many experts and various stakeholders within and beyond the campus community were engaged to realize this document which proposes six sectors (refer to Figure 1), in line with the globally accepted Sustainable Development Solutions Network's (SDSN) guideline[9].

Notes:

1 UM Estates Department. (2024). *Utilities*. Universiti Malaya. https://jpphb.um.edu.my/utilities

2 Calculation based on the Tenaga Nasional Berhad and Energy Commissions Malaysia electricity supply carbon emission intensity for 1MWh = 0.78 $kgCO_2e$

3 Calculation based on Air Selangor water supply carbon emission intensity of 0.562 kg/CO_2 m^3

4 NEA. (2024). National Energy Awards Winners. Malaysia Green Technology and Climate Change Corporation. https://www.nationalenergyawards.com.my/the-award/nea-winners/

5 NTU Sustainability Office. (2023). *NTU Sustainability Report 2023*. Nanyang Technological University (NTU).

6 University Campus Infrastructure, Sustainability Strategy Unit. (n.d.). *Campus Sustainability Roadmap 2030: Advancing Sustainability*. The National University of Singapore (NUS).

7 Massachusetts Institute of Technology. (2015). *A Plan for Action on Climate Change*.

8 Holmes, D. (2020, January 13*). Thammasat University – the largest rooftop farm in Asia*. World Landscape Architecture. https://worldlandscapearchitect.com/thammasat-university-the-largest-urban-rooftop-farm-in-asia/

9 SDSN, Climateworks Centre, and Monash University (2022). *Net Zero on Campus*. New York: Sustainable Development Solutions Network (SDSN), Climateworks Centre, and Monash University (Monash).

SECTOR
01

ENERGY

Sector 1 – Energy

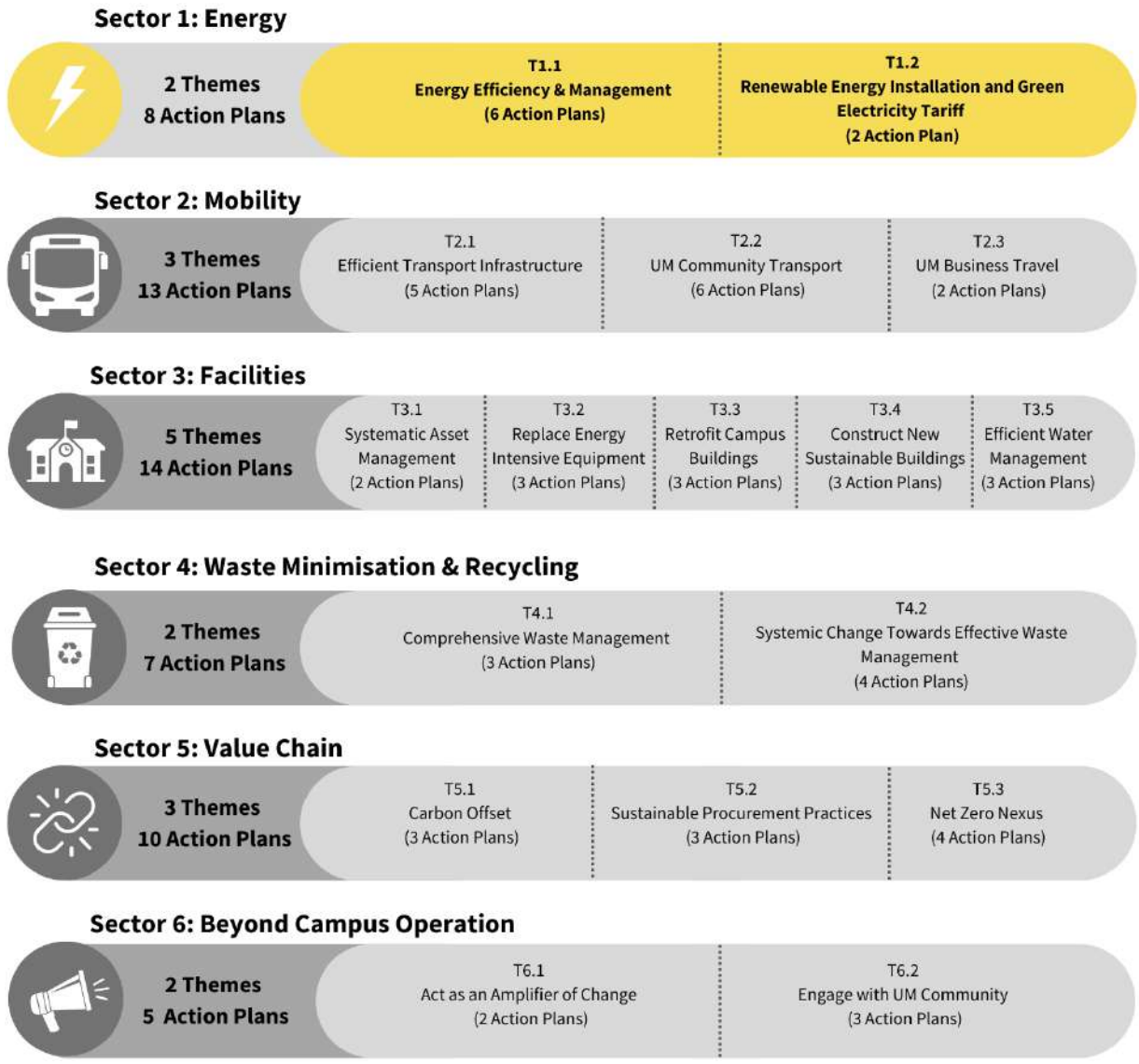


Figure 2: Sector 1 – Energy summary

Definition & General Statement

In the pursuit of a Net Zero campus at Universiti Malaya (UM), Malaysia's oldest and most prestigious university, energy management and efficiency are crucial. The UM Net Zero Strategic Plan for Energy serves as a comprehensive framework designed to guide the campus community in achieving ambitious sustainability objectives across multiple operational domains, including electricity consumption, water conservation, waste management, mobility, and facilities management. The plan targets a 30% reduction in carbon emissions across the entire campus, with an even more rigorous target of 50% reduction for new buildings, enhancing overall sustainability performance. Using 2016 as a baseline year, the plan delineates actionable steps to significantly lower UM's carbon footprint and shows a strong commitment to environmental

responsibility, setting a leading example for sustainability practices among higher education institutes.

Theme 1.1: Energy Efficiency & Management

Energy efficiency and management are critical elements in the pursuit of Net Zero emissions, focusing on optimizing energy use across all operations and facilities. By implementing energy-efficient technologies, practices, and behaviours, UM can significantly reduce her energy consumption while lowering operational costs and enhancing productivity. Effective energy management ensures that energy resources are used wisely, aligning with sustainability goals and paving the way toward a more resilient and environmentally responsible future.

Action Plan 1.1.1: Energy Efficiency Management Framework

This action plan aims to establish a comprehensive energy efficiency and management framework by forming a multidisciplinary task force of experts in engineering, environmental science, and facilities management. The team will develop the framework, starting with a baseline analysis of electricity, water, and fuel usage, using Building Energy Intensity (BEI) as a guiding metric. Key Performance Indicators (KPIs) will measure progress, focusing on energy consumption per square meter and energy usage per capita, with benchmarking against leading global institutions. To streamline the process, the plan will prioritise limiting BEI and fulfilling the Malaysia Green Building Council (MGBC) CarbonScore tool to evaluate building carbon emissions. This focused approach aims to enhance energy management and sustainability across the campus, aligning with the university's broader environmental goals.

Enabler(s): Associate Vice-Chancellor – Corporate Strategy Office [AVC (CS)], Deputy Vice-Chancellor - Development Office [DVC (D)]
Timeframe: Immediately
Indicators: Energy consumption per square meter, energy usage per capita and MGBC CarbonScore Certification.

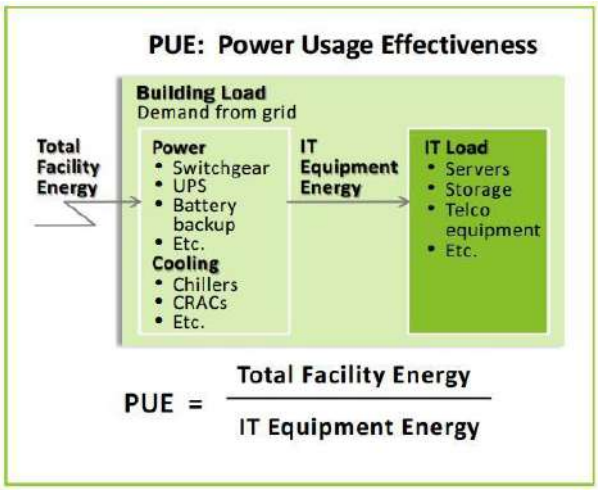
Action Plan 1.1.2: Energy efficiency and building performance metrics

This action plan involves developing metrics for UM buildings (new and existing) with a minimum requirement of BEI calculation and a maximum building performance requirement aligned with Green Building Index (GBI) or equivalent rating tools. This is to ensure that all buildings perform at the intended energy efficiency level or better, by meeting nationally accepted green building standards.

In addition to the BEI, the Department of Information Technology (JTM) must utilise Power Usage Effectiveness (PUE) to ensure the energy efficiency of UM's data centres and information and communication technology (ICT) infrastructure, which are significant energy consumers in a modern university settings. By integrating PUE and BEI metrics,

UM aims to optimise energy use, reduce carbon footprints, and enhance the sustainability of its digital and technological resources.

Enabler(s): AVC (CS), DVC (D)
Timeframe: Immediately
Indicator: BEI calculations, number of GBI or (equivalent) certifications, and percentage of UM ICT infrastructure energy usage reduction.



PUE	Level of efficiency	DCIE
3.0	Very inefficient	33%
2.5	Inefficient	40%
2.0	Average	50%
1.5	Efficient	67%
1.2	Very efficient	83%

Source: https://www.42u.com/measurement/pue-dcie.htm

Figure 3: Power usage effectiveness

Action Plan 1.1.3: Energy Audit Grant for Savings

This action plan aims to identify areas within university buildings where energy savings can be maximised, contributing to reduced energy consumption, costs, and the university's broader sustainability and carbon neutrality goals. It involves a comprehensive energy audit of select offices and lecture halls, financed by a RM60,000 government grant

from the Sustainable Energy Development Authority (SEDA). This grant will support auditing 2-3 buildings over 5-7 years.

Enabler(s): DVC (D)
Timeframe: 5 - 7 years
Indicator: Number of audited buildings & percentage of electricity bill reduction.

Action Plan 1.1.4: Energy Performance Contract (EPC) Development

This action plan proposes the development of an Energy Performance Contract (EPC) involving a committee that includes external experts, from SEDA, to implement energy-saving measures at UM. The committee will utilise a Request for Proposal (RFP) and may consider a Private Finance Initiative (PFI) to select an Energy Service Company (ESCO) to oversee the project. The RFP/PFI will outline the project's scope, encompassing building audits, energy-saving measures, and desired outcomes. Bidders will be assessed based on their experience, proposed solutions, financial models, and alignment with the university's energy efficiency objectives. The EPC will incorporate performance guarantees and structured payment mechanisms.

Enabler(s): Bursary, DVC (D)
Timeframe: Immediately (proposal), 3-5 years for EPC implementation
Indicator: Energy Audit Report.

Action Plan 1.1.5: Energy Management Implementation

This action plan entails the establishment of an Energy Management Committee and the appointment of a dedicated Energy Manager to oversee campus energy initiatives and ensure compliance with sustainability standards. Supported by the AVC (CS), the committee will implement energy-saving strategies and monitor performance. Success will be assessed through regular energy audits, aimed at preventing non-conformance and fostering continuous improvement in energy efficiency across the university. The Energy Manager will be instrumental in driving these initiatives and ensuring alignment with the university's broader sustainability objectives.

Enabler(s): AVC (CS) & DVC (D)
Timeframe: Immediately
Indicator: Energy Audit Report.

Action Plan 1.1.6: Targeted Building Carbon Emission Reduction

Based on the 2016 energy baseline, this action plan aims to reduce building operation carbon emissions by 30% throughout the campus, with operation of new buildings needing to reduce carbon emissions by 50% to improve overall performance. This performance standard should be in line with the Malaysia Government’s Low Carbon Cities 2030 Challenge for building operations.

Enabler: AVC (CS)
Timeframe: Immediately
Indicator: Reduction of monthly/annual energy usage.

Theme 1.2: Renewable Energy Installation and Green Electricity Tariff

Renewable energy installation and green electricity tariffs are vital components of a Net Zero strategy, as they facilitate the transition to sustainable energy sources and reduce reliance on fossil fuels. Investing in renewable energy systems enables UM to generate clean energy on-site, significantly lowering carbon footprint. Concurrently, green electricity tariffs allow UM to purchase energy from verified renewable sources, further supporting the growth of clean energy markets. By combining these approaches, UM can not only meet their energy needs sustainably but also contribute to the broader goal of decarbonizing the energy sector, ultimately driving progress toward a Net Zero future.

Action Plan 1.2.1: Renewable Energy Installation Framework

This action plan aims to establish a comprehensive framework for evaluating and recommending the installation of Renewable Energy (RE) systems across campus facilities. Led by JHB at UM, this initiative will identify suitable sites and technologies for RE deployment, including solar panels and wind turbines. Success will be measured by the submission and approval of detailed proposals for RE installations across various RC (faculties or departments). This framework will facilitate the university's transition to sustainable energy sources, significantly contributing to its long-term carbon reduction goals.

Enabler: JHB
Timeframe: Immediately
Indicator: Capacity of installed RE systems.

Action Plan 1.2.2: Continuation of TNB Green Electricity Tariff (GET)

For short term carbon emission, it is advantageous to continue the TNB Green Electricity Tariff (GET) subscription to reinforce the university's commitment to renewable energy sources. This is to allow for the upgrading of existing infrastructures for lowering carbon emissions to complete over a medium term, before the subscription to TNB's GET could be reduced or discontinued.

Enabler: JHB
Timeframe: Immediately
Indicator: Electricity bill, mREC certificate.

SECTOR
02

MOBILITY

Sector 2 – Mobility

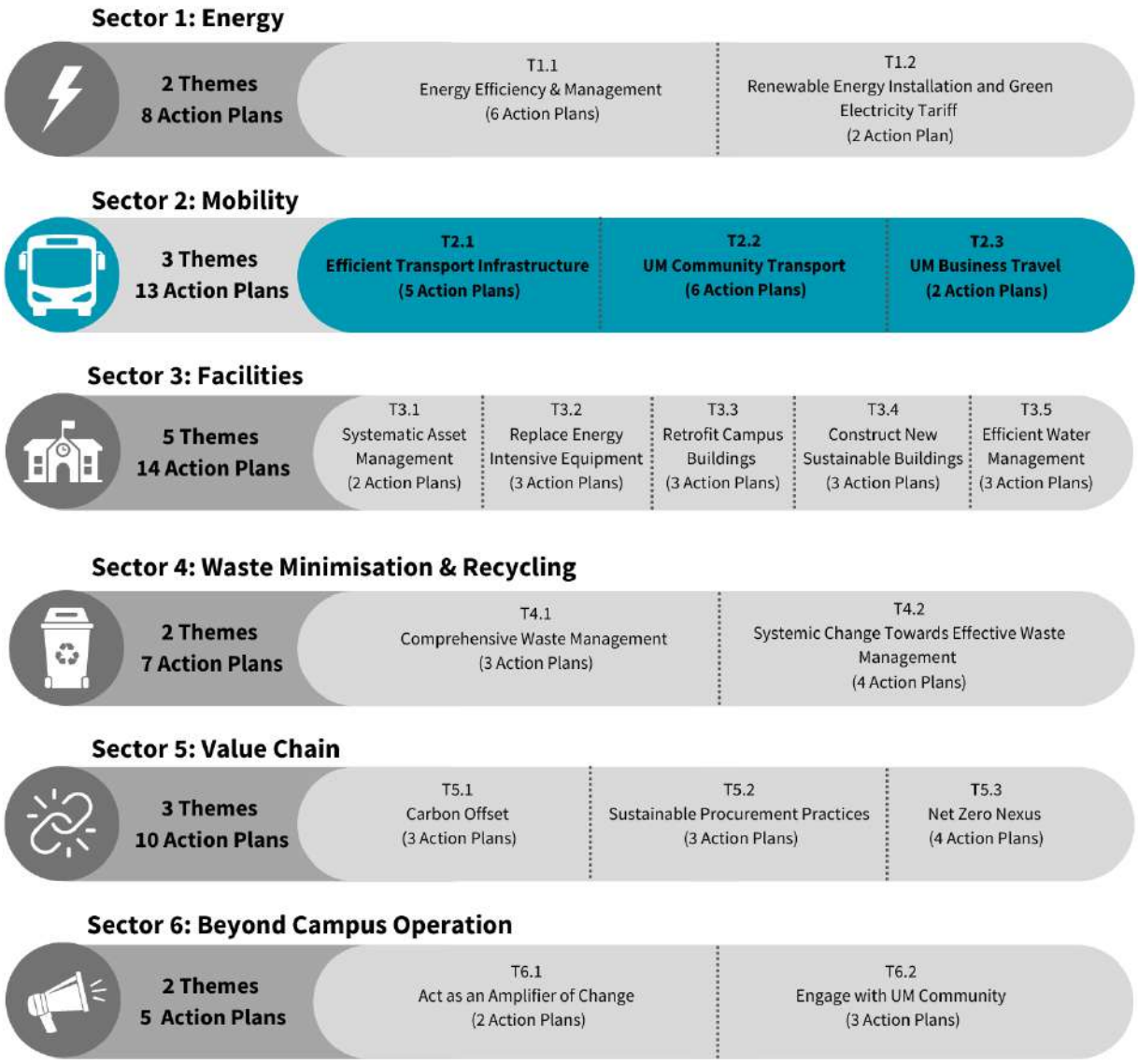


Figure 4: Sector 2 – Mobility summary

Definition & General Statement:

As the foremost Research University (RU) in Malaysia, UM is a multidisciplinary institution with over 30,000 students and more than 5,000 staff members, encompassing approximately 381 campus buildings. Daily operations, activities, and events necessitate constant mobility across various transport modes. Key challenges in campus mobility include traffic congestion, unrestricted vehicle access, limited parking spaces, and a low cycling culture among the university

community. Consequently, establishing a sustainable and integrated transportation management system is essential for effectively addressing mobility needs and enhancing accessibility.

To enhance campus transportation and mobility, UM should implement a series of action plans aimed at modernising and streamlining various aspects of campus life. These following action plans are designed to enhance the efficiency, safety, and sustainability of transportation and mobility on campus, benefiting the entire UM community.

Theme 2.1: Efficient Transport Infrastructure

Efficient transport infrastructure is essential for achieving Net Zero goals, as it enables the smooth movement of people and goods while minimising energy consumption and emissions. By optimising traffic flow, reducing congestion, and enhancing connectivity between various modes of transport, efficient transport infrastructure helps lower overall fuel use and greenhouse gas emissions. These improvements not only support sustainable mobility but also enhance accessibility and resilience, creating a foundation for long-term environmental and economic benefits in the transition to a Net Zero campus.

Action Plan 2.1.1: Optimizing Student Accommodation

Enhance student accommodation arrangements by offering housing options close to academic facilities to minimise the need for motorised transportation and reduce internal travel time. Below are the proposed Residential College (KK) zoning suggestions:

- KK1: Faculty of Law, Faculty of Engineering
- KK2: Faculty of Built Environment, Faculty of Engineering, Faculty of Business and Economics
- KK3, KK4, KK7: Faculty of Science, Faculty of Art and Social Science, Faculty of Education, Faculty of Languages and Linguistics, Faculty of Business and Economics, Academy of Malay Studies.
- KK5: Sport Centre, API, PASUM
- KK6: Faculty of Medicine, Faculty of Pharmacy, Faculty of Built Environment
- KK8, KK10: Academy of Malay Studies, Faculty of Computer Science and Information Technology.
- KK9: All faculties
- KK11: Sport Centre, PASUM
- KK12: All faculties

Enabler: Student Affairs Department (HEP)
Timeframe: Next academic session
Indicator: 70% of the residents are from the faculties within 700-meter radius of the KK.

Action Plan 2.1.2: Park and Ride: Streamlined Campus Transportation Solution

Optimise campus transportation and reduce congestion by implementing a "Park and Ride" system where UM staff and students can park at a multi-storey parking facility located at the university gates. From there, they will have various transportation options to reach their destinations on campus. This streamlined campus transportation solution includes:

- Multi-Storey Parking Facility:
  - Location and Capacity: Develop and maintain a multi-storey parking lot at the university's main gates to accommodate a significant number of vehicles. This facility will serve as a central parking hub, reducing the need for on-campus parking and alleviating congestion near academic buildings.
  - Safety and Security: Ensure the parking facility is well-lit, secure, and monitored with surveillance cameras to provide a safe environment for all users.

- Transportation Options:
  - Campus Bus Service: Provide frequent and reliable campus bus services that connect the multi-storey parking facility to key locations across the university, including academic buildings, administrative offices, and student residences.
  - Bicycle and E-Scooter Stations: Install designated areas for bicycle racks and e-scooter charging stations near the parking facility. This will offer convenient and eco-friendly transportation options for those who prefer cycling or using e-scooters to navigate the campus.
  - Integration and Accessibility: Ensure that all transportation options are well-integrated, with clear signage and information to guide users efficiently from the parking facility to their destinations.

Enabler: JHB
Timeframe: 5 years
Indicator: increase at least 50% parking supply in the campus at the designated Park and Ride spots, at least 30% of the staff support the park and ride program.

Action Plan 2.1.3: Enhanced Traffic Calming Measures for Safer Campus Driving

To enhance the overall campus driving and walking experience, UM aims to create a safer and more pedestrian-friendly campus environment by implementing traffic calming measures. The aim of this action plan is to reduce at least 20% of vehicles entering UM daily by:

- Adding strategically placed speed humps throughout the campus roads, especially in high-traffic areas, near pedestrian crossings, and around frequently used facilities. Ensure that these speed humps are designed to effectively slow down vehicles while maintaining comfort for passengers.
- Lowering the speed limits on campus roads to enhance safety, particularly in areas with high pedestrian activity or complex traffic patterns. Update the speed limits based on safety assessments and traffic flow data.
- Installing clear and visible road signs indicating the new speed limits. Ensure that signage is placed at appropriate intervals to remind drivers of the reduced speed limits and promote compliance.
- Marking speed limits directly on the road surface to reinforce speed reduction and improve visibility for drivers, especially during low light conditions.
- Installing rumble strips at key locations such as intersections, pedestrian crossings, and transition areas where a reduction in speed is necessary. Rumble strips will alert drivers through tactile and auditory feedback, prompting them to slow down.
- Introducing chicanes (roadway features) that create a series of tight turns or curves to slow down traffic. These can be implemented on longer, straight stretches of road where excessive speeding is a concern.

Enabler: JHB
Timeframe: 2025
Indicator: Percentage in vehicles entering the UM campus; Compliance with the reduced 35 km/h speed limit.

Action Plan 2.1.4: Enhancing Traffic Safety and Environmental Awareness with UM's Digital Billboard

Pertinent information will be displayed to promote safe driving practices and raise awareness about carbon emissions. The information to be displayed are:

- Traffic safety measures: The billboard prominently features real-time data related to traffic conditions around the UM campus. This includes current speed limits and traffic calming messages designed to encourage safer driving habits. By displaying speed limits and alerts about high-traffic areas, the billboard helps to remind drivers of the importance of adhering to speed regulations, thereby reducing the risk of accidents and improving overall traffic flow.
- Environmental awareness: In addition to traffic safety, the billboard also plays a significant role in raising awareness about environmental issues, specifically focusing on carbon emissions. It provides real-time statistics on the average carbon emissions per vehicle, offering drivers a visual representation of their environmental impact. This information encourages the UM community to consider more sustainable transportation options, such as carpooling, using public transit, or cycling.

Enablers: JHB, UMSDC
Timeframe: 2025
Indicator: Number of billboard contents; Vehicle speed & driver behaviour.

Action Plan 2.1.5: AI-Driven Traffic Monitoring System

The new traffic monitoring system will incorporate both counters and high-resolution cameras installed at key entry and exit points of the UM campus. These devices will collect real-time traffic data such as vehicle plate numbers and travel time (at least 90% accuracy), which will be analysed using sophisticated AI algorithms. The primary goals of this system include:

- Real-Time Traffic Analysis: By processing images and data from the cameras and counters, the system will provide up-to-date information on vehicle count, speed, and traffic congestion. This will help in making informed decisions about traffic management and implementing timely interventions.
- Incident Detection and Alerts: The system will be capable of detecting traffic incidents, such as accidents or unusual delays, and generating immediate alerts to campus security and traffic management teams. This proactive approach aims to ensure a rapid response to any issues, improving safety for all campus users.
- Enhanced Security Monitoring: In addition to traffic management, the cameras will serve as high-resolution security devices capable of capturing detailed footage of vehicles entering and exiting the campus. The AI algorithms will facilitate automatic number plate recognition, which can be crucial for quickly identifying and tracking vehicles involved in campus-related incidents, such as thefts or accidents, enabling prompt action by campus security.

The development of this system involves a collaborative effort between Faculty of Computer Science and Information Technology (FSKTM) and JTM. FSKTM will provide expertise in developing and refining the image processing algorithms, while JTM will focus on integrating these algorithms into a comprehensive app.

Data Protection and Privacy: Given the dual-purpose nature of the system, ensuring data protection and privacy is of utmost importance. The system will incorporate several safeguards to prevent misuse and protect individual privacy:

- Data Anonymisation: All personal and vehicle-related data will be anonymised to protect the privacy of individuals. Only relevant information related to security incidents will be accessible to authorised personnel.
- Secure Data Storage: Data collected by the system will be securely encrypted and stored to prevent unauthorised access and ensure the integrity of the information.
- Access Control: Strict access controls will be implemented to ensure that only authorised security and administrative staff can view or manage sensitive data.

Enablers: JTM, FSKTM, Security Division
Timeframe: 2025
Indicator: Daily traffic volume (at least 90% accuracy).

Theme 2.2: UM Community Transport

Community transport is a key component of a Net Zero strategy, focusing on reducing the carbon footprint associated with commuting and local mobility. By fostering a culture of sustainable transportation, UM community can contribute to broader climate goals while enhancing accessibility and quality of life.

Action Plan 2.2.1: Real-Time Bus Tracking and Increased Bus Frequency

While acquiring new Electric Vehicles (EVs), the existing bus service must be improved by addressing issues of unpredictable bus arrivals and congestion. This initiative includes the integration of a GPS tracking system with existing apps and a plan to increase bus services during peak hours. In detail, UM has to:

- Integrate GPS technology into the UM Touch app or other JTM-developed apps to provide real-time tracking of campus buses. This feature will allow students and staff to view the exact location of buses, estimate their arrival times, and plan their journeys more effectively.
- Increase Bus Frequency: Implement a plan with JHB to increase the number of buses operating during peak hours. This will address congestion issues and ensure that transportation services are sufficient to meet the high demand during these times. Continuously monitor ridership patterns and peak hour demand to make data-driven adjustments to bus service levels.

Communication and Feedback: Keep the campus community informed about changes in bus service and encourage feedback to identify areas for further improvement. This will help in fine-tuning the service to better meet user needs.

Enabler: JHB, JTM
Timeframe: Immediately
Indicator: Bus frequency. Deploy more buses during peak hour (more capacity) with higher frequencies (suggested frequency every 10 minutes), off peak hour can have lower frequency (one in every 20 minutes).

Action Plan 2.2.2: UM Feeder Service: Connecting Campus to Public Transport Hubs

Launch an on-demand van service to address first and last mile connectivity issues, particularly in areas where public transportation options are limited or unavailable. This service will provide flexible, scheduled pick-ups and drop-offs based on user requests. Implement an easy-to-use booking system via a mobile app or website where users can

request van services in real-time. The system will allow for advance reservations and track the van's location for added convenience.

Provide shuttle services from train stations close the campus (University LRT station, Kerinchi LRT station, and MRT Phileo Damansara station), with the frequency of every 15 minutes during peak hour and every 30 minutes during off peak hour.

Enablers: JHB, JTM
Timeframe: 2026 [Getting APAD/authority approval first]
Indicator: Number of van requests fulfilled; User satisfaction ratings.

Action Plan 2.2.3: A Centralised Vehicle Management System

The Centralised Vehicle Management System aims to modernise and streamline vehicle booking and management across different zones within the university, building on the existing UM Fleet system to provide a more efficient, user-friendly, and adaptable solution.

Enabler: JHB
Timeframe: 2025
Indicator: User satisfaction level with the booking system and vehicle management.

Action Plan 2.2.4: Private Vehicle Ride-Sharing Service

A dedicated mobile app allows users to easily book rides, customise vehicle preferences, track vehicle locations, and manage payments. The app also includes features for monitoring the environmental impact of rides and exploring eco-friendly travel options. Targeted at least 30% of the students may use the ride-sharing service for their campus travel.

Enablers: HEP, JTM, FSKTM
Timeframe: 2026
Indicator: Ridership rate; Percentage of vehicular carbon emissions.

Action Plan 2.2.5: Electric Vehicles for Internal Trips

This action plan entails the purchase and operation of EVs to shuttle the campus community without harming the environment. These vehicles should replace all of the campus community internal trips. Three types of vehicles are needed to serve different purposes while complementing other modes of campus transport, which are:

- Electric trams that will run on a regular schedule, allowing students, faculty, and staff to hop on and off at designated stops across campus without long waits. The tram should be operated with focus on operational efficiency (on-time performance, service reliability), energy efficiency (energy consumption, charging efficiency), carbon emission reduction, passenger experience, and utilisation rate. The tram usage should help to reduce on-campus vehicular carbon emissions. The

tram occupancy rate should meet at least 0.5 load factor (50% occupancy) at all times. A specially designated lane will be established to ensure the tram operates smoothly and efficiently, minimising delays caused by other traffic and ensuring a safe, reliable route.

- Big electric buggies will operate continuously along a designated internal route. This service will function similarly to a traditional shuttle, running at regular intervals throughout the day.
- Small electric buggies, which are flexible, will provide on-demand service to respond to specific needs as they arise. These small electric buggies can be requested via a mobile app or by calling a central dispatch. They are perfect for short trips, emergency transportation, or reaching less frequented areas of the campus.

Enablers: JHB, UMSDC
Timeframe: 5 years
Indicator: Ridership rate; Percentage of vehicular carbon emissions.

Action Plan 2.2.6: Staff Mobility Reduction Incentive Program

This action plan will encourage staff to minimise campus travel through incentives and performance metrics focused on proximity-based activities and sustainability. In detail, UM has to:

- Reduce staff mobility on campus: Offer incentives for behaviours that support proximity-based activities, such as dining near their faculty or department to reduce unnecessary travel.
- Priority Access to Facilities: Offer free or priority access to campus facilities, such as sports facilities or reserved meeting rooms, as an incentive for staff who actively reduce their mobility. This can include designated “green” parking spots or early access to booking popular facilities.
- Sustainability KPI Integration: Incorporate a sustainability metric into the staff performance evaluation process. This KPI will track and reward staff based on their efforts to minimize travel and engage in campus-based activities.

Enabler: University management
Timeframe: 2025
Indicator: at least 30% of the staff participating in the program, reduce at least 30% of the lunch time travel trip among the faculty members.

Theme 2.3: UM Business Travel and Working Arrangements

Business travel is a significant consideration in any Net Zero strategy, as it can contribute substantially to UM's overall carbon footprint. Reducing the environmental impact of business travel involves rethinking travel policies, encouraging remote work and virtual meetings, and promoting more sustainable travel options when in-person meetings are necessary. By carefully

managing and minimising the need for business travel, organisations can lower their greenhouse gas emissions, align with sustainability goals, and move closer to achieving their Net Zero targets.

Action Plan 2.3.1: New Guidelines for Event Logistics and Sustainable Business Travel

Event logistics and transport planning: All event organisers are required to include a comprehensive logistics and transport plan as part of their event proposals. This plan should outline transportation arrangements for attendees, including options for both on-campus and off-campus travel. Encourage the use of sustainable transport options, such as EVs, and ensure that all transportation plans minimise environmental impact.

- Sustainable Business Travel Policies:
  - Online Meetings: Prioritise virtual meetings over in-person gatherings whenever possible to reduce travel and associated emissions.
  - Public and Sustainable Transport: When travel is necessary, prioritize the use of public transportation and the most sustainable transport options available, such as EVs.
- Additional Initiatives:
  - Travel Baseline Survey: Conduct a survey to collect baseline data on staff travel mileage and frequency. This data will help in assessing current travel patterns and identifying opportunities for improvement.
  - UM FLEET Booking System: Implement the UM FLEET booking system for official duties to streamline vehicle usage. This system will integrate the option for free use of UM vehicles for all staff, promoting efficient and sustainable transport options.
  - Emissions Awareness: Staff will be informed about the carbon emissions generated based on their travel distance, helping them understand the environmental impact of their business trips.

Enablers: All RC
Timeframe: 3 years
Indicator: At least 30% of the event participants transport is arranged using the non-motorised transport mode, or carpooling using university vehicle or private vehicle, or using public transport.

Action Plan 2.3.2: Remote Working

Academic staff should be given the leeway to work in remote when there are no physical classes to conduct. Meetings and discussions should be done in hybrid mode to allow for academic staff who are remotely working. This initiative will substantially reduce carbon emissions from academic staff commuting between their homes and UM campus. Academic staff members must plan their working week in advance using the UM Touch app and ensure that their work is uninterrupted while working remotely. Remote working

applications via eHR can be made for a whole month in advance with approval from the respective Head of Department. Remote working shall not compromise KPI attainment.

Enablers: HR, Heads of Department
Timeframe: Immediately
Indicator: Percentage of academic staff applying for remote working.

SECTOR
03

FACILITIES

Sector 3 – Facilities

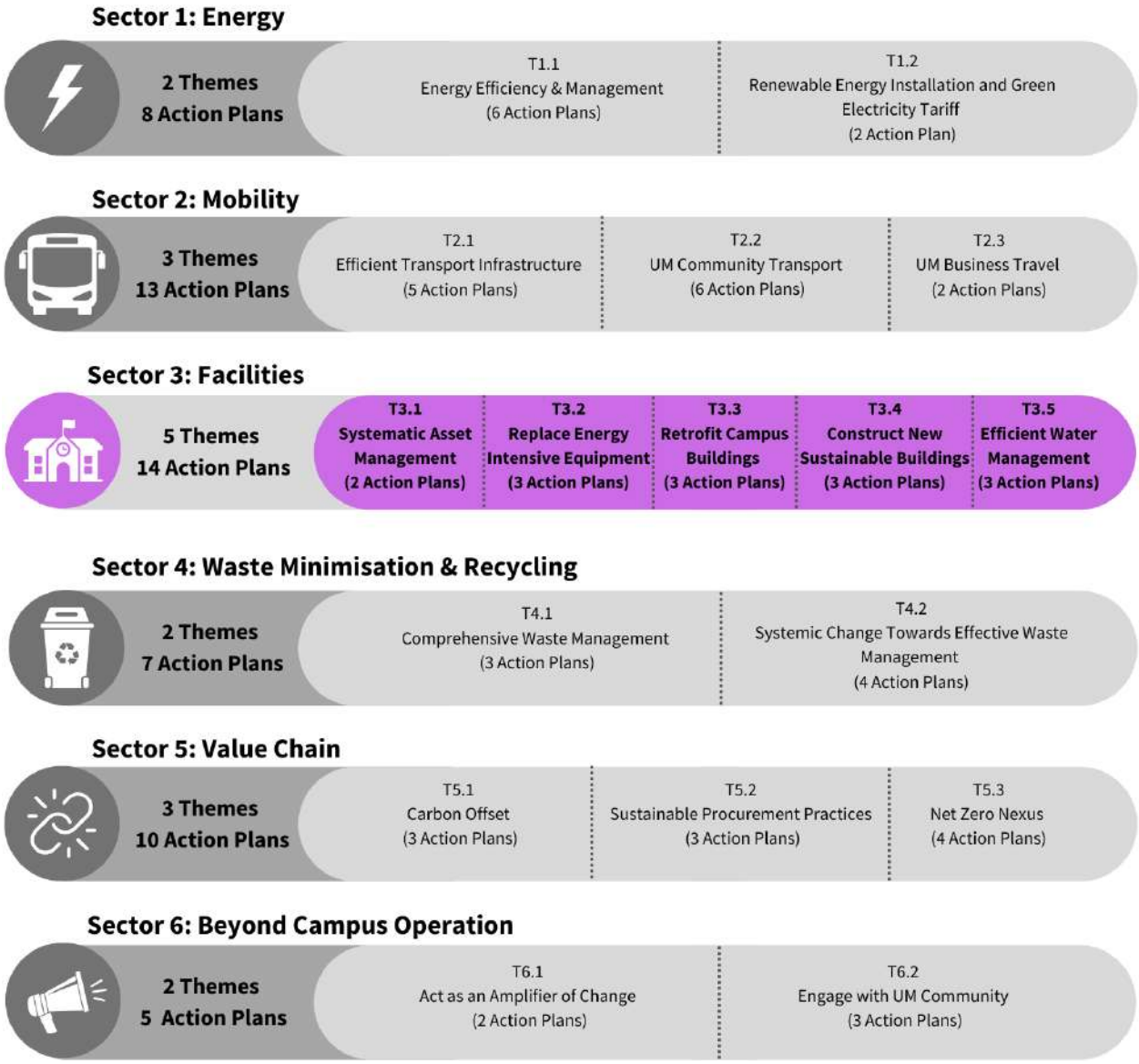


Figure 5: Sector 3 – Facilities summary

Definition & General Statement

UM facilities encompass the various buildings and spaces in the university and residential college that provide academic programs, administrative and research functions. These facilities collectively create an environment that supports the university mission, enhances student life and contributes to the educational and operational goals of the institution. To transform the university towards Net Zero emissions, it is essential for the facilities of UM to minimise its energy use and emissions. In accomplishing this, there are 27 action plans across five themes that can be adopted to promote Net Zero facilities for UM.

Theme 3.1: Systematic Asset Management

Systematic asset management plays a pivotal role in achieving Net Zero energy goals by ensuring that building assets are managed efficiently throughout their lifecycle. This approach involves a comprehensive strategy to monitor, maintain, and optimise building systems and infrastructure, maximising their performance while minimising energy consumption and operational costs. By leveraging data-driven insights and predictive maintenance, systematic asset management helps to extend the lifespan of equipment, identify potential inefficiencies, and strategically plan upgrades or replacements. This holistic approach not only ensures the longevity and reliability of assets but also contributes to reducing the carbon footprint of buildings, supporting their transition toward a sustainable, Net Zero energy future.

Action Plan 3.1.1: Consolidation and Digitisation of Asset Portfolio

To keep up with current and future asset management challenges, various steps are needed that include the following:

- Asset inventory audit:
  - Conduct a comprehensive audit of all existing assets across the campus or facility.
  - Identify and categorise assets based on type, age, condition, and usage.

- Centralised asset management system:
  - Implement a centralised, cloud-based asset management system to consolidate all asset information.
  - Ensure that the system allows for real-time tracking and management of assets.

- Digitisation of asset records:
  - Digitise all physical records of assets, including manuals, maintenance records, and warranties.
  - Integrate these digital records into the asset management system for easy access and retrieval.

- Geospatial mapping of assets:
  - Use Geographic Information Systems (GIS) to map the location of all physical assets.
  - Create a digital map overlay that integrates with the asset management system for spatial analysis and planning.

- Asset tagging and barcoding:
  - Implement a tagging system (e.g., barcodes, RFID tags) for all assets to enable easy identification and tracking.
  - Link these tags to the digital records in the asset management system.

- Data integration and interoperability:
  - Ensure that the asset management system is interoperable with other digital systems, such as financial management, maintenance, and procurement systems.
  - Enable seamless data sharing and integration across platforms.

- Automated Reporting and Analytics
  - Develop automated reporting tools within the asset management system to generate insights on asset utilisation, maintenance schedules, and lifecycle costs.
  - Use analytics to inform decision-making regarding asset consolidation, replacement, or disposal.

Enablers: JHB and JTM
Timeframe: 2 years
Indicator: Percentage of digitised assets.

Action Plan 3.1.2: Asset Monitoring and Continuous Improvement

The comprehensive digital asset management system must be continuously monitored and analysed to ensure efficiency and limit liabilities. This action plan includes the following:

- Training and capacity building:
  - Provide training to relevant staff on the use of the digitised asset management system.
  - Encourage ongoing capacity building to ensure that the system is effectively used and maintained.

- Asset consolidation planning
  - Analyse the asset portfolio to identify opportunities for consolidation (e.g., removing redundant assets, combining similar functions).
  - Develop and implement a plan for consolidating assets, with a focus on optimising the portfolio for efficiency and cost savings.

- Continuous monitoring and improvement:
  - Establish a process for continuous monitoring and updating of the asset portfolio.
  - Regularly review and improve the digitisation and management processes to adapt to changing needs and technologies.

Enablers: JHB and JTM
Timeframe: 2 years
Indicator: Number of reported continuous improvements; Zero reported system faults.

Theme 3.2: Replace Energy Intensive Equipment

In the transition toward Net Zero energy buildings, replacing energy-intensive equipment is a critical strategy. This process involves identifying and phasing out equipment with high energy consumption and substituting them with energy-efficient alternatives. By reducing energy demand at the source, these upgrades help to lower operational costs and decrease GHG emissions, aligning with the broader goals of sustainability and carbon neutrality.

Action Plan 3.2.1: Upgrade Air-Conditioning & Mechanical Ventilation (ACMV)

This action plan is very important to significantly reduce UM's electricity bills and it involves three phases which are:

- Phase 1: Assessment and Planning
  - Conduct a comprehensive energy audit, building assessment, and feasibility study to establish a baseline to benchmark energy reduction on cooling loads and JHB to set a clear policy on purchasing ACMV accordingly to space usage and capacity. Establish specific and measurable energy reduction targets.

- Phase 2: System upgrade
  - Replace old ACMV equipment with more energy-efficient systems i.e., District cooling system (DCS), chiller refrigerants, etc. Upgrade building automation systems to gain better monitoring and control over ACMV systems. Establish a 24-degree Celsius temperature setpoint as a regulatory measure. Integrate ACMV systems with sensors i.e., CO_2 to monitor the ventilation effectiveness based on occupancy demand. Upgrade filtration of ACMV to enhance air filtration systems to improve indoor air quality and reduce energy consumption (airflow rate).

- Phase 3: Replacement of inefficient existing systems
  - Further, UM must replace inefficient split-unit air conditioning systems across campus buildings with a more efficient, centralised air conditioning system with smart individual controllers and CO_2 sensors. This system allows for individual temperature control in different areas or rooms, ensuring comfort while minimising energy waste. Smart controllers enable precise regulation of cooling based on occupancy and usage patterns, reducing unnecessary energy consumption. This upgrade enhances overall energy efficiency, reduces the carbon footprint, and lowers operational costs by optimising the use of air conditioning across the entire campus.

Enablers: RC, JHB

Timeframe: 12- 18 months
Indicator: Energy savings in monthly/yearly bills.

Action Plan 3.2.2: Lighting and Other Energy-Consuming Systems

Replace traditional lighting fixtures with energy-efficient LED ambient and task lights to significantly reduce energy use. Use advanced lighting control technologies, such as occupancy/movement sensors and daylight harvesting, to optimise lighting usage based on occupancy and natural light conditions. Maximise natural light penetration through building design to reduce the need for artificial lighting. Implementing task lighting (without creating glare or shadows) in specific areas within the building where focused light is required, such as workstations, reading corners, or kitchen counters.

Enablers/ Stakeholders: RC, JHB
Timeframe: 12- 18 months
Indicator: Energy savings in monthly/yearly bills.

Action Plan 3.2.3: Plug-Load and Other Energy-Consuming Systems

Phase 1: Identify and replace energy intensive appliances.

- Conduct a thorough assessment of existing equipment and/or electrical appliances to identify old and energy-intensive devices. Prioritise replacements based on age, energy consumption and energy efficiency star ratings. Invest in high-efficiency models of computers, printers, and other electronic devices to significantly reduce energy consumption. To reduce operational disruptions, implement a phased replacement plan. Dispose of old equipment in a responsible manner to minimise its negative impact on the environment.

Phase 2: Implement Power Management Strategies.

- Develop and enforce power management circulars for computer shutdown, screen dimming, and equipment usage during idle periods, or when any equipment is not in use. Install occupancy sensors / timer to automatically turn off equipment / appliances when rooms are unoccupied.

Enablers: RC, JHB
Timeframe: 3 years
Indicator: Number of replaced equipment or electrical appliances.

Theme 3.3: Retrofit Campus Buildings

Retrofit Campus Buildings refers to the process of upgrading and modifying existing campus buildings to improve their energy efficiency and reduce carbon emissions. This can involve a variety of measures, such as enhancing insulation, installing energy-efficient windows, upgrading ACMV systems, implementing smart energy management systems (smart metering system), and

integrating renewable energy sources like solar panels. By retrofitting buildings, campuses can significantly lower their energy consumption and carbon footprint, contributing to both carbon neutrality and Net Zero emissions goals. These retrofits not only reduce GHG emissions but also lead to long-term cost savings through reduced energy use.

Action Plan 3.3.1: Space Audit & Planning

Space Audit & Planning involves a thorough assessment of the current utilisation of all campus spaces to identify inefficiencies and opportunities for improvement. This action plan includes conducting a detailed inventory of spaces, analysing usage patterns, and mapping energy consumption. The goal is to identify underutilised or overcrowded areas, eliminate redundant functions, and develop plans to reconfigure and repurpose spaces for optimal functionality and energy efficiency. The process emphasises flexible and adaptive design, ensuring that spaces can be easily modified to meet evolving campus needs while reducing overall energy consumption and operational costs.

Enablers: RC, JHB
Timeframe: 12 months
Indicator: Building plans, Net lettable areas (NLA).

Action Plan 3.3.2: Building Shared Office and Low Footprint Spaces for Work and Study (Co-Work Space)

UM should build shared office and low footprint spaces for work and study (co-working spaces) involves creating versatile, communal areas that accommodate multiple users for work, study, and collaboration. These spaces are designed to minimise environmental impact through efficient use of space, energy-saving technologies, and sustainable materials. By consolidating individual offices and study areas into shared co-working spaces, the campus can reduce its overall footprint, promote collaboration, and optimise resource use. The design emphasizes flexibility, allowing the space to be easily adapted for different activities and user needs, further enhancing efficiency and sustainability.

Enablers: RC
Timeframe: 12-18 months
Indicator: Number of shared space bookings/rental amount.

Action Plan 3.3.3: Alternative Energy Integration

Integrating Alternative Energy involves incorporating renewable energy sources, such as solar, wind, or geothermal energy, into the campus's energy infrastructure. This action plan includes assessing the feasibility of alternative energy installations on existing buildings or new developments, such as solar panels on rooftops, small-scale wind turbines, or geothermal heat pumps. The goal is to reduce reliance on conventional energy sources, decrease GHG emissions, and enhance the sustainability of campus operations. By leveraging alternative energy, the campus can lower energy costs, contribute to carbon neutrality, and demonstrate a commitment to environmental stewardship.

Enablers/ Stakeholders: JHB, RC
Timeframe: 2-3 years
Indicator: Renewable energy usage over RC / whole campus.

Theme 3.4: Construct New Sustainable Buildings

In the years to come, UM should design and construct new campus buildings and infrastructures with sustainability at the core. This includes using eco-friendly materials, maximizing energy efficiency through advanced building technologies, incorporating renewable energy systems like solar panels, and designing for optimal natural lighting and ventilation. These buildings are designed to minimise their environmental impact, reduce energy consumption, and support the achievement of carbon neutrality and Net Zero emissions. Sustainable buildings contribute to a campus's overall sustainability goals by reducing operational emissions and setting a standard for future developments.

Action Plan 3.4.1: Incorporating Sustainable Building Practices and Policies

All new UM buildings must incorporate architectural and design strategies that naturally reduce energy consumption by optimising the building's orientation, layout, and materials. This action plan focuses on maximising natural light, enhancing natural ventilation, using thermal mass to regulate indoor temperatures, and strategically placing windows and shading devices to minimise heat gain in warm climates and retain heat in cooler climates. By leveraging these passive design elements, the campus can significantly reduce reliance on artificial lighting, heating, and cooling systems, leading to lower energy usage, reduced carbon emissions, and improved indoor comfort. This approach aligns with sustainability goals by creating energy-efficient buildings that operate with minimal environmental impact.

Further, this action plan entails intentionally selecting and using building materials with low carbon footprint during construction, renovation, and maintenance of campus buildings. This action plan includes prioritising materials that are sustainably sourced, recycled, or have lower embodied carbon, such as bamboo, reclaimed wood, recycled steel, and low-carbon concrete. It also involves setting policies that require the consideration of a material's life cycle impact during the planning and procurement stages. By adopting these practices, the campus can significantly reduce the carbon emissions associated with building activities, promote environmental responsibility, and support the overall sustainability and carbon neutrality goals.

Enablers: JHB
Timeframe: 3-5 years
Indicator: Number of related policies / guidelines on sustainable building.

Action Plan 3.4.2: Reusing Existing Buildings and Materials to Reduce Building Waste

Reusing Existing Buildings and Materials to Reduce Building Waste focuses on minimising construction waste and reducing the environmental impact by repurposing existing structures and materials. This action plan involves renovating and adapting existing buildings instead of demolishing them, and salvaging materials like bricks, wood, metal, and fixtures for use in new or updated projects. By reusing these resources, the campus can significantly cut down on waste sent to landfills, conserve natural resources, and lower the carbon footprint associated with new construction. This approach supports sustainable development goals, reduces costs, and preserves the historical and architectural value of older buildings.

Enablers/ Stakeholders: JHB
Timeframe: 3-5 years
Indicator: No. of buildings repurposed.

Explanations:

- Increase low carbon materials usage for retrofitting
- Suggestion: For commercialisation and renting out

Action Plan 3.4.3: Green Landscaping

This action plan involves the integration of natural elements and ecosystems into the campus landscape design to enhance environmental sustainability, improve air quality, and promote well-being. This action plan includes creating or expanding green spaces such as parks, green corridors, gardens, green roofs, and rain gardens, as well as incorporating permeable surfaces, bioswales, and living walls. It also involves selecting native and drought-resistant plants, using sustainable irrigation systems like drip irrigation or rainwater harvesting. These green infrastructures help manage stormwater, reduce the urban heat island effect, and support local biodiversity. Additionally, green spaces offer aesthetic and recreational benefits, fostering a healthier and more vibrant campus environment while contributing to the overall sustainability goals.

Enablers: JHB
Timeframe: 3-5 years
Indicator: Green space coverage.

Theme 3.5: Efficient Water Management

Water supply sufficiency refers to ensuring that a facility or campus has a reliable and sustainable supply of water to meet its current and future needs. This involves managing water resources efficiently, implementing water-saving technologies, and ensuring that water is available in sufficient quantity and quality for all intended uses. Action plans to achieve water supply sufficiency include rainwater harvesting, greywater recycling, reducing water waste, and

optimising irrigation systems. Ensuring water supply sufficiency is crucial for sustainability, helping to reduce the environmental impact and support the long-term resilience of the facility.

Action Plan 3.5.1: GIS Mapping of Water Piping & Sewerage

This action plan involves creating a detailed, geospatial representation of the campus's water supply and sewerage infrastructure using Geographic Information System (GIS) technology. This action plan includes mapping the location, size, and condition of all water pipes, sewer lines, valves, and related infrastructure across the campus. By utilising GIS, the campus can easily monitor and manage its water and sewerage systems, identify potential issues like leaks or blockages, and plan for maintenance or upgrades more effectively. GIS mapping enhances the ability to ensure water supply sufficiency, optimise resource allocation, and improve the overall efficiency and reliability of the water management system.

Enabler: JHB
Timeframe: 3 years
Indicator: GIS on Utilities Mapping.

Action Plan 3.5.2: Efficient Water Management

This action plan focuses on reducing water usage across the UM campus through a combination of conservation practices, technological upgrades, and behavioural changes. This action plan includes installing water-efficient fixtures such as low-flow taps, toilets, and showerheads; fully utilising rainwater harvesting for non-potable usages; implementing smart irrigation systems that minimise water waste in landscaping; and promoting water conservation awareness among students, faculty, and staff. Additionally, the plan involves regular monitoring and auditing of water usage to identify areas for further improvement. By adopting these measures, UM aims to significantly lower its water consumption, reduce costs, and contribute to its overall sustainability and environmental responsibility goals.

Enablers: RC, JHB
Timeframe: 5 years
Indicator: Percentage of water usage reduction.

Action Plan 3.5.3: Non-Revenue Water (NRW) Program & Monitoring

This action plan refers to the implementation of a program aimed at reducing water losses within the campus's distribution system. NRW is the difference between the amount of water supplied to the distribution system and the amount of water billed to consumers. This action plan includes identifying and addressing issues such as leaks, unauthorized connections, and meter inaccuracies. The monitoring aspect involves the continuous tracking of water flow through advanced metering infrastructure (AMI) and pressure management systems to detect anomalies in real-time. Regular audits and maintenance checks are also part of the program to ensure sustained efficiency. By reducing NRW, the

university can improve water supply efficiency, reduce costs, and enhance the sustainability of its water management practices.

Enablers/ Stakeholders: RC, JHB
Timeframe: 5 years
Indicator: Percentage of water bills reduction.

SECTOR
04

WASTE MINIMISATION & RECYCLING

Sector 4 – Waste Minimisation & Recycling

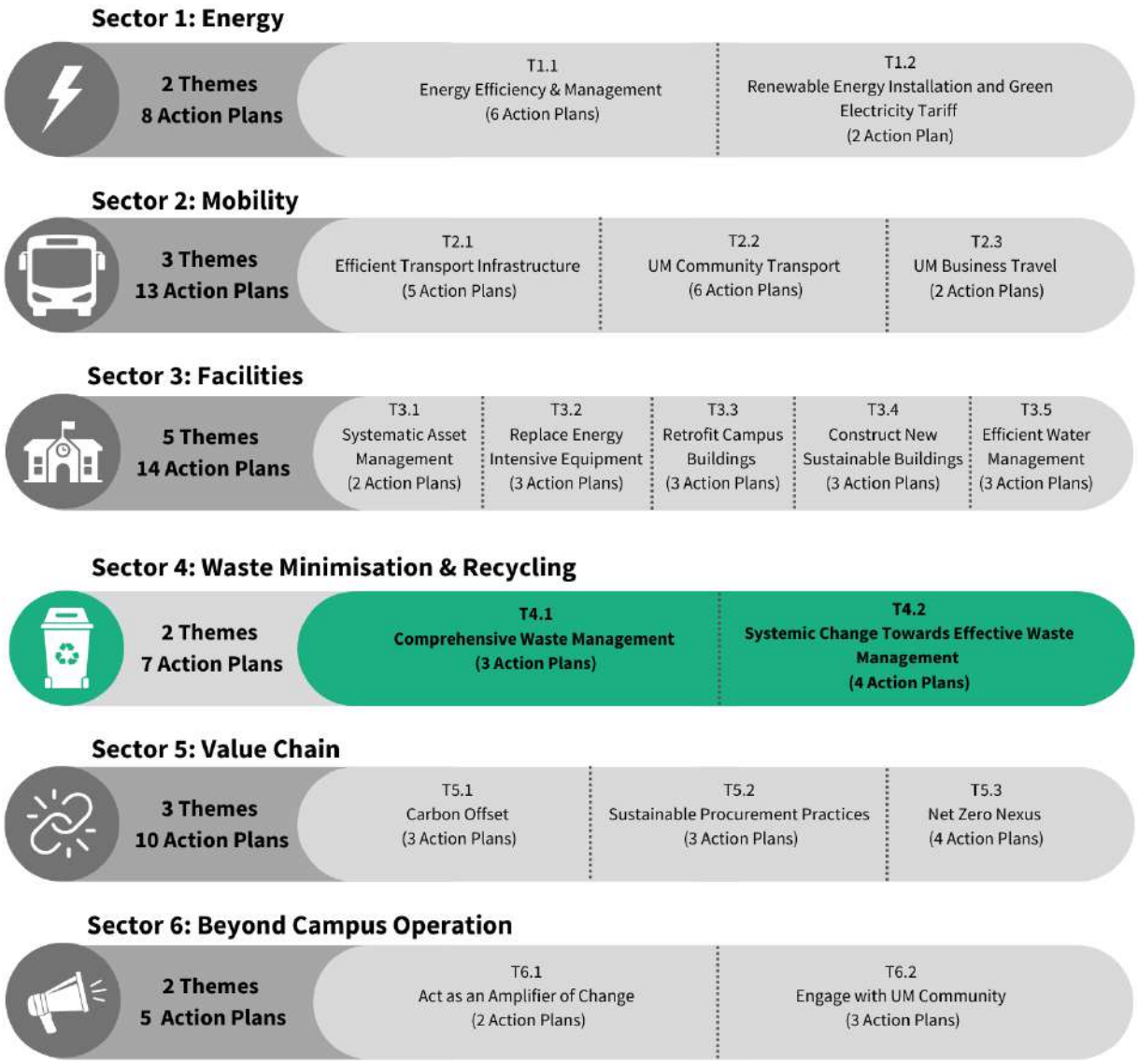


Figure 6: Sector 4 - Waste minimisation & recycling summary

Definition & General Statement

Waste minimisation focuses on reducing waste generation through approaches such as the 6R model and improving material efficiency to enhance environmental protection. UM is committed to advancing waste minimisation and recycling practices as part of its dedication to environmental sustainability. Our strategy encompasses reducing waste generation via an effective waste management plan, enhancing recycling programmes, and integrating sustainable practices into campus operations. By establishing ambitious goals, engaging students and staff, and continuously refining our waste management systems, we aim to minimise our ecological footprint and foster a culture of sustainability within our dynamic university community.

Figure 7: Waste Management Hierarchy

Theme 4.1: Comprehensive Waste Management

As global awareness of climate change intensifies, achieving Net Zero emissions has become a crucial objective for countries, organizations, and communities. A key component of this goal is effective waste management, which addresses the reduction, disposal and maximising recycling and reuse, and leveraging advanced technologies to treat residual waste in an eco-friendly manner. Emphasis is placed on creating a circular economy model, where materials are kept in use for as long as possible, extracting maximum value before recovering and regenerating products and materials at the end of their service life. Effective waste management strategies can play a pivotal role in mitigating these emissions, advancing the transition towards a more sustainable and carbon-neutral future.

Action Plan 4.1.1: Revise / Establish UM Waste Management Plan (WMP)

To strengthen the existing waste program, we will prioritise the waste hierarchy as our guiding principle, emphasising waste prevention, minimisation, and increased recycling. Our strategy will align with UM's Sustainability Policy and the UM Eco-Campus Blueprint, integrating these principles into a comprehensive framework. This will involve defining waste streams and data metrics, establishing a baseline year, monitoring progress, and setting both short-term (quarterly and yearly) and long-term objectives and targets, all supported by a detailed action plan.

This approach offers UM campus several benefits, including:

- Legal compliance
- Reduced environmental impact
- Improved reputation
- Support for carbon reduction targets
- Cost savings/Revenue Stream

Enablers: DVC (D), HEP
Timeframe: 1 year
Indicator: Completion of the waste management plan, including quarterly reports on progress towards short-term and long-term objectives. Specific metrics could include the number of waste reduction initiatives implemented and improvements in recycling rates.

Action Plan 4.1.2: Measureable Waste Management Targets

Clear targets and indicators are needed to ensure measureable outcomes. To achieve this, the following initiatives are needed:

- **Establish a KPI for RC on Waste Management:** Implement a KPI focused on waste generation, encompassing both reduction and disposal. This KPI will be based on baseline data and aligned with JHB's sustainability goals to effectively track progress.
- **Introduce KPI *Pembudayaan Lestari* for Individual Staff:** Develop a KPI for individual staff members under the *Pembudayaan Lestari* programme. This KPI will measure and encourage personal contributions towards sustainability initiatives, fostering a culture of environmental responsibility within the organisation.

Enabler: DVC (D), JHB, UMSDC
Timeframe: 3 years
Indicator: Development and tracking of KPIs for waste management at all facilities and for individual staff, including measurable reductions in waste generation and improvements in sustainability practices.

Action Plan 4.1.3: Enhance Waste Data Accuracy for all Waste Streams

- **Office/RC Waste:** Enhance data collection and reporting processes for office and RC waste streams. Implement detailed tracking systems to monitor waste volumes, types, and disposal methods, ensuring accurate and actionable insights.
- **Food Waste from Cafe:** Develop a comprehensive approach to monitor and analyse food waste generated by cafes. Introduce measures for precise recording of waste amounts and types, along with benchmarks for waste reduction.
- **Hazardous Waste (Compliance):** Strengthen data management for hazardous waste to ensure regulatory compliance. Improve tracking systems to monitor quantities, disposal practices, and adherence to safety protocols, thereby ensuring accurate reporting and risk mitigation.

Enablers: All RC
Timeframe: 1 – 2 years
Indicator: Compilation of waste data, recycling rates, and number of innovations.

Theme 4.2: Systemic Change towards Effective Waste Management

Achieving effective waste management requires more than just incremental improvements, it demands a systematic transformation in how waste is handled, recycled and disposed of across all sectors. As waste management becomes increasingly critical in the fight against climate change and environmental degradation, it is clear that current methods must evolve to build resilience against future challenges. This transformation involves rethinking processes, adopting innovative technologies, and redefining responsibilities at every stage of the waste lifecycle.

Action Plan 4.2.1: Transition to Bioplastics and Implement Single-Use Plastic Fee Policy

To significantly mitigate the environmental impact of single-use plastics on campus, we will transition to bioplastics and implement a fee for single-use plastic items provided by vendors.

- Transition to Bioplastics:
    - **Implementation:** Initiate the replacement of traditional plastic products on campus with bioplastics, including cutlery, plates, straws, and bags used in dining facilities, events, and other campus activities.
    - **Standards and Procurement:** Develop procurement guidelines to ensure that all bioplastics meet established environmental and quality standards. Collaborate with suppliers to source bioplastics that are compostable or biodegradable.
    - **Awareness and Training:** Organise workshops and training sessions for campus staff and students to educate them about the benefits of bioplastics and proper disposal methods.

- Vendor Fee for Single-Use Plastics:
    - **Policy Implementation:** Require all campus vendors to implement a fee for single-use plastic items, including bags, utensils, and containers. The fee will encourage the reduction of plastic use and promote the adoption of sustainable alternatives.
    - **Fee Structure:** Establish a standardised fee structure and provide vendors with guidance on how to integrate this fee into their pricing models. Ensure transparency and communication with the campus community about the new policy.
    - **Monitoring and Compliance:** Develop a monitoring system to track compliance and evaluate the impact of the fee on plastic usage. Regularly review the policy's effectiveness and make necessary adjustments as needed to enhance its impact.

Enabler: All RC
Timeframe: 2024
Indicator: Percentage increase in the use of bioplastics on campus (e.g., 20% increase within one year) and the reduction in single-use plastic items following the implementation of the fee policy.

Action Plan 4.2.2: Enhance food waste management on campus to reduce waste management costs

To effectively manage food wastes generated on campus, existing processes must be improved through the following initiatives:

- **Upgrade Existing Food Waste Bins:** Enhance food waste bins by incorporating strainers designed to reduce moisture and oil content. This modification will facilitate better separation of liquids and solid waste, improving composting efficiency, quality, minimising odours and reducing pest issues. This will also reduce landfill waste.

- **Implement Distributed Food Waste Composting:** Establish localised composting facilities at each RC (department or unit) across campus. Each RC will have access to composting bins and resources tailored to manage the specific types of food waste generated in that area.

- **Foster Student Involvement in Waste Management:**
  - Engagement Programs: Develop initiatives to actively involve students in waste management efforts through volunteer opportunities, awareness campaigns, and educational workshops.
  - Leadership Opportunities: Create student leadership roles or committees focused on waste management and sustainability to drive initiatives and cultivate a culture of responsibility.

- **Bring Your Own Reusable Container Initiative:** Launch a campus-wide campaign encouraging students, staff, and faculty to use reusable containers for meals and beverages. Offer incentives such as discounts at campus dining facilities for individuals who use their own containers. Provide resources and guidelines on suitable and safe types of containers for campus use.

Enabler: All RC
Timeframe: 1 year
Indicator: Reduction in food waste generated (measured in weight or volume); number of participants in the Bring Your Own Reusable Container Initiative; and effectiveness of distributed composting programs, including the quality and volume of compost produced.

Action Plan 4.2.3: Review Existing Waste Management Service Providers

Review and update existing service provider contracts (cleaning & canteen) to incorporate the following elements:

- **WMP Guiding Principles**: Integrate waste hierarchy principles with a strong emphasis on recycling and Standard Operating Procedures (SoP).
- **Sustainable Cleaning Products**: Require the utilisation of environmentally friendly cleaning products.
- **Resource Efficiency Enhancement**: Focus on improving resource efficiency, including labour and tools.
- **Innovation Identification**: Identify opportunities for innovation and low-hanging fruits within current SoPs.
- **Integration of Waste Data and Audits**: Incorporate waste data and audits to monitor the volume of recyclables diverted from landfills.
- **Engagement in Enculturation**: Ensure that service providers engage in awareness and training initiatives to promote a culture of sustainability.

Enablers: JHB, Bursary, All RC with cafeterias
Timeframe: 1 year
Indicator: Reduction in number of complaints against cleaning and canteen operators concerning waste management.

Action Plan 4.2.4: Campus Reuse and Innovation Hub

To promote sustainability and creativity on campus by establishing a second-hand shop and a creative station that encourages students to develop and market innovative products from recycled materials.

Establish a Second-Hand Shop:

- Create a dedicated space on campus for a second-hand shop where students, staff, and faculty can donate, buy, or exchange pre-owned items.

Create a Creative Station:

- **Concept:** Develop a creative station where students can design and produce innovative products using recycled materials. This station will provide tools, resources, and workspace for students to experiment with crafting and repurposing materials.
- **Workshops and Courses:** Offer workshops, courses, and mentorship programs focused on sustainable design, upcycling techniques, and product development. These educational opportunities will equip students with the skills to transform recycled materials into marketable products.
- **Product Marketplace:** Facilitate a marketplace or exhibition space where students can showcase and sell their creations. This platform will support student entrepreneurs and promote the value of sustainable innovation.

Integrate into Curriculum:

- **Sustainable Course Example:** Incorporate projects and assignments related to the reuse program into relevant courses. For instance, a course on sustainable design could include a module where students develop products using recycled materials and present their work at the creative station.
- **Interdisciplinary Collaboration:** Encourage collaboration between departments, such as art, design, engineering, and business, to enhance the impact of the creative station and support student projects.

Enablers: All RC
Timeframe: 3 - 5 years
Indicator: Percentage increase in material reuse; number of items donated, bought, or exchanged at the second-hand shop; and the number of products developed and sold through the creative station, along with student participation in related workshops and courses.

SECTOR
05

VALUE CHAIN

Sector 5 – Value Chain

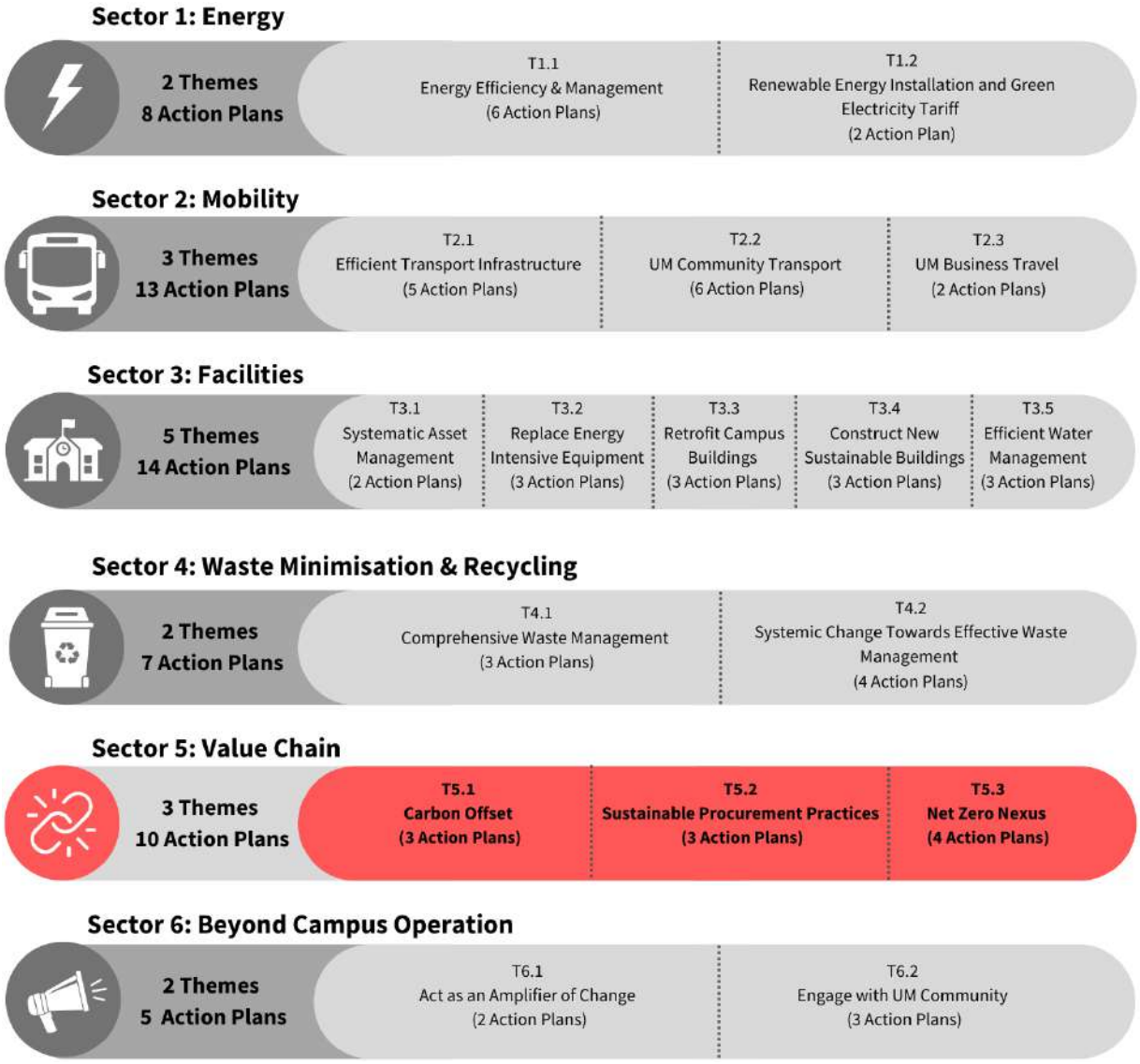


Figure 8: Sector 5 - Value chain summary

Definition & General Statement

In the context of UM's goal to achieve Net Zero emissions, the value chain encompasses the comprehensive set of activities and processes involved in the university's operations. This includes all stages from the procurement of goods and services, energy consumption, and campus infrastructure management to transportation, waste handling, and community engagement. UM is committed to systematically reducing or eliminating greenhouse gas (GHG) emissions at each stage of this value chain to attain a Net Zero carbon footprint.

UM is dedicated to embedding sustainability across its entire value chain as part of its commitment to achieving Net Zero emissions. This involves a thorough and integrated approach to managing

all aspects of campus operations. From the sourcing and procurement of materials, through the optimisation of energy use and implementation of low-carbon transportation options, to the establishment of effective waste management practices, the university focuses on minimising its environmental impact. By addressing emissions at every stage of its value chain, Universiti Malaya aims to significantly reduce its carbon footprint, thereby supporting global efforts towards environmental sustainability and contributing to overarching Net Zero objectives.

Theme 5.1: Carbon Offset

As the global community intensifies efforts to combat climate change, carbon offsets have emerged as a key tool for individuals, businesses, and governments seeking to achieve carbon neutrality. Carbon offsets allow entities to compensate for their GHG emissions by investing in projects that reduce or remove an equivalent amount of carbon dioxide or other greenhouse gases from the atmosphere.

The fundamental idea behind carbon offsets is to balance out unavoidable emissions, creating a pathway to reach Net Zero emissions. By supporting activities that absorb or reduce emissions elsewhere, UM can take responsibility for her carbon footprint even when direct reductions are not feasible due to prohibitive costs and technological challenges.

However, for carbon offsets to be effective, it is crucial that they are implemented with transparency, rigorous standards, and accountability. Ensuring that offset projects deliver genuine, measurable, and permanent reductions in GHG emissions is essential to maintaining the credibility of this approach. Additionally, a focus on high-quality offsets that promote sustainable development and benefit local communities can further enhance their impact.

Action Plan 5.1.1: Engage Carbon Offset Provider

This action plan aims to identify a suitable carbon offset provider that aligns with UM's environmental goals. By rigorously evaluating potential partners, we seek to select a provider capable of delivering effective carbon offset solutions to compensate for our emissions. This strategic initiative is designed to enhance our sustainability efforts, reduce our carbon footprint, and support our broader objective of achieving Net Zero emissions. Partnering with the appropriate provider will be critical in advancing our commitment to environmental stewardship and strengthening our campus's green initiatives.

Enabler: AVC (CS)
Timeframe: 1 year
Indicator: Baseline of GHG/carbon emission; Identify carbon emitters; number of carbon offset providers.

Action Plan 5.1.2: Leverage Assets for Carbon Offset

This action plan focuses on optimising existing resources and infrastructure to effectively mitigate UM carbon footprint. By integrating carbon offset strategies into UM operations

and maintenance practices, we aim to enhance the environmental performance of our campus. This approach will contribute to our goal of achieving Net Zero emissions while demonstrating our commitment to sustainable management and environmental responsibility.

Enablers: RC
Timeframe: 5 years
Indicator: Baseline of GHG emission; UM carbon stock inventory.

Action Plan 5.1.3: Cap-and-Trade Systems

This approach establishes a cap on emissions, allowing UM to buy and sell permits for CO_2 emissions. Funds will be allocated in the annual operating expenditure for purchasing carbon emission permits. Conversely, UM can sell permits to others when emissions are reduced or retain them for future use. This creates a financial incentive for UM to lower emissions.

Enablers: JHB & Industry partners
Timeframe: 5-10 years
Indicator: Amount of GHG emission; UM carbon stock inventory.

Theme 5.2: Sustainable Procurement Practices

Sustainable procurement is a critical approach that integrates environmental, social, and economic considerations into UM's purchasing decisions, aiming to minimise negative impacts on the planet while maximising positive outcomes for communities and economies. By prioritizing products and services that are produced and delivered in a more sustainable manner, UM can reduce its carbon footprint, conserve resources, and promote ethical practices throughout their supply chains.

Sustainable procurement not only contributes to the achievement of broader UM corporate sustainability goals but also helps to mitigate risks, reduce costs, and enhance UM's reputation with stakeholders who value environmentally and socially responsible practices.

Action Plan 5.2.1: Upgrade Green Procurement for Net Zero

This action plan aims to upgrade UM's green procurement policies by integrating Net Zero principles and in line with the Government Green Procurement (GGP) method. It involves revising existing guidelines to align with sustainability objectives and collaborating with key suppliers listed in the Malaysia Green Technology and Climate Change Corporation (MGTC) *MyHijau* Directory to improve procurement processes.

Through these partnerships, we will develop and implement practices that fulfil essential carbon reduction criteria. The plan includes establishing enhanced green procurement procedures to ensure that all acquired goods and services contribute to lowering our

carbon footprint. The university will continuously monitor and evaluate the effectiveness of these updates, reporting on progress and making necessary adjustments to optimise our commitment to achieving Net Zero emissions.

Enabler: Bursary, All RC
Timeframe: Within 5 years (to achieve 100%)
Indicator: Establishment of UM Green Procurement method.

Action Plan 5.2.2: Report High Emission Products via GHG Inventory

Require Responsibility Centres (RC) to report their use of the GHG inventory to identify products or services with high emissions within their value chains. This reporting will provide critical insights into the sources of significant carbon emissions and facilitate targeted actions to mitigate their impact. By analysing this data, we can make informed decisions to prioritise low-emission alternatives and enhance our overall sustainability performance.

Enabler: All RC, JHB (coordinator)
Timeframe: Immediately
Indicator: GHG reporting framework; Internal life-cycle assessments can identify products that have high extraction, energy, transportation, operational and end-of-life related emissions.

Action Plan 5.2.3: Integrate Net Zero & Sustainability in Supplier Assessment

The action plan will integrate Net Zero requirements with broader sustainability impacts by developing criteria that encompass carbon reduction as well as environmental and social factors. Suppliers and vendors will be assessed against these criteria to ensure they meet high sustainability standards. These evaluations will inform procurement decisions, prioritise alignment with Net Zero goals, and promote positive environmental and social contributions. Ongoing monitoring, regular reporting, and collaboration with suppliers will facilitate continuous improvement and advance our sustainability objectives.

Enabler: All RC, JHB (coordinator)
Timeframe: Immediately
Indicator: Number of Net Zero and sustainability criteria in supplier assessment.

Theme 5.3: Net Zero Nexus

The concept of the Net Zero nexus represents the interconnected efforts required to balance carbon emission management with removal measures, ultimately aiming to achieve a state where no additional carbon emissions are added to the atmosphere. The "nexus" emphasises the interconnectedness of different sectors such as campus management, research, innovation, and benchmarking, that must work in harmony to achieve Net Zero emissions. It highlights the need

for collaboration between various UM entities to create holistic solutions that address both emission reduction and sustainable development goals.

Action Plan 5.3.1: Eco Campus Management

Structural changes are needed to ensure the delivery of Net Zero projects through efficient management of an eco-campus. To meet this target, UMSDC must be placed under the purview of the AVC (CS) office to shift their focus from research-led activities towards strategic planning and execution of high impact campus wide strategic projects. UMSDC should work closely with other RCs especially the JHB to implement Net Zero and sustainability aspirations and monitor achievements. Suitable and ample manpower should be provided to run the enhanced UMSDC in addition to financial support to implement high impact projects, which are derived from the UM Net Zero Strategic Plan 2030.

Enabler: VC, AVC (CS), Bursary, Registrar
Timeframe: Immediately
Indicator: Updated AVC (CS) and UMSDC organisational structures; UMSDC yearly budget; Number of UMSDC staff.

Action Plan 5.3.2: Supporting Net Zero Research and Innovation

In order to accelerate the development of new technologies and innovations to realise a Net Zero campus, ongoing research endeavours need to be redirected through the following initiatives:

- Strategic branding of UM Living Labs Action Research, highlighting key thematic areas related to Net Zero and carbon offsetting.
- Develop and enhance FYP Sustainability Development Goal (SDG) @UM through the Academic Strategic and Planning Department (ASPD).
- Explore strategic industry/agency linked research program (e.g. the Energy Audit Conditional Grant from SEDA Malaysia, to support energy management and capacity building, including the appointment of ESCO under UMConsult).
- Integrate Net Zero into relevant academic courses (e.g. Building Performance).

Enablers: ASPD, Deputy Vice-Chancellor – Research & Innovation [DVC (R&I)], UMSDC, UMCares, JSM & Industry partners
Timeframe: Immediately
Indicator: UM SVC platform; Number of research projects on Net Zero; Number of FYP on Net Zero/sustainability; Number of academic courses mapped with Net Zero elements; Number of related publications.

Action Plan 5.3.3: Innovative and Creative Group (KiK) Thematic challenge

The Innovative and Creative Group (KiK) thematic challenge at UM is a targeted initiative designed to address specific sustainability issues through innovative solutions. This challenge encourages teams across the university to develop and implement novel approaches to key environmental and operational problems. By harnessing the collective expertise and creativity of our community, the thematic challenge aims to drive significant advancements in sustainability practices and contribute to our broader goal of creating a more eco-friendly and efficient campus.

Enabler: RC & Assistant Registrar
Timeframe: Immediately
Indicator: Output from KIK relevant to carbon offset.

Action Plan 5.3.4: Sustainability Ranking and Reporting

A robust data collection and analysis methodology is needed to ensure UM's readiness for any relevant sustainability ranking initiatives. These rankings help to establish UM's credibility and worldwide visibility in environmental stewardship, social responsibility and responsible governance while conducting its core processes.

In support of rankings, UM's Net Zero and sustainability achievements must be categorically compiled and reported in line with environmental, social and governance (ESG) framework. Besides forming the base for sustainability rankings, this reporting method will help UM attract external investments into research, product developments, and academic programmes. These investments will directly support the UM's long-term financial sustainability.

Enabler: AVC (CS)
Timeframe: Immediately
Indicator: Reduction in ranking indicators without data; ESG report.

SECTOR
06

BEYOND CAMPUS OPERATIONS

Sector 6 – Beyond Campus Operations

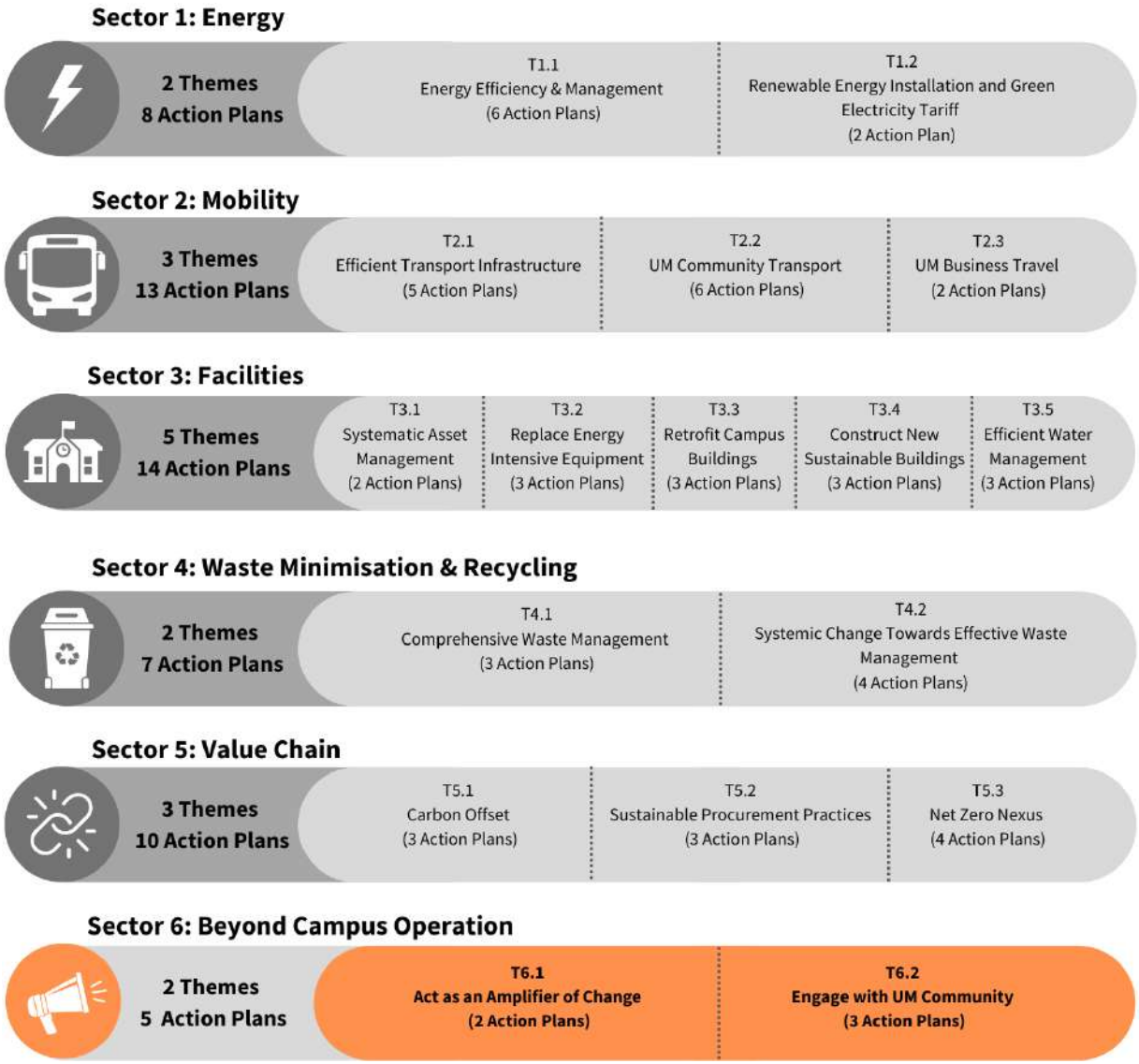


Figure 9: Sector 6 - Beyond campus operation summary

Definition & General Statement

"Beyond campus operations" refers to activities, strategies, or functions that extend outside the typical scope of university's internal activities. In the context of a Net Zero campus, this concept involves the integration of sustainable practices that promote behavioural changes supporting sustainability efforts. This sector signifies a collaborative approach to achieving Net Zero targets, including community outreach, partnerships with industries, and engagement with relevant stakeholders.

At UM, we have developed three strategies and five action plans focused on measures to support and complement campus operations. This encompasses initiatives or functions occurring outside the traditional campus environment that align with the institution's mission and goals.

Theme 6.1: Act as an Amplifier of Change

In the context of a Net Zero campus, the "ACT AS AN AMPLIFIER OF CHANGE" principle refers to the ability of educational institutions to catalyse significant shifts toward sustainability through integrated strategies. This involves leveraging existing resources and infrastructure to optimise energy use and reduce emissions, exemplified by the multi-energy campus system that employs co-generators and renewable energy credits to achieve carbon neutrality and cost savings.

Additionally, adopting a new delivery paradigm that emphasises collaboration, technological flexibility, and digital monitoring is essential for tracking progress and scaling efforts toward Net Zero goals. Educational initiatives, such as experiential learning and behavioural interventions, can cultivate energy citizenship among students, thereby fostering grassroots sustainability movements.

Moreover, higher education institutions can serve as models for urban sustainability by implementing zero-carbon action plans that engage various community stakeholders. Collectively, these approaches position campuses as pivotal players in the broader transition to a sustainable future.

Action Plan 6.1.1: Talent Development: Magnifying Knowledge and Expertise to Influence Change

UM must continue and excel in developing talents who will enable all planned Net Zero strategies by implementing the following programme:

- **Enhance *Program Transformasi Minda* (PTM)**: Review and revise the programme to incorporate courses on sustainability and Net Zero principles.
- **Offer sustainability/Net Zero training:** Provide training courses led by Human Talent Development for existing staff and Deputy Deans focused on sustainability.
- **Promote visibility:** Disseminate periodic communications that include information on Net Zero and sustainability initiatives.
- **Monetary incentives for sustainability performance**: Introduce financial incentives to encourage healthy competition among RCs for sustained sustainability performance.

Enablers: Human Resources Department (JSM), Deputy Vice-Chancellor (Academic & International) [DVC (A&I)], Deputy Vice-Chancellor (Student Affairs) [DVC (SA)], & Deputy Vice-Chancellor (Development) [DVC (D)]
Timeframe: 12 months
Indicators: Number of people trained (staff and students); Campus sustainability performance on monthly basis; Number of sustainability coordinators; Number of SDG Champions.

Action Plan 6.1.2: Convening and Connecting Key Stakeholders

UM community must work together towards Net Zero targets and must not continue to work in silos. Therefore, UM should:

- Establish an integrated database of stakeholders related to Net Zero and sustainability initiatives on campus.
- Enhance strategic partnership through MoU/A with relevant agencies focused on Net Zero and sustainability efforts.

Enablers: UM Industry Liaison Centre (ILO), International Relations Centre (IRC) & UM Centre of Innovation and Enterprise (UMCIE)
Timeframe: 12 months
Indicator: Database of stakeholders (internal and external).

Theme 6.2: Engage with UM Community

Engaging with UM community in the context of a Net Zero campus involves fostering a collaborative and educational environment that promotes the adoption of sustainability and Net Zero practices among both staff and students. Research indicates that experiential education effectively shapes responsible behaviour, encouraging active participation in sustainability initiatives. A holistic approach, combined with innovative engagement methods, can empower students and staff to take ownership of their roles in achieving Net Zero goals, thereby fostering a sense of community and shared responsibility on campus.

Action Plan 6.2.1: Embedding Student Engagement in Decarbonisation Initiatives

Students are the largest stakeholder that must be with the UM management and staff to execute the Net Zero strategies. Despite the relatively short study length on campus, their involvement in Net Zero decision making and practice is crucial to successfully achieving the intended targets. Therefore, effective engagements as listed below are needed.

- Integration of Net Zero & sustainability themes in UM-Week of Welcome (UM WOW) / *Minggu Suai Kenal Pelajar* (MSKP) activities.
- Upskilling courses in collaboration with relevant partners (e.g. SEDA Malaysia) to offer upskilling courses for both students and staff including facilities manager and sustainability coordinator.
- Provide certification programs in micro-credential courses focused on sustainability.

Enablers: DVC (A & I), DVC (SA) & UMSDC
Timeframe: 1 – 3 years
Indicators: Number of sustainability student leaders.

Action Plan 6.2.2: Enabling Student-led Initiatives

Empower students by supporting student-led activities and innovation for effective Net Zero and sustainability enculturation across the campus through the following initiatives:

- Development of UM Sustainability Volunteers and Competencies Certification (UM SVC) in partnership with *Yayasan Hijau Malaysia*, relevant government agencies, and industry stakeholders.
- Launch UM Net Zero Challenge/Competition for RC and student bodies to foster sustainability leadership.
- Conduct a series of town hall sessions across the campus to engage discussions on Net Zero initiatives.
- Enhance projects in every RC by promoting and implementing student-led sustainability projects within each RC.

Enablers: DVC (SA), UM Student Council (MPP), ASPD, JHB, UMConsult, UMSDC & UM Community Engagement Centre (UMCares)
Timeframe: 1 – 3 years
Indicator: Number of projects/events; Number of participating students.

Action Plan 6.2.3: Foster a Campus Sustainability Culture

The involvement of all facets of the UM community is paramount in realising Net Zero targets. Therefore, formal staff and student representations through the initiatives below will help to strengthen institutional processes.

- **Appoint a Sustainability Champion at RC:** Designate a dedicated sustainability champion within each RC (department or unit) to lead and advocate for sustainable practices. This role will focus on driving initiatives, engaging the community, and ensuring effective implementation of sustainability goals.
- **Implement a Student Sustainability Championship Program:** Launch a tiered sustainability championship program for students across all academic years (Year 1, 2, 3, and 4). This program will encourage and recognise students' contributions to sustainability efforts, integrating environmental stewardship into their academic experience and personal development.

Enabler: DVC(SA), AVC(CS), Registrar, UMSDC
Timeframe: 1 year
Indicator: Number of sustainability champions appointed and active; participation rates in the Student Sustainability Championship Program; and measurable improvements in campus-wide sustainability practices and environmental responsibility.

UM Net Zero Strategic Plan Implementation

Implementation timeline

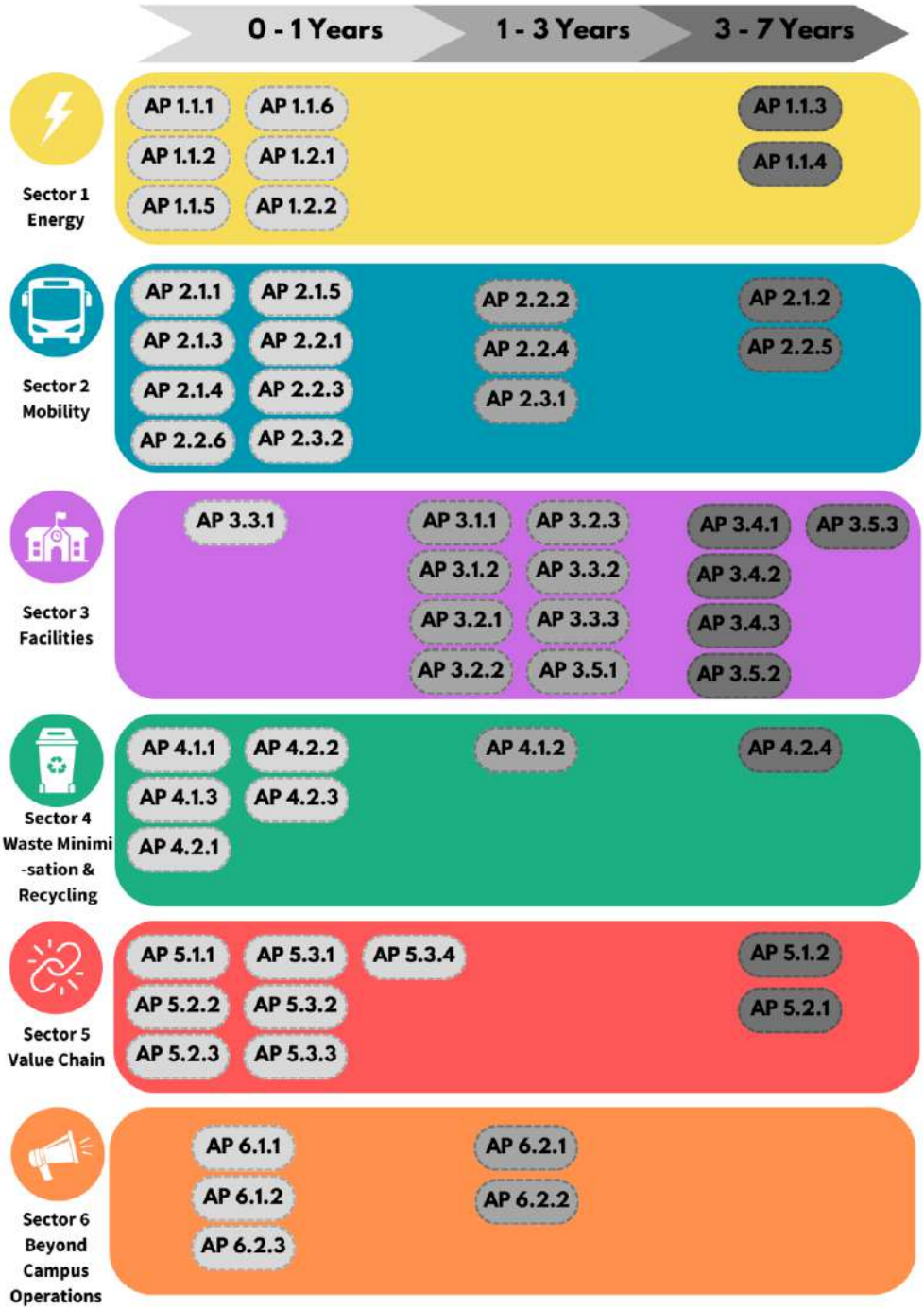


Figure 10: UM Net Zero Strategic Plan implementation timeline

Note:
AP = Action Plan

The UMNZSP must be implemented in stages to ensure that the whole campus community is well-equipped with ample knowledge and experience in net-zero carbon development and lifestyle. Over the course of seven year, until 2030, all action plans will be executed and monitored in terms of effectiveness in curbing campus carbon emissions and project delivery. Besides, certain action plans require long planning and development processes especially those involving the upgrading of buildings and infrastructure. Whereas others are more immediate and require insightful procurement, capacity building and management.

As shown in Figure 10, 53.6% of the action plans are slated for implementation in the first year of this strategic plan. This is a major financial undertaking that requires careful but resolute consideration to exact a noticeable impact in UM's carbon emissions. Indirectly, other benefits would be:

- Efficient energy management and cost savings through Sector 1: Energy.
- Cleaner air along the campus road network through Sector 2: Mobility.
- A better understanding of the campus's existing facilities through Sector 3: Facilities.
- A cleaner campus through Sector 4: Waste Minimisation and Recycling.
- Increased efficiency in work processes through Sector 5: Value Chain.
- A more active campus community through Sector 6: Beyond Campus Operations.

A further 25.0% of the action plans will be implemented in the second phase up to three years from the commencement of this strategic plan. They mostly involve upgrades and retrofits to existing campus buildings and infrastructure and fostering collaboration with external organisations for efficient connectivity and effective capacity building. The remaining 21.4% of the action plans which require some institutional changes and a deep understanding about UM's physical assets and resource consumption will be done in phase three.

Enablers

The success of this strategic plan requires university leaders, academicians, managers, professionals and supporting staffs who are dedicated, knowledgeable and resolute in their pursuit of a net zero campus. A diverse range of enablers, who are also this strategic plan's stakeholders are listed below. They are tasked according to their expertise and current scope of work. Some sectors such as Sector 1: Energy and Sector 3: Facilities involve a few specialist enablers while Sector 5: Value Chain and Sector 6: Beyond Campus Operations involve many enablers across UM which will require effective communication of data and ideas besides continuous cooperation by all identified parties.

Overall, the Associate Vice Chancellor (Corporate Strategy) Office must oversee the overall effectiveness of the UM Net Zero Strategic Plan implementation. Regular meetings, goals, key performance indicators and periodic audits are needed to ensure an effective implementation of this strategic plan.

Sector	Action Plan	*Enabler*																
		ASPD	AVC (CS)	B*	DVC (D)	DVC (R&I)	FSKTM	HEP	IRC	ILO	JHB	JSM	JTM	HR	S*	U*	RC	UMCIE	UMSDC
Energy	1.1.1		✓		✓														
	1.1.2		✓		✓														
	1.1.3				✓														
	1.1.4			✓	✓														
	1.1.5		✓		✓														
	1.1.6		✓		✓														
	1.2.1										✓								
	1.2.2										✓						✓		✓
Mobility	2.1.1							✓											
	2.1.2										✓								
	2.1.3										✓								
	2.1.4										✓								✓
	2.1.5						✓						✓		✓				
	2.2.1										✓		✓						
	2.2.2										✓		✓						
	2.2.3										✓								
	2.2.4						✓	✓					✓						
	2.2.5										✓								✓
	2.2.6															✓			
	2.3.1																✓		
	2.3.2													✓					

Note:
B* = Bursary, R* = Registrar/Asst Registrar, S* = Security Division, U*= University Management.

✓ = Enabler for the respective Action Plan

Sector	Action Plan	*Enabler*																	
		ASPD	AVC (CS)	B*	DVC (D)	DVC (R&I)	FSKTM	HEP	IRC	ILO	JHB	JSM	JTM	HR	S*	U*	RC	UMCIE	UMSDC
Facilities	3.1.1										✓		✓						
	3.1.2										✓		✓						
	3.2.1										✓						✓		
	3.2.2										✓						✓		
	3.2.3										✓						✓		
	3.3.1										✓						✓		
	3.3.2																✓		
	3.3.3										✓						✓		
	3.4.1										✓								
	3.4.2										✓								
	3.4.3										✓								
	3.5.1										✓								
	3.5.2										✓						✓		
	3.5.3										✓						✓		
Waste Minimisation & Recycling	4.1.1				✓			✓											
	4.1.2				✓						✓								✓
	4.1.3																✓		
	4.2.1																✓		
	4.2.2																✓		
	4.2.3			✓							✓						✓		
	4.2.4																✓		

Note:
B* = Bursary, S* = Security Division, U*= University Management.

✓ = Enabler for the respective Action Plan

Sector	Action Plan Action Plan	*Enablers*																		
		ASPD	AVC (CS)	VC	B*	DVC (A&I)	DVC (D)	DVC (R&I)	DVC (SA)	IRC	ILO	IP*	JHB	JSM	MPP	RC	R*	UMCA*	UMCO*	UM CIE	UM SDC
Value Chain	5.1.1		✓																		
	5.1.2															✓					
	5.1.3											✓	✓								
	5.2.1															✓					
	5.2.2												✓			✓					
	5.2.3												✓			✓					
	5.3.1		✓	✓	✓												✓				✓
	5.3.2	✓	✓					✓				✓		✓				✓			✓
	5.3.3															✓	✓				
	5.3.4		✓																		
Beyond Campus Orient -ation	6.1.1					✓	✓		✓					✓							
	6.1.2									✓	✓									✓	
	6.2.1					✓			✓												✓
	6.2.2	✓							✓				✓		✓			✓	✓		✓
	6.2.3		✓						✓								✓				✓

Note:
B* = Bursary, IP* = Industry Partners, R* = Registrar/Asst Registrar, UMCA* = UMCares, UMCO* = UMConsult.

✓ = Enabler for the respective Action Plan

Measurable Indicator

Every action plan in this document has measurable indicator(s) to ensure finite outcomes for periodic impact assessments every two years until 2030. Below is a list of all indicators:

Sector 1: Energy		
Theme	**Action Plan**	**Indicators**
Energy Efficiency & Management	1.1.1	Energy consumption per square meter, energy usage per capita and MGBC CarbonScore Certification
	1.1.2	BEI calculations, number of GBI or (equivalent) certifications, and percentage of UM ICT infrastructure energy usage reduction
	1.1.3	Number of audited buildings & percentage of electricity bill reduction
	1.1.4	Energy audit report
	1.1.5	
	1.1.6	Reduction of monthly/annual energy usage
Renewable Energy Installation and Green Electricity Tariff	1.2.1	Capacity of installed RE systems
	1.2.2	Electricity bill, mREC certificate
Sector 2: Mobility		
Theme	**Action Plan**	**Indicators**
Efficient Transport Infrastructure	2.1.1	70% of the residents are from the faculties within 700-meter radius of the residential college
	2.1.2	Increase at least 50% parking supply in the campus at the designated Park and Ride spots, at least 30% of the staff support the park and ride program
	2.1.3	Percentage in vehicles entering the UM campus; Compliance with the reduced 35 km/h speed limit
	2.1.4	Number of billboard contents; Vehicle speed & driver behaviour
	2.1.5	Daily traffic volume (at least 90% accuracy)
UM Community Transport	2.2.1	Bus frequency. Deploy more buses during peak hour (more capacity) with higher frequencies (suggested frequency every 10 minutes), off peak hour can have lower frequency (one in every 20 minutes)
	2.2.2	Number of van requests fulfilled; User satisfaction ratings
	2.2.3	User satisfaction level with the booking system and vehicle management
	2.2.4	Ridership rate; Percentage of vehicular carbon emissions
	2.2.5	Ridership rate; Percentage of vehicular carbon emissions
	2.2.6	At least 30% of the staff participating in the program, reduce at least 30% of the lunch time travel trip among the faculty members
UM Business Travel and Working Arrangements	2.3.1	At least 30% of the event participants transport is arranged using the non- motorized transport mode, or carpooling using university vehicle or private vehicle, or using public transport
	2.3.2	Percentage of academic staff applying for remote working

Sector 3: Facilities		
Theme	**Action Plan**	**Indicators**
Systematic Asset Management	3.1.1	Percentage of digitised assets
	3.1.2	Number of reported continuous improvements; Zero reported system faults
Replace Energy Intensive Equipment	3.2.1	Energy savings in monthly/yearly bills
	3.2.2	
	3.2.3	Number of replaced equipment or electrical appliances
Retrofit Campus Buildings	3.3.1	Building plans, Net lettable areas (NLA)
	3.3.2	Number of shared space bookings/rental amount
	3.3.3	Renewable energy usage over RC / whole campus
Construct New Sustainable Buildings	3.4.1	Number of related policies / guidelines on sustainable building
	3.4.2	For commercialisation and renting out
	3.4.3	Green space coverage
Efficient Water Management	3.5.1	GIS on Utilities Mapping
	3.5.2	Percentage of water usage reduction
	3.5.3	Percentage of water bills reduction
Sector 4: Waste Minimisation & Recycling		
Theme	**Action Plan**	**Indicators**
Comprehensive Waste Management	4.1.1	Completion of the waste management plan, including quarterly reports on progress towards short-term and long-term objectives. Specific metrics could include the number of waste reduction initiatives implemented and improvements in recycling rates
	4.1.2	Development and tracking of KPIs for waste management at all facilities and for individual staff, including measurable reductions in waste generation and improvements in sustainability practices
	4.1.3	Compilation of waste data, recycling rates, and number of innovations
Systemic Change towards Effective Waste Management	4.2.1	Percentage increase in the use of bioplastics on campus (e.g., 20% increase within one year) and the reduction in single-use plastic items following the implementation of the fee policy
	4.2.2	Reduction in food waste generated (measured in weight or volume); number of participants in the Bring Your Own Reusable Container Initiative; and effectiveness of distributed composting programs, including the quality and volume of compost produced
	4.2.3	Reduction in number of complaints against cleaning and canteen operators concerning waste management
	4.2.4	Percentage increase in material reuse; number of items donated, bought, or exchanged at the second-hand shop; and the number of products developed and sold through the creative station, along with student participation in related workshops and courses

Sector 5: Value Chain		
Theme	**Action Plan**	**Indicators**
Carbon Offset	5.1.1	Baseline of GHG/carbon emission; Identify carbon emitters; number of carbon offset providers
	5.1.2	Baseline of GHG emission; UM carbon stock inventory
	5.1.3	Amount of GHG emission; UM carbon stock inventory
Sustainable Procurement Practices	5.2.1	Establishment of UM Green Procurement method
	5.2.2	GHG reporting framework; Internal life-cycle assessments can identify products that have high extraction, energy, transportation, operational and end-of-life related emissions
	5.2.3	Number of Net Zero and sustainability criteria in supplier assessment
Net Zero Nexus	5.3.1	Updated AVC (CS) and UMSDC organisational structures; UMSDC yearly budget; Number of UMSDC staff
	5.3.2	Number of research projects on Net Zero; Number of FYP on Net Zero/sustainability; Number of academic courses mapped with Net Zero elements; Number of related publications
	5.3.3	Output from KIK relevant to carbon offset
	5.3.4	Reduction in ranking indicators without data; ESG report
Sector 6: Beyond Campus Operations		
Theme	**Action Plan**	**Indicators**
Act as an Amplifier of Change	6.1.1	Number of people trained (staff and students); Campus sustainability performance on monthly basis; Number of sustainability coordinators; Number of SDG Champions
	6.1.2	Database of stakeholders (internal and external)
Engage with UM Community	6.2.1	Number of sustainability student leaders
	6.2.2	Number of projects/events; Number of participating students
	6.2.3	Number of sustainability champions appointed and active; participation rates in the Student Sustainability Championship Program; and measurable improvements in campus-wide sustainability practices and environmental responsibility.

Conclusion

This document should be read in conjunction with the UM Master Plan 2050 for a more holistic view of what the UM campus could be by 2030 and beyond. UM must be modernised and be ready, in line with new technologies and practices and be an internationally recognised net zero campus showcase. This requires dedication and keen participation among the campus community and lead by a clear vision for carbon neutrality by 2030 and net-zero carbon emissions by 2050.

Beyond 2030, continuous monitoring of earlier action plans and significant changes to UM's work processes will lead towards a new set of guidelines to accelerate carbon emission reduction, carbon sequestration and efficiency in resource consumption and management practices. New technologies and measures should be incorporated into the next UM Net Zero Strategic Plan.

Contributors

Role	*Affiliation*
Editors	
Ts. Dr. Muhammad Azzam Bin Ismail	Director, UM Eco Campus
Assoc. Prof. Dr. Zeeda Fatimah Binti Mohamad	Director, UM Sustainable Development Centre
Advisor	
Prof. Dr. Yahaya Ahmad	Associate Vice Chancellor (Corporate Strategy)
Contributors	
Prof. Ir. Dr. Shaliza Ibrahim	UM Climate Change Committee
Prof. Ts. Dr. Jeyraj Selvaraj	Director, UMPEDAC
Ar. Dr. Sharifah Noor Nazim Syed Yahya	Executive Director, UM Estates Department
Ts. Dr. Steve Anthony Lojuntin	Director, Energy Demand Management Division, Sustainable Energy Development Authority (SEDA) Malaysia
Assoc. Prof. Sr. Dr. Norhayati Binti Mahyuddin	Department of Building Surveying, Faculty of Built Environment
Assoc. Prof. Ir. Dr. Khairunnisa Hasikin	Department of Biomedical Engineering, Faculty of Engineering UM Sustainable Development Centre (Governance & Acculturation Section Coordinator)
Assoc. Prof. Dr. Noor Suzaini Mohamed Zaid	Department of Building Surveying, Faculty of Built Environment
Assoc. Prof. Dr. Santha A/P Chenayah @ Ramu	Department of Economics, Faculty of Business and Economics
Assoc. Prof. Dr. Fauziah Shahul Hamid	Institute of Biological Sciences, Faculty of Science
Ir. Ts. Dr. Yuen Choon Wah	Department of Civil Engineering, Faculty of Engineering Head, Centre for Transportation Research
Dr. Fong Chng Saun	Institute of Advanced Studies UM Sustainable Development Centre

	(Research Section Coordinator)
Dr. Mohamad Rizal Baharum	Department of Building Surveying, Faculty of Built Environment
Dr. Teh Bor Tsong	Department of Urban and Regional Planning, Faculty of Built Environment
Dr. Elia Syarafina Abdul Shakur	Department of Real Estate, Faculty of Built Environment
En. Mohd Husni On	UM Estates Department (Policy Division)
En. Muhammd Faris Ali	UM Estates Department (Transportation Section)
En. Ramzi Bin Mohd Ruslan	UM Estates Department (Civil Section)
En. Noor Azril Bin Ramli	UM Estates Department (Strategic Planning Section)
Dr. Azizi Abu Bakar	UM Sustainable Development Centre
En. Mohd Fadhli Rahmat Fakri	UM Sustainable Development Centre
En. Affan Nasaruddin	UM Sustainable Development Centre
Pn. Siti Norasiah Abd. Kadir	UM Sustainable Development Centre
Cik Nuratikah Mohd Zainodin	UM Sustainable Development Centre
En. Muhd Aqmal Zullif	UM Sustainable Development Centre