2023

Building a Better, Greener World

SUSTAINABILITY REPORT ON UNIVERSITY OPERATIONS - 2022-2023

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OUR VISION

Global leadership in human development, excellence in education and healthcare.

We will become a university where sustainability is truly embedded through knowledge, engagement, collaboration, and innovation. All of our staff and students will understand the principles of sustainability. It will be an integral part of our operations and education. This will bring about positive change for future generations by creating leaders sensitive to climate action. We aspire to be leaders in every discipline of education and health care and a pioneer in sustainability practices while being the most preferred destination for students, staff, and industry.

Sustainability Policy Vision

Manipal Academy of Higher Education (MAHE) endeavours to promote community welfare, environmental protection, and efficient energy use to a level of performance that moves "beyond compliance". We strive to set educational, healthcare, environmental, and energy management benchmarks nationally and internationally. MAHE is committed to cleaner and greener campuses.

MAHE recognises that its operations consume resources and energy, leading to the emission of carbon dioxide and other greenhouse gases, adversely affecting the environment. The impacts of climate change and the subsequent requirement for carbon reduction are recognised globally and locally, leading to India setting legally binding CO_2 reduction targets. The University is committed to reducing the carbon emissions associated with its operations. MAHE has begun its journey to map its carbon footprint. We are setting benchmarks and targets and developing strategies to meet our Net zero Carbon goals.

INTRODUCTION – WHAT'S IN THIS REPORT

We understand that being sustainable is more than reducing our environmental impact; it is about wellbeing, resilience and intelligence – building the links between students, research and our operations so that we can make a positive difference.

Our approach to sustainability means focusing on the things that have a real impact. This approach encompasses the essential features of being holistic, inclusive, challenging, proactive and embedded. We want to give an accurate picture of the breadth of work we have been doing in the areas that matter. However, this report does not include every single project or activity, but it does give an overview of our actions, along with a more detailed look at some of our key achievements.

This report pertains to the operational aspects of the campuses located in Manipal and Mangalore for the financial year 2022-23. The courses offered are multi-disciplinary and vary across the spectrum. The student mix is heterogeneous, blending ethnic and international cultures. The campuses abide by various protocols to meet our sustainability ideologies, and we keep pushing our students to contribute hands-on and be part of the change we all need. The campuses are testimony to how an environment-conscious institution instils profound values in its students and influences the micro-dynamics of the location. This year, we have included the Manipal and Mangalore campuses of MAHE under the sustainability reporting scope; as the Bangalore campus is still under construction, it will be included in the subsequent years.

OUR THEMES AND SUSTAINABLE DEVELOPMENT GOALS (SGDS)

The Sustainability Report follows nine themes that we believe best suit our Sustainability Strategy and are linked to SDGs:

THEME 1: Energy Management

THEME 2: Water Conservation

THEME 3: Waste Management

THEME 4: Green Infrastructure Development

THEME 5: Biodiversity Enhancement

THEME 6: Transportation

THEME 7: Carbon Mapping

THEME 8: Carbon Sequestration

Throughout the report, we also identify how our actions contribute to the UN Sustainable Development Goals (SDGs) – a set of 17 goals to end poverty, protect the planet and ensure prosperity for all. This global focus is intrinsic to our sustainability efforts. From our home in Manipal, we understand how we can impact a local, regional, national, and international scale.

Of course, there is still work to do, and it is essential to keep focused. Each section outlines our priorities for the next twelve months and our goals to incorporate sustainability into our research, degree programmes and operations. This a comprehensive Sustainability Report on University operations. Education-related information is available in the annual report @ Annual Reports | Manipal Academy of Higher Education. and https://manipal.edu/mu/sdg.html.
Your opinions and ideas are essential to us, and we would love to hear what you think about our progress and ambitions for the future. Let us know by emailing registrar@manipal.edu.

THEME 1: Energy Management

MAHE's practices align with the United Nations SDGs, which aim to transform our world and promote prosperity for all while protecting our planet. The University's policy on energy efficiency supports the following:
Goal 7: Affordable and Clean Energy
Goal 12: Responsible Consumption and Production
Goal 13: Climate Action

Our Progress

The MAHE institutions have an energy efficiency policy to procure only energy-efficient appliances and phase out the old ones. Emphasis is now on improving energy management with better controls, monitoring through BMS and reducing losses. The University has an elaborate operation and control policy for purchasing, operating and monitoring the HVAC equipment on the campus.
Some of the measures adopted by the campus are:

- Underground High-Tension and Low-tension electric cables to reduce transmission loss and bird deaths.
- Replacement of conventional transformers by energy efficient 3 star rated low loss transformer.
- Power quality improvements include Power factor, Harmonics of the Transformers, and generators.
- The procurement policy ensures that only eco-friendly refrigerants such as R 410A, R 134A, R 508, R22, R134A, and R404 are used. It also ensures that ozone-depleting refrigerants are eliminated as per the specified dates under the terms of the Montreal Protocol.
- Energy efficient pumps/fans/blowers of IE4 and above for HVAC systems.
- Energy efficient pumps of IE4 and above for water pumping to be installed.
- Replacements of HPSV/ HPMV/CFL/Halogen lighting fittings by energy-efficient LED lights.
- Replacement of old units of chillers and outdoor units with energy-efficient systems
- Implementation of BMS for better management of HVAC systems.
- AMF auto load sharing and auto synchronisation panels are installed, developing an optimum design for Diesel generators.
- Solar heating and use of energy efficient Heat pumps for heating water for various purposes on campus instead of boilers and electric geysers.
- The use of master switches and motion sensors for hostels and academic buildings to optimise energy use.

The campus operational policy mandates regular energy audits, follow-ups and maintenance of its HVAC systems.

The University has invested in Rooftop solar energy and purchased solar energy to reduce the overall energy dependency on fossil fuels. The University has steadily increased its Rooftop solar PV bank by four times since 2015 and doubled its green-wheeling energy. Currently, the University has a Rooftop Solar PV capacity of 1,678.0 kWp. In addition to solar power, solar water heaters were installed in the residential and Hospital buildings of the campus to meet the hot water requirements and have an installed capacity of 4,87,891 LPD, thus reducing the dependency on electric water heating systems. Over the last year, the Institute has established a biogas plant of 6m3/day capacity that can convert 50 kg of organic waste into cooking fuel. This energy is used as cooking fuel in the campus's food court kitchens and is equivalent to 10,800kWh of Calorific energy.

Total Electrical energy consumed over campus is **6,43,67,868 kWh,** and Total Green energy used on campus is 4,59,30,134 kWh. The percentage of green energy offset over Electrical energy consumed is **71%**.

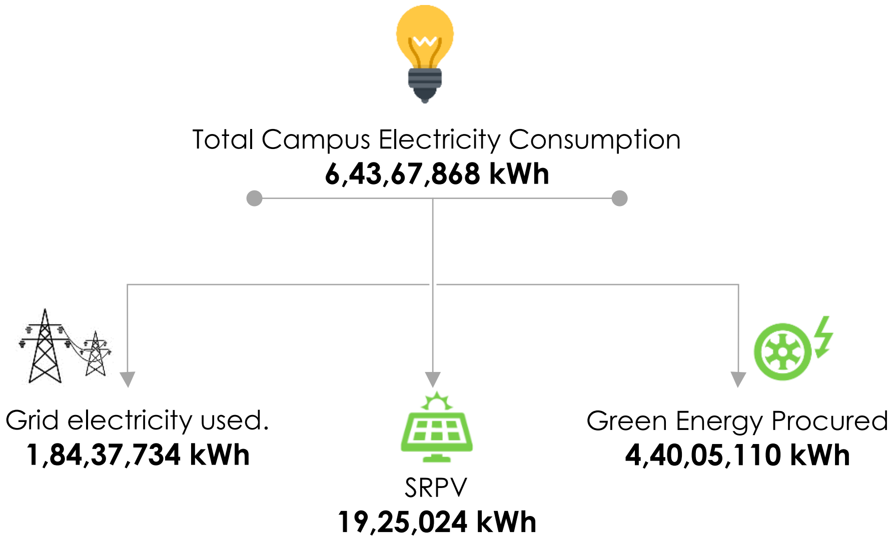


Figure 1: Electrical Consumption and Green Energy Breakdown

To further understand the energy performance of each building, its energy Performance Index (EPI) was calculated and compared with the BEE star rating EPI benchmarks under three building typologies- Academic/Office, Residential and Hospitals. The buildings were grouped, and their EPI was analysed to assess the potential for improvements and energy savings in each building. The energy performance index is a metric that shows the energy used per unit of the built-up area. The figures below show the percentage of buildings meeting the BEE star rating benchmark under each typology.

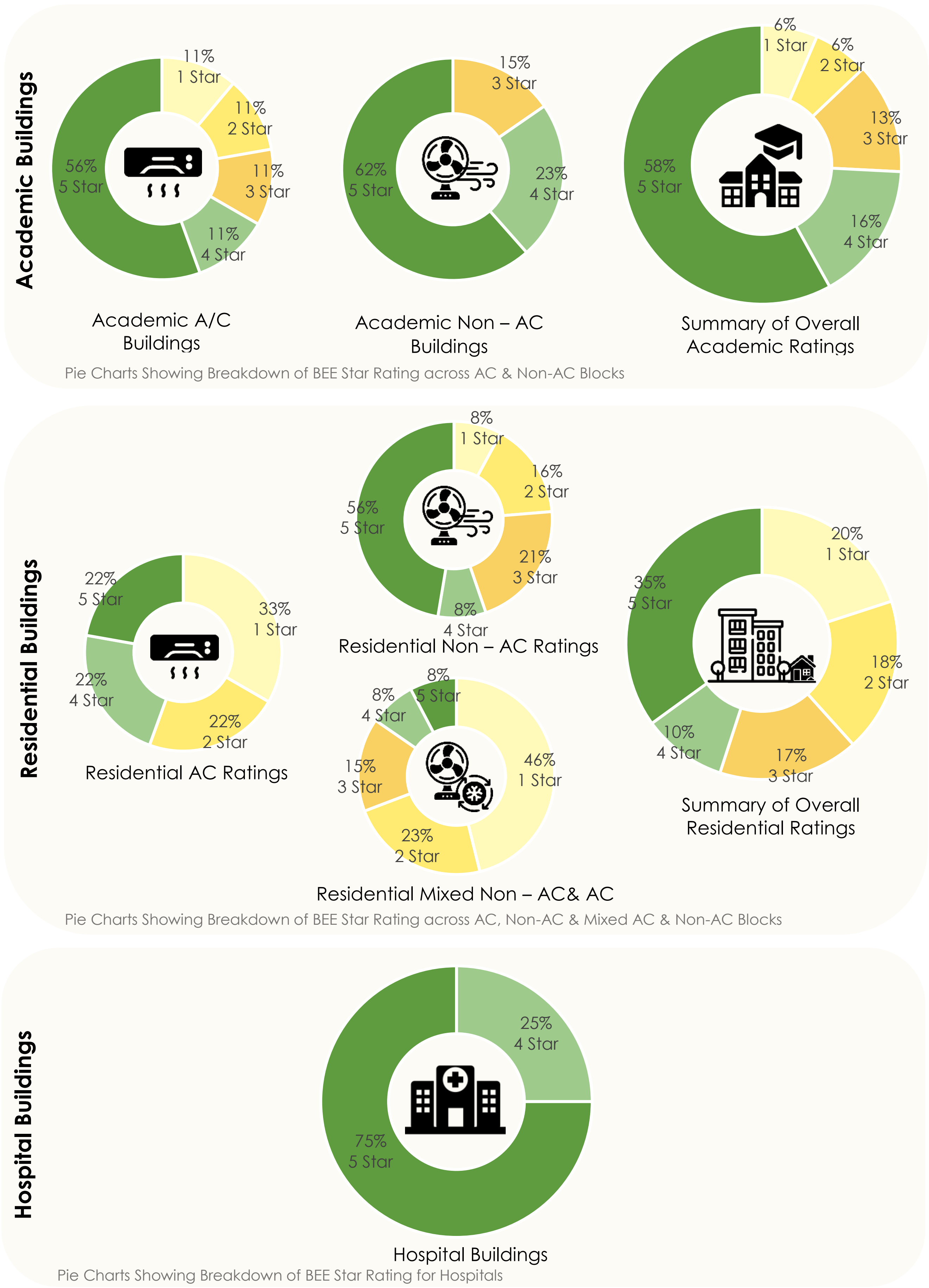


Figure 2: Summary Showing Break Down of BEE Star Rating for Buildings at MAHE

THEME 2: Water Conservation

MAHE's practices align with the United Nations SDGs, which aim to transform our world and promote prosperity for all while protecting our planet. The University's policy on water consumption supports the following:
Goal 6: Clean Water and Sanitisation
Goal 12: Responsible Consumption and Production

Our Progress

We recognise that many of our operations use water; therefore, we are committed to reducing water use and promoting water efficiency. Our campus sites have installed water-saving devices such as low-flow taps, waterless and sensor-based urinals, and dual-flushing toilets. Last year, around 223 waterless urinals were retrofitted on campus. The operations and management team actively monitors water usage to identify and fix leaks within buildings and below ground and ensures all facilities operate efficiently. Few hostel blocks use recycled water for toilet flushing, thus reducing freshwater dependence.

Decoding Net Zero Water

The first step of conservation is protecting and recharging the available water. The campus has successfully implemented several measures to save fresh water. Rooftop rainwater is harvested and sent to percolation pits, and water is recharged through the artificial lake on the campus. The excess water from stormwater drains is used for groundwater recharge through bore wells and pervious surface absorption. The open green spaces and native landscapes ensure water percolation.

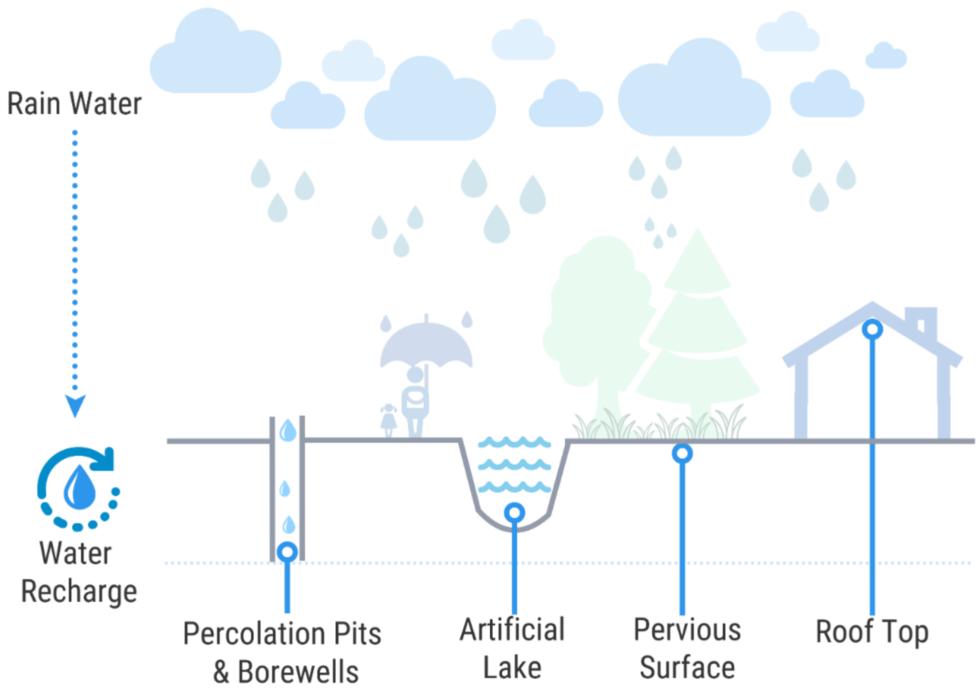


Figure 3: Schematic Diagram Showing Sources of Water Recharge on Campus

MAHE has a water availability of over 60 Lakh Kilolitres through rainfall. Mapping the campus demand helps realise the water neutrality potential, visualise our status and develop goals for our future. The brief narrative explains the background and assumptions for reported numbers.

At a Campus level.

- Total campus Area of land available for capturing rainwater = 564.4 Acres
- Annual Rainfall in Manipal = 4042 mm
- The ideal potential of rainwater recharge on site = Annual Rain (in mm) X Area (in SQM) x Coefficient Factor
- It is considered the total rainfall; 70% can be captured, and the remaining 30% must be allowed to naturally flow into the nearby water bodies to maintain surface water balance.
- Further, the site has pervious elements and Recharge wells that aid in capturing rainwater.

Hence, the campus can potentially capture 65,98,619 kL of rainwater a year. But the current recharged water through the artificial lake, natural drain through softscape and rechange wells is 50,07,907 kL.

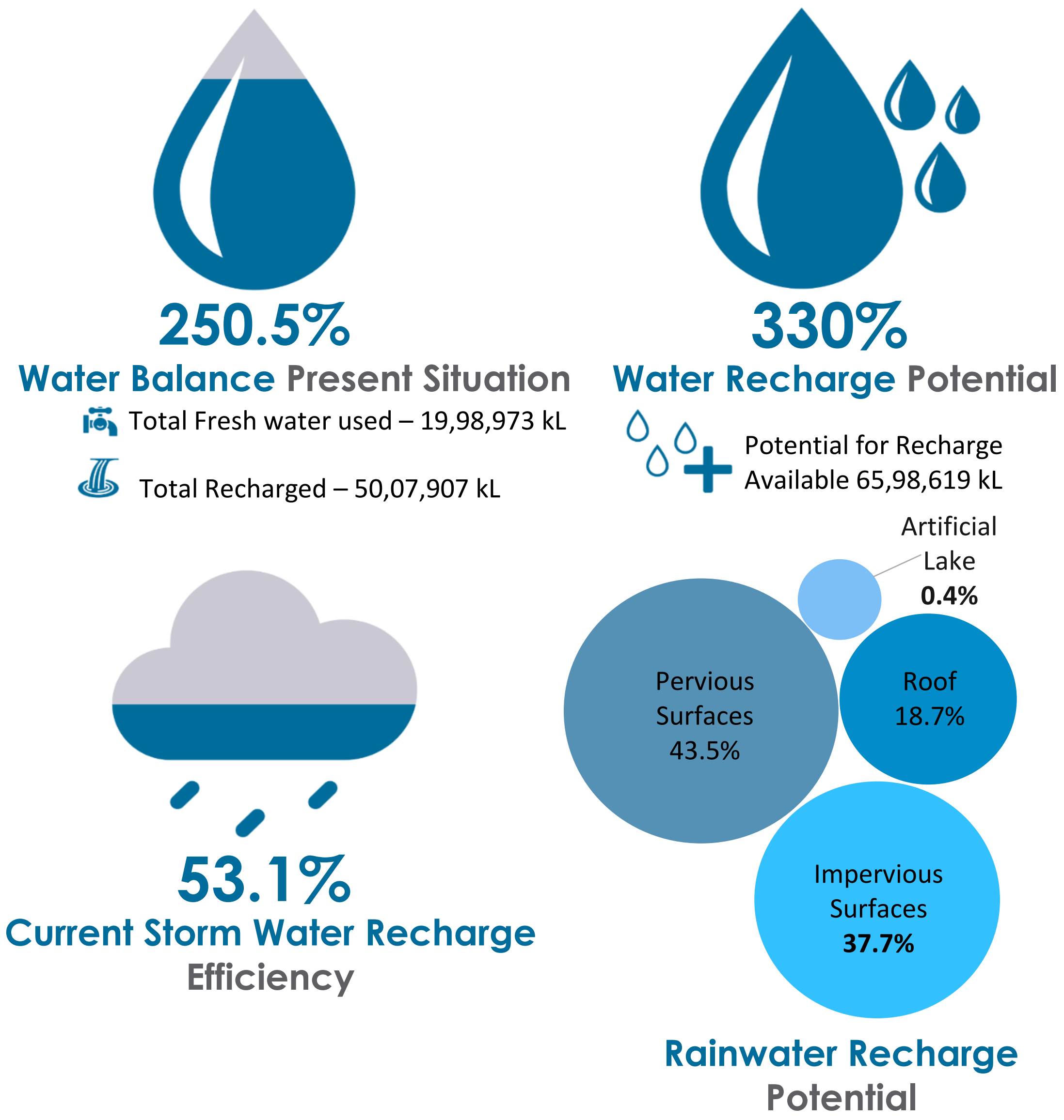


Figure 4: Water Balance Scenario - 2022-23

At the building level, domestic freshwater consumption is measured. The demands are then classified based on the building type – indicating the required water requirement per the National Building Code

(NBC) against the actual need. This helps us analyse if the water demand of the building type is within an acceptable range or if it exceeds it. The analysis will enable us to plan measures to reduce water use. The consumption has been compared against the domestic water requirement of NBC standards in the Figure below.

The overall campus buildings have been divided into the following building typology:

- Academic
- Hostel
- Residential
- Hospital
- Food Courts

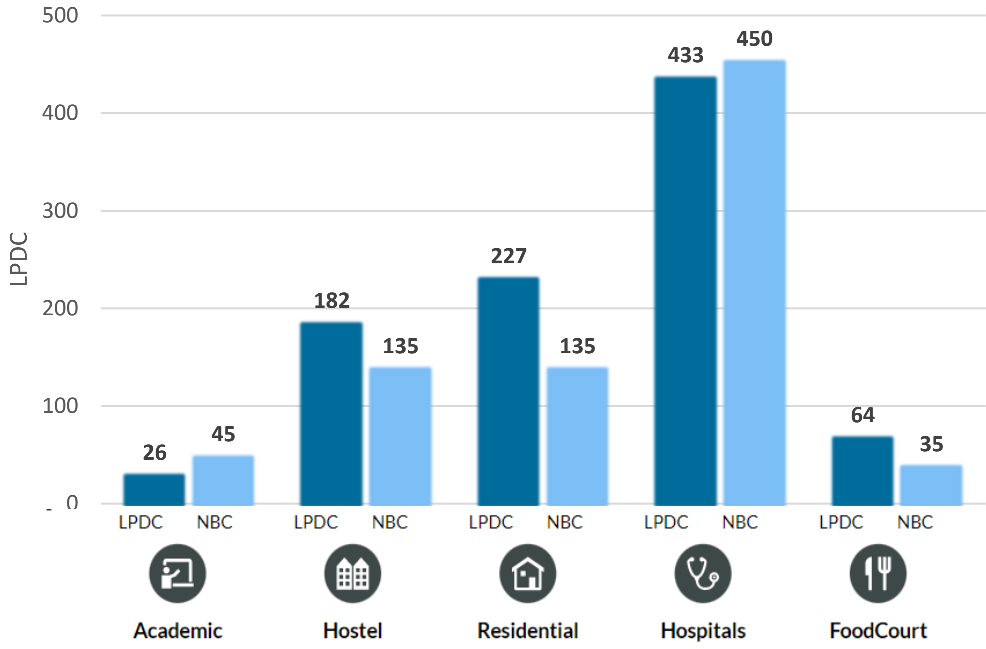


Figure 5: Water Demand Mapping - Actual Versus NBC

After accounting for the domestic water use, the water demand is further divided to understand the water use under the following categories:

- Domestic use- 19,98,973 kL (Includes all freshwater used for buildings, chiller plants, Recreational and axillary activities; excludes flushing water of 3,28,500 kL)
- Landscape- 18,61,978 kL (Treated STP water is used)

The next step is to recycle and reuse wastewater. The wastewater generated on the campus is recycled in state-of-the-art sewage treatment plants with a capacity of 7400 cubic meters/day and three Sullage treatment plants with a capacity of 375 cubic meters /day within the campus. The campus refrains from using fresh water for inland gardens and estates and shall only utilise treated wastewater from its in-house sewage treatment plants. Treated water from the Sullage treatment plant is re-circulated to the flush system and for landscaping purposes. The campus maintains the sewage treatment and the underground drainage systems. This ensures untreated wastewater does not join any waterbody, stream or lake and cause adverse environmental impact. Measuring devices in the plant ensure that energy use and water generation are captured.

The dried sludge generated is used as manure for gardens. This ensures that all the black and grey water is treated and reused. The treated water is 100% reused on campus for the abovementioned purposes. MAHE has decided to phase-wise replace packaged drinking water bottles procured for events and conference/meeting halls. Drinking water available in floor-wise areas is to be served in glass jugs/bottles and tumblers. Drinking water points are provided in buildings for students, staff and visitors at no cost. Water testing is conducted monthly to ascertain safety. The In-house water bottling plant supplies drinking water in glass bottles for hotels, guest houses, meeting rooms and conferences.

The following are the conclusions:

I. Currently, 250% of water is being harvested against a potential of 330% when compared to the freshwater demand on campus. Since the Manipal site has large catchment areas that can capture runoff, the recharge exceeds our freshwater use. Yet, we have a high potential to move towards a grid-independent water-positive balance.
II. Even after being captured by Rooftops and percolation pits, the excess rainwater runoff still poses a high risk of flooding. Corrective measures to manage the runoff may help establish water security.
III. The water demand per capita per day against the NBC norms has been tabulated.
IV. The treated water efficiency – all the water treated in the STP is metered and redirected for reuse for flushing and landscape.
V. Storm Water Recharge Efficiency – It is found that 53% of the stormwater is being captured for recharge with the help of the softscape, artificial recharge lake and rainwater recharge pits. Hence, the recharge potential for the campus is 47%.

Overall, our roadmap for water includes steps to mitigate water demand, build infrastructure to absorb more rainwater on-site and achieve a net zero water balance.

THEME 3: Waste Management

MAHE's practices align with the United Nations SDGs, which aim to transform our world and promote prosperity for all while protecting our planet. The University's policy on waste management supports the following:
Goal 6: Clean Water and Sanitisation
Goal 11: Sustainable cities and communities
Goal 12: Responsible Consumption and Production

Our Progress

MAHE campuses have a massive footprint with a variety of waste streams produced. The campus has taken various policy-level decisions to reduce the generation of paper and plastic waste at source.

- Exampad is a custom Tablet PC with associated software for managing and delivering examinations. The Exampad is a Tablet PC custom-built for education on which one can write and draw (using a stylus) similar to paper. It has a screen with the appropriate surface traction, mimicking the writing experience of paper, with specialised software and biometric authentication. It is estimated that this has saved 474 trees this year.
- A platform for the issue of glass bottles and then for retrieval and reuse. The university has a bottling plant that cleans and ensures the bottles can be reused safely. These bottles are used for hotels, guesthouses, meeting halls and conferences.
- The phasing out of hard copies of convocation reports since 2018 continues to save on paper and logistics again this year.
- Campus enforces that all stakeholders on campus minimize plastic items and thermocol use and phase out single-use plastic at Eateries on campus. Ensure eateries on campus only use food-grade paper, which can be recycled.
- Efforts are made throughout campus to segregate waste at source by providing separate waste bins at various locations within the campus. Additionally, waste bins are provided outdoors to avoid littering and maintain pristine surroundings.
- Any activity on campus that requires packaging should use eco-friendly materials as feasible without compromising on the intent or safety of the item.
- The University has launched an internal program called RePen to reduce the use of single-use pens, enhance refills for pens, and recycle used pens.

To ensure that all the waste is handled from the source to the end of life – MAHE has established a system that looks at each typology of waste. Any waste that can be reused on-site, redirected to sources where they can be reused/recycled, or hazardous waste that is a risk to the public – every aspect has been thought upon to establish mandatory protocols.
In 2022-23 - 76,138kg of scrap waste was recycled.

The University introduced an e-waste collection system on campuses and has been successfully segregating this waste stream for further eco-friendly management. Items collected are Batteries: AA/AAA/Laptop, CD/DVD, USP/Memory sticks, and Printer cartridges. A separate collection exists for IT and electrical end-of-life equipment.
Thermocol or Styrofoam is a persistent pollutant that impacts soil, water bodies, and marine life if not managed properly. Hence, the University has set up an in-house melting machine that melts the thermocol and produces raw material that can be used as input to the plastic recycling industry.

An organic waste composter of 500 kgs per day capacity aids in converting all wet waste collected on campus into pre-compost within eight hours, which is a vital input to the University gardens. Additionally, a vermicomposting plant with seven composting sheds aids in converting organic waste to manure. This year, a biogas plant of 6m3 per day capacity, with the ability to digest 50kgs/day or kitchen waste to cooking fuel. This year, approximately 77% of waste generated in the MAHE campus was diverted from landfills, thus preventing pollution of soil, air, and groundwater.

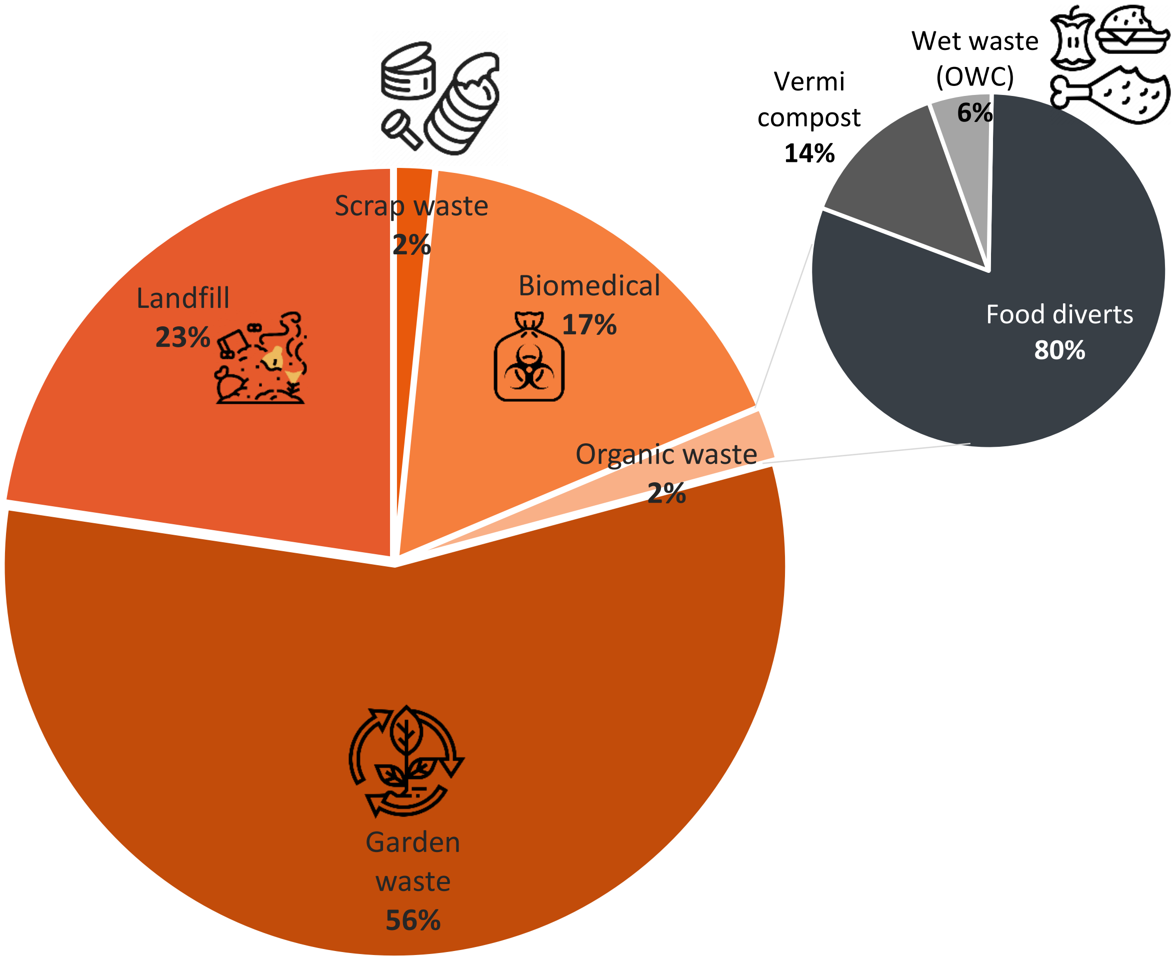


Figure 6: Break Down of Type of Waste Produced

Figure 7: Key Highlights of Waste Management

THEME 4: Green Infrastructure Development

MAHE's practices align with the United Nations SDGs, which aim to transform our world and promote prosperity for all while protecting our planet. The University's policy on buildings supports the following:
Goal 09: Industry, Innovation and Infrastructure.
Goal 11: Sustainable Cities and Communities
Goal 12: Responsible Consumption and Production
Goal 13: Climate Action

Our Progress

The university campuses are in the coastal districts of Karnataka-Udupi and Mangalore amidst the rolling hills of the Western Ghats and the blue waters of the Arabian Sea. The campus caters to students from India and abroad with diversified higher education courses in multiple domains.

The Total campus area is 23,32,162 sqm with a built-up area of 9,78,678 sqm. The total building footprint is about 12% of the campus (2,86,366 sqm).

In efforts to move towards a sustainable development approach, this year, the Manipal School of Architecture and Planning is designed to be a green-rated building. The building is in the MAHE campus at Manipal and is designed to maximize daylight and natural ventilation and minimize glare, heat gains and energy use. These features were implemented by providing external shading devices, insulating roofs to reduce direct heat transfers, saw-tooth windows, and room layout optimization to reduce glare and window orientation to allow natural ventilation. Air conditioning is limited to CAD labs and faculty rooms, and artificial lighting is provided through LED bulbs. Manipal lies in a hot and humid climatic zone and receives heavy rains during monsoons. Rain control is provided for corridors through external overhangs. The building has a dual plumbing system, and treated water is used for flushing.

The upcoming MAHE campus in Bangalore is also designed to be green-rated, with sustainability as the driving force behind all design-related decisions. Sustainability is targeted from the site's development through implementing best practices during construction, conservation of topsoil, and labor safety.
The building massing is analyzed so that wind flow is not hindered and to reduce leeward wind areas. Water and waste management needs are designed at the project planning stage by creating water recharge pits and percolation wells. The landscape is designed with native trees and plants that need less water.

Each of its buildings is designed considering the impact of solar gains, the favorable climatic conditions available in Bangalore and the occupant's comfort. Emphasis is given to avoiding glare in classrooms with external shades, internal light shelves, and louvres. Heat transfer through the walls and roof is reduced through insulation. The materials used in the construction have recycled contents, and the internal finishes have low VOC content. The interior lighting is optimized to minimize the energy used while maintaining the required lighting levels per the National Building Codes.

THEME 5: Biodiversity Enhancement

MAHE's practices align with the United Nations SDGs, which aim to transform our world and promote prosperity for all while protecting our planet. The University's policy on biodiversity supports:
Goal 11: Sustainable Cities and Communities
Goal 13: Climate Action
Goal 15: Life on Land

Our Progress

The campus has boasted greenery over the years by planting trees. Today, 30.3% of the campus has large trees and planted vegetation. The campus has a policy only to plant native plants, aiding reduced water use for the landscape and emphasising the native flora and fauna. Over 100 varieties of plants and trees are planted on the campus. A new two-acre green area (Vajra Vana) was created with over 1000 saplings planted around a water body to create a forest-like atmosphere. The site is pedestrian-friendly, with walkways and well-lit paths, allowing students to explore and familiarise themselves with nature. This has led to a boost in the local biodiversity, allowing local birds and small animals to nestle. The green cover on campus has also helped offset carbon as it helps in carbon capture. 1200 saplings are planted annually as part of the drive to consistently improve the campus's green coverage. Today's green cover supports many species that visit the campus, including migratory birds.

THEME 6: Transportation

MAHE aligns with the United Nations SDGs, which aim to transform our world and promote prosperity while protecting our planet. The University supports:
Goal 09: Industry, Innovation and Infrastructure.
Goal 11: Sustainable Cities and Communities
Goal 12: Responsible Consumption and Production
Goal 17: Partnership for the Goals

Our Progress

MAHE is a prominent institute with over 314 courses and a student strength 27,502. The campus has a fleet of 25 college buses that cater to the students travelling within the campuses. The campus also has cars facilitating staff and delegates travelling to and from the campus.
The campus is pedestrian-friendly, with elevated and shaded paths and road speed limiters. The students use around 1500 bicycles and E-bikes to commute, while the campus is bicycle-friendly, with covered bicycle parking provided at all academic and hostel buildings.
In the past few years, the campus has initiated the use of EV cars and buggies to transport staff and delegates within campus. EV cars are also used for airport travel from the campus for faculty and dignitaries. For the safety of the students, two electric patrol vehicles circuit the campus. Intra-campus goods transportation is done with an electric load carrier.

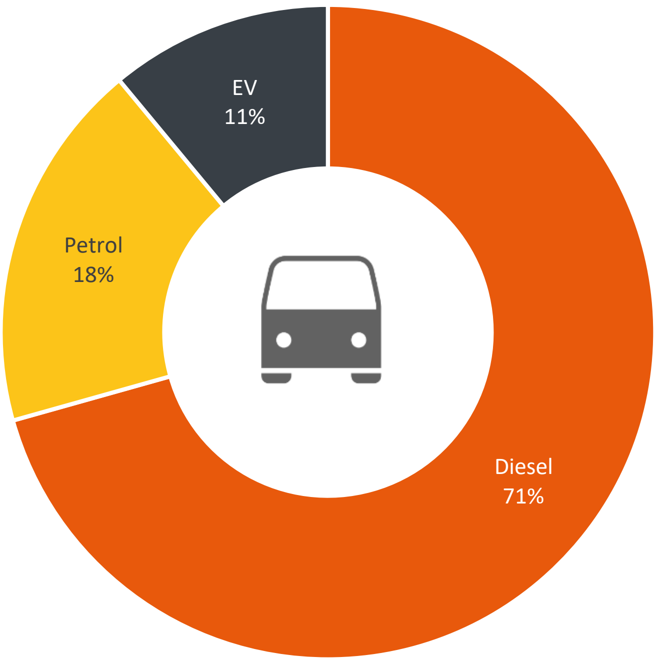


Figure 8: Breakdown of Vehicle Types Used on Campus

Introducing four EV cars, five EV Buggies, two EV patrol cars and a goods carrier to the current vehicle fleet has reduced overall transport carbon emissions by **28%** as the EV fleet is entirely powered by Solar power.

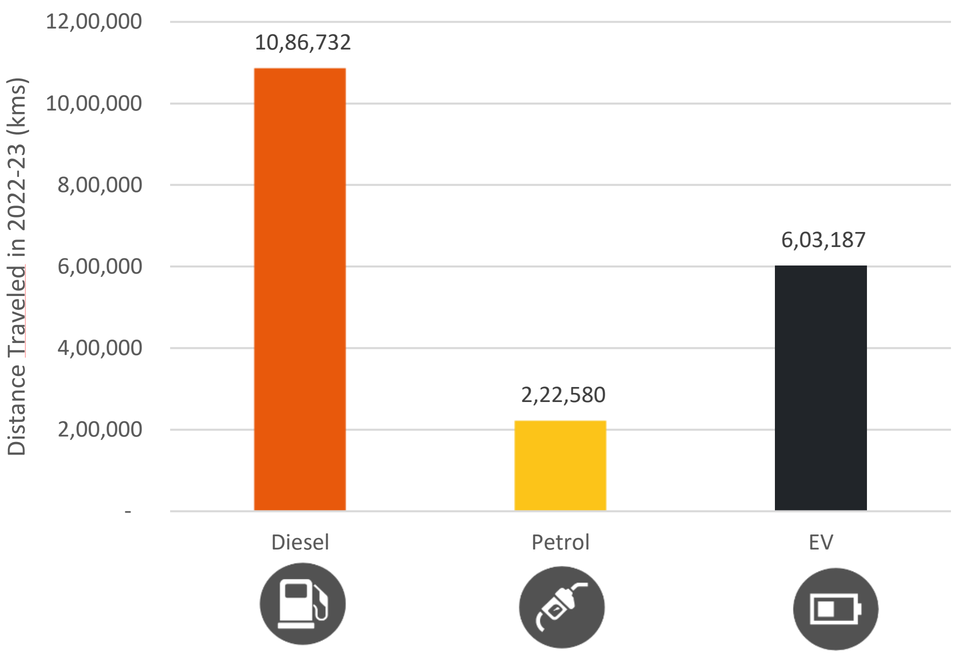


Figure 9: Kilometres run by each vehicle type.

THEME 7: Carbon Mapping

MAHE's practices align with the United Nations SDGs, which aim to transform our world and promote prosperity for all while protecting our planet. The University's policy on mapping carbon supports:
Goal 6: Clean Water and Sanitisation
Goal 7: Affordable and clean energy
Goal 11: Sustainable Cities and Communities
Goal 12: Responsible Consumption and Production
Goal 13: Climate Action

The University recognises that human-induced climate change is one of the world's most significant threats. Our day-to-day operations as a university cause the release of carbon emissions and other Greenhouse Gases, and we recognise that we have to reduce these where possible.

Background to Carbon mapping.

Evidence has shown that our climate is changing rapidly and has placed further emphasis on organisations and individuals to commit to action for a zero-carbon future.

The 2018 Intergovernmental Panel on Climate Change (IPCC) report shows that every effort to limit global warming to 1.5 ^{o}C must be made if the most catastrophic effects of climate change are to be avoided. For example, a warming of 2^{o}C would mean (worldwide) 11 million more people exposed to extreme heat, 61 million more people exposed to drought, and 10 million more to rising sea levels. This is because, under the 'current-policy' and no-policy baseline scenarios, median global temperature rises of approximately 3^{o}C and more than 4^{o}C are projected, respectively, by 2100.

The driving force behind this rapid change in climate can be attributed to the rise in anthropogenic greenhouse gases since the pre-industrial era. These greenhouse gases (GHGs) are gaseous components of the Earth’s atmosphere that can trap heat and create a greenhouse effect within our planetary boundaries. The primary GHGs in our atmosphere are carbon dioxide (CO2), nitrous oxide (N2O), methane (CH4), water vapour (H2O) and ozone (O3). As CO2 is the principal anthropogenic GHG disturbing the Earth’s atmosphere and ocean temperature, it is used as a reference to measure the other GHGs in the form of carbon dioxide equivalents, CO2 equivalent, and is attributed a Global warming Potential of 1.

"Climate science has made it clear that a significant transformation is needed to avoid the most catastrophic effects of climate change and that such a transformation must start early and result in significant emission reductions even before 2030."
Two significant achievements in global negotiations, the Sustainable Development Goals and the United Nations Framework Convention on Climate Change (UNFCCC) “Paris Agreement”, aspire to transform how development issues and climate change are addressed. The success of either of these two global agreements depends mainly on the capacity of countries to implement programmes of action in an integrated, coordinated, and comprehensive manner. The need for the world to follow a more carbon-neutral path is clear. Responsibility for achieving this lies with policymakers and is shared with all stakeholders, including governments, private sectors, and civil society.

In this direction, Universities also play their part. Higher education establishments show leadership as:

1. They are integral to designing an effective management strategy to achieve net carbon zero.
2. Academic curiosity-led R&D can extend beyond the typical academic or industrial boundaries.

Carbon emissions

To understand the impact of any strategies implemented towards reducing energy consumption and their contribution to carbon neutrality, we need to evaluate their carbon impact. The carbon impact is evaluated by converting all fuel sources which are the source of Greenhouse gases to their carbon equivalent values.
Greenhouse gas emissions are currently emitted from various on-campus and off-campus activities. The definition for carbon emissions used is that of the GHG Protocol, an internationally recognised set of standards to account for GHG emissions. The protocol categorises GHG emissions into three categories: Scope 1, Scope 2 and Scope 3, which are explained below and defined in Figure 10.

- **Scope 1** covers direct greenhouse gas emissions from sources owned or controlled by the University. This is mainly the fuel used to power generators and the fuel used in university-owned vehicles, but it also includes emissions from the fleet, fugitive emissions and refrigerant leakage.
- **Scope 2** covers indirect emissions from electricity the University consumes, which it does not generate itself.
- **Scope 3** covers the other indirect emissions that occur upstream and downstream, associated with the University, including carbon emissions generated from commuting, business travel, waste, water, and construction."

The definition of scope per GHG protocol is shown in the flowchart below:

Figure 10: Scope of Data Evaluation of Carbon Emissions

Within the University's boundary, the emissions under Scope 1 and 2 are mapped for the current financial year 2022-2023. The emissions data for the current year will be used to establish the baseline emissions for the University. This will subsequently help in setting the carbon reduction target.

When setting the University's emission reduction targets, all Scope 1 and Scope 2 emissions are included. At present, Scope 3 emissions are not included in the present study. The University recognises that Scope 3 accounts for a significant proportion of its carbon emissions and will work to establish a quantification methodology and baseline for Scope 3 emissions in the coming year to set a net-zero target that includes Scopes 1 to 3.

Data Collection and Conversion

To provide context on how carbon mapping is conducted, we must collect quantities of different fuels and other gases contributing to carbon emissions. This data is then converted to a comparable scale, here the amount of carbon (Kg CO2) using conversion factors recognised by IPCC.

A large amount of data must be collected for carbon mapping from various sources on campus. Table Table 1 below shows the data parameter, source of information and the frequency of data collection.

Table 1: How is the data being collected?

Criteria	Type of Data Collected	Source	Frequency of Data Collection
LPG	Record of Number of Cylinders Used on Campus	General services Dept.	Monthly
Petrol	Record of Travel Distances (in km) and Make and Model of Transport used.	General services Dept.	Monthly
Diesel	Litres of fuel used for Generator Requirements. Record of Travel Distances (in km), the quantity of fuel used, and Make and Model of Transport used.	General services Dept.	Monthly
Refrigerant	Make & Model of HVAC Equipment, Type of Refrigerant, quantity and Number of Refills.	General services Dept.	Yearly
Medical Emissions	Type of Gas, Quantity used (In Litres) and Refill Data.	General services Dept.	Yearly
Organic Waste	Weighed at Source	General services Dept.	Monthly
Wastewater Treatment	Water meters	General services Dept.	Monthly
Fresh Water Consumption	Water Meters	General services Dept.	Monthly
Electricity Consumption	Building Management System	General services Dept.	Monthly

A campus has multiple fuel types used for combustion, and emissions released need to be converted to an equivalent metric. Carbon equivalency for different fuels is used to calculate carbon emissions.[1]

Results for 2022-23

Carbon Scope One Emissions

Scope one emissions include emissions caused by burning fuel or using certain gases on site. They include emissions from institute-owned vehicles, cooking gas in the mess and food courts, fuel combustion due to energy backup systems – generators, Refrigerant losses, and Fugitive emissions due to medical gases. Total Carbon Emissions under scope1 for the campus is **4,201 Ton CO_2**. The images below show the Carbon emissions in functional units of Per capita and Per unit built-up area.

[1] Refer to the appendix for CO_2 equivalent values used for the carbon mapping.

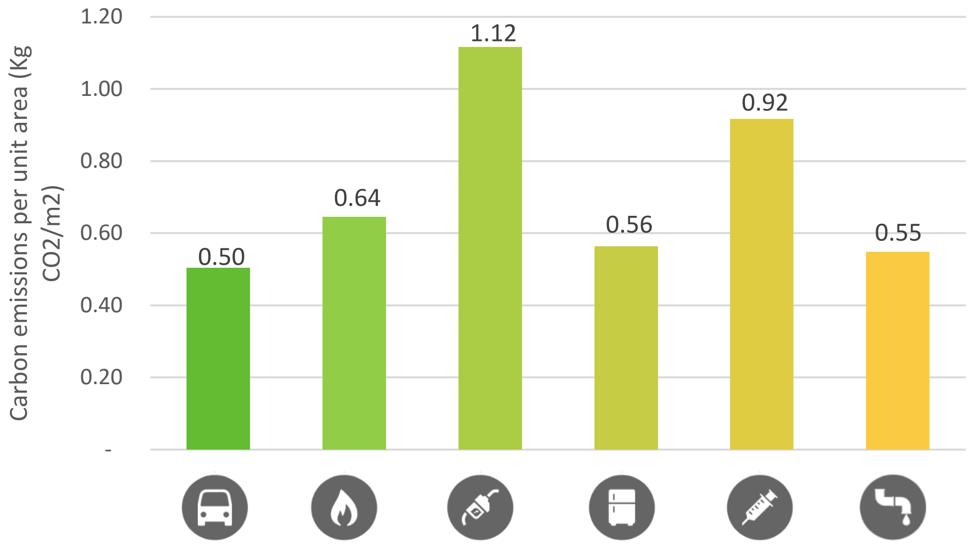


Figure 11: Scope One Carbon Emissions per SQM

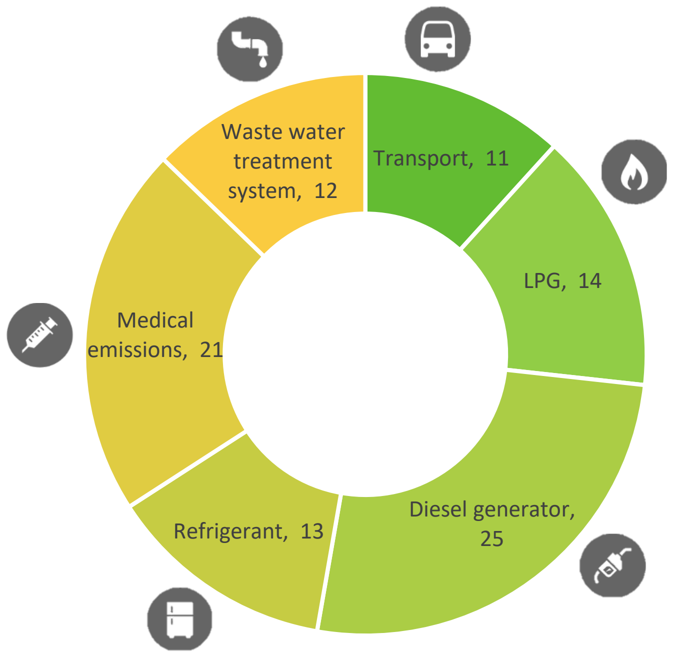


Figure 12: Scope One Carbon Emissions per Capita/person

Total Carbon Emissions per SQM – **4.29 Kg CO_2/SQM**

Carbon Emissions per Capita – **96.5 Kg CO_2/Person**

Carbon Scope Two Emissions

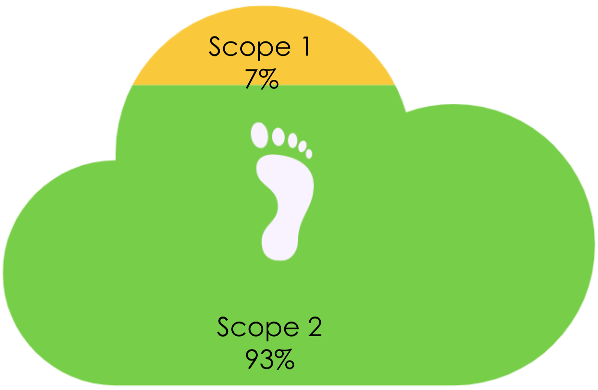
Scope 2 carbon emissions included the emissions from electricity consumption. MAHE has a total energy consumption of 6,43,67,868kWh for the entire campus. Total Carbon Emissions under scope 2 of the campus is **52,782 Ton CO_2**

Carbon Emissions per SQM – **53.9 Kg CO_2/SQM**

Carbon Emissions per Capita – **1212.1 KgCO_2/Person**

Total emissions from Scope 1 and Scope 2

The images below show the breakup in Carbon emissions and the Total carbon emissions for the campus.



Scope 1 – 4,201 Ton CO_2

Scope 2 – 52,782 Ton CO_2

Total Emissions is 56,982 Ton CO_2

Carbon Emissions per SQM – **58.2 Kg CO_2/SQM**

Carbon Emissions per Capita – **1308.5 KgCO_2/Person**

Net Emissions are calculated after subtracting all the factors that may offset the emissions. The following chapter details all the elements that help offset these emissions.

Net Emissions is 13,852 Ton CO_2

Net Carbon Emissions per SQM – **14.2 Kg CO_2/SQM**

Net Carbon Emissions per Capita – **318.1 KgCO_2/Person**

THEME 8: Carbon Offset and Sequestration

MAHE's practices align with the United Nations SDGs, which aim to transform our world and promote prosperity for all while protecting our planet. The University's policy on Carbon Offset and Sequestration supports:
Goal 7: Affordable and clean energy
Goal 11: Sustainable Cities and Communities
Goal 12: Responsible Consumption and Production
Goal 13: Climate Action

Our Progress

The progress to carbon sequestration is twofold:
- Carbon Offsets
- Carbon reduction initiatives.

Offsets

Carbon Offset is a method to remove Carbon dioxide or any other greenhouse gases from the atmosphere to compensate for the emissions made. Some of the offset methods used at MAHE are:

1. **On-site renewable generation**: These projects hold significant potential from a carbon and financial saving perspective for the University. Power purchase agreements or self-funding are two options that can be used to bring the technology online. The former has substantially lowered upfront costs associated with its installation, making it more favourable for now. MAHE has invested in Solar PV- Root top installation on campus and green energy procurement through wheeling and banking since 2015. Over the past eight years, the Solar rooftop capacity has increased by four times. Today, the campus has a Solar rooftop capacity of 1640kWp, producing 19,25,024 units of electricity.

2. **Off-site renewable energy generation**: Securing an off-site renewable energy supply via a PPA or similar is an attractive route to significantly lower their carbon emissions while receiving a competitive electricity price backed by verified energy generation certifications. Over the past eight years, the green wheeling capacity doubled, and the total green wheeled energy procured during the academic year is 4,40,05,110 units.

The study of Scope One and Scope Two tells us about the demands of the campus. To offset carbon emissions, we have taken various initiatives. The evaluation of the offsets and sequestration is tabulated as follows:

Table 2: Carbon Emission Offsets

Offsets	Description
Solar PV	3% of the energy demand or 19,25,024 kWh is met by Roof Top Solar PV
On-Site Organic Waste Conversion	All organic waste in MAHE campus is converted to manure using Vermi - Composting or OWC. The compost is then used as manure in the extensive green covered area.
Green Energy	Renewable Energy is procured through green wheeling. 4,40,05,110 kWh of energy was procured, which offsets 36,084 Ton CO_2 of carbon emissions. The total renewable energy offset over electrical energy used is 71%
Onsite Sewage Treatment	The emission from Onsite treatment adds to the Scope 1 of the carbon emissions instead of Scope 3 emissions. But provisions of onsite Wastewater treatment system; allows us to reuse the treated water for Flushing and Landscape reducing domestic water demand. Additionally, the byproduct-Sludge can be used as Manure. This leads to Zero Liquid discharge and transportation emissions.
Sludge Conversion	Sludge waste used as manure for landscape. This helps to capture and lock the carbon present in the manure into the earth. The quantity of sludge collected over the year is 673.9 Ton and Total carbon captured is 418.1 Ton CO_2.
Tree Cover	MAHE campus has a green cover of 7,07,160sqm. Thus has a high potential for carbon sequestration through trees. The Total carbon capture in a year is 156.4 Ton CO_2
Electrical Vehicles	MAHE has a fleet of 4 EV cars, 5buggies 2 Patrol Cars, a 3-Wheeler Good Carriers, which runs 6,03,187kms. Its EV carbon footprint offset is 92.4 Ton CO2 as the power is through Solar PV, But the emissions compared to the same number of diesel-powered vehicles, the emission is reduced by 16%.
Solar Hot Water	Solar Hot Water Systems effectively offsets 4800.7 Ton CO_2 annually by heating 487,875 LPD of water instead of using an electric geyser. 58,54,500 kWh of electricity is saved from this measure. *[2]

Total Offset for Emissions is 43,130 Ton CO_2

[2] It is assumed that a 15 Litre 2KW Geyser (Jaguar ELM 15 Litre) would have been used as a baseline. The calculations for the offsets have been attached in the appendix. This carbon offset has been included in SRPV carbon offsets.

Initiatives to reduce carbon emissions.

Carbon reduction initiatives are policy or technology-driven initiatives that lead to avoidance/reduction of materials or improving operations that will lower carbon emissions compared to standard practices.
The following initiatives have been implemented further to offset our carbon emissions at a policy level. The impact is tabulated below.

Table 3: Carbon Reduction Initiatives

Initiatives	Description
Moving from Paper to Online	The institute uses E-Pads for Examinations which has saved 19.74Tons of paper and there by saved 474 trees in a year.
Water Bottling Plant	MAHE has its own bottling plant to provide water for its delegates and guests. This system allows for Reuse and Retrieval of Glass Bottles. In the present year over 1,50,000 bottles used and reduced the use of PET bottles.
Food Grade Paper Cutlery	Single use Plastic is Banned on Campus. Only the use food grade paper is allowed in all eateries on campus.
High Performing Equipment	All equipment used on campus is energy efficient and lights are LED.

CREATING A ROAD MAP TO NET ZERO

1. **Construction of baseline of emissions**: A comprehensive baseline review of Scope 1 and 2 emissions is necessary for constructing appropriate targets and a reduction pathway that aligns with net zero goals.
2. **Demand Reduction and Optimisation**: There are several accessible energy demand reduction projects that Manipal can undertake. Starting with policy-level interventions such as All new buildings will be constructed to the highest sustainable design standards, upgrading existing facilities, using efficient fixtures and watering systems to reduce water demand, etc.
3. **Scope 3**: Start and formulate the processes to measure and manage Scope 3 emissions. Currently, only Scope One and Two are mapped in the above sections.
4. **Transparency and Reporting**: It is advisable to have transparent reporting streams for any net-zero plan. At the University, this comes in the form of updating the University's progress internally every quarter. Additionally, a dashboard of emission data could be developed to report, monitor, and engage with staff and students on climate action. The dashboard could also provide the basis for research opportunities among academics and students and a targeted educational campaign.

VISION OF THE FUTURE

Organisations must take action to achieve a 1.5 ◦C limit to global temperatures that are supported by climate science, international frameworks, and national policies. As a higher education institution with leadership in sustainability research and teaching, MAHE felt it was essential to demonstrate its values by creating an active, science-based Pathway to Net Zero.

Undoubtedly, any pathway to net zero is full of learning curves and will evolve. We have not only committed to becoming net zero carbon in Scopes 1 and 2 emissions by 2040 and reducing Scope 3 emissions by 2050 but also to reanalyse our Institution as a whole and to consider what impacts our core mission, research, learning, and teaching can have on becoming a leader in decarbonisation.

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APPENDIX

Energy

BEE Star Rated Building Schedule for Office Buildings*[3]
Climate Type: Hot & Humid

Air Conditioned more than 50% BUA	
EPI	Star
190-165	1 Star
165-140	2 Star
140-115	3 Star
115-90	4 Star
Below 90	5 Star

Air Conditioned less than 50% BUA	
EPI	Star
85-75	1 Star
75-65	2 Star
65-55	3 Star
55-45	4 Star
Below 40	5 Star

(Efficiency, Schedule for Star Rating of Commercial Buildings, 2022)

Building Energy Rating for Residence	
Climate Type: Hot & Humid	
EPI	Star Label
58-64	1 Star
49-58	2 Star
39-49	3 Star
30-39	4 Star
Below 30	5 Star

(Efficiency, Residential Building Energy Labelling Program, 2018)

[3] The functions of an academic building are closest to that of institutional buildings. Hence, this rating system was used as a reference.

BEE Star Rating for Hospital	
EPI - kWh/Bed	Star Rating
11440 - 13548	1 Star
9752 - 11440	2 Star
8194 - 9752	3 Star
6528 - 8194	4 Star
0 - 6528	5 Star

(Collective, 2014)

Water

Water Requirements of Buildings as per NBC (Clause 4.1.2)

Type of Building	**Total Consumption Per Day (Domestic + Flushing)**
Academic	45
Hostel	135
Residential	135*[4]
Hospitals	450
Food Court	35

(Standards, 2016)

CO_2 Conversion Factors & References

	Criteria	**Conversion Factor**	**Unit**	**Reference**	**Formulae**
Scope One	LPG	2.16	(Kg/CO_2/litre)	(Bartram, Cai, & Others, 2019)	Emissions =Fuel Consumption X Emission Factor
	Diesel	2.534	(Kg/CO_2/litre)		
	Petrol	2.370	(Kg/CO_2/litre)		
	Refrigerant	R134a -1300 R22 -1760 R404 -3942.8 R508 - 11698	GWP (Kg CO_2/ kg of gas)	(Pachauri & Meyer, 2014)	Emissions = Global Warming Potential X Quantity of refrigerant Filled

[4] Water Supply for Residences –National Building Code, Part 9, Page 11 – 4.1.1 – b) For Communities with population 20,000 to 100,000 together with full flushing system.

	Medical Emissions	Carbon Dioxide- 1 Nitrous Oxide- 265 Methane - 28	GWP (Kg CO_2/ kg of gas)		Emissions = Quantity of Gas X Global Warming Potential
Scope Two	Electricity	0.82	Kg CO_2 /kWh	(Central Electricity Authority, 2018)	Emissions = Total Electricity Demand X CEF
Offsets	Sludge	0.62	(Kg CO_2/kg of sludge)	(Liu, Zheng, Chen, Zheng, & Gao, 2014)	Emissions = Total Treated Water Generation X Conversion Factor
	STP	CO_2 – 1 NO_2 – 265 CH_4 - 28	GWP (Kg CO_2/kg of gas)	(Georges, Thomton, & Sadler, 2009)	Emissions = Quantity of Gas Produced X Emission Factor
	Trees	25	Kg CO_2 /Tree	(EcoTree, 2019)	Emissions = Number of Trees of 12 Metre Ø X Emission Factor

Solar Hot Water Offset Calculation

Consideration: 15 Liter Geysers (2-4 Members, Bucket usage)				
Model - Jaguar ELM 15 Liters	Quantity	Units		
LPD per day to be heated	487875	Liters		
Assumed Capacity of One Geyser	15	Liters		
Power demand of One Geyser	2	Kilowatt		
Time to rise to temp	18	Minutes	0.3	Hours
No. of Geysers of 2Kw Needed to heat total LPD	32525			
Total Power Demand per day	65050	Kilowatt		
Conversion Factor for Electricity to Carbon	0.82			
Electricity Used by geysers per day	19,515.00	kWh		
Electricity Used by Geysers annually (300 Working Days)	58,54,500.00	kWh		
Carbon Offset w.r.t geysers	48,00,690.00	Kg CO2		