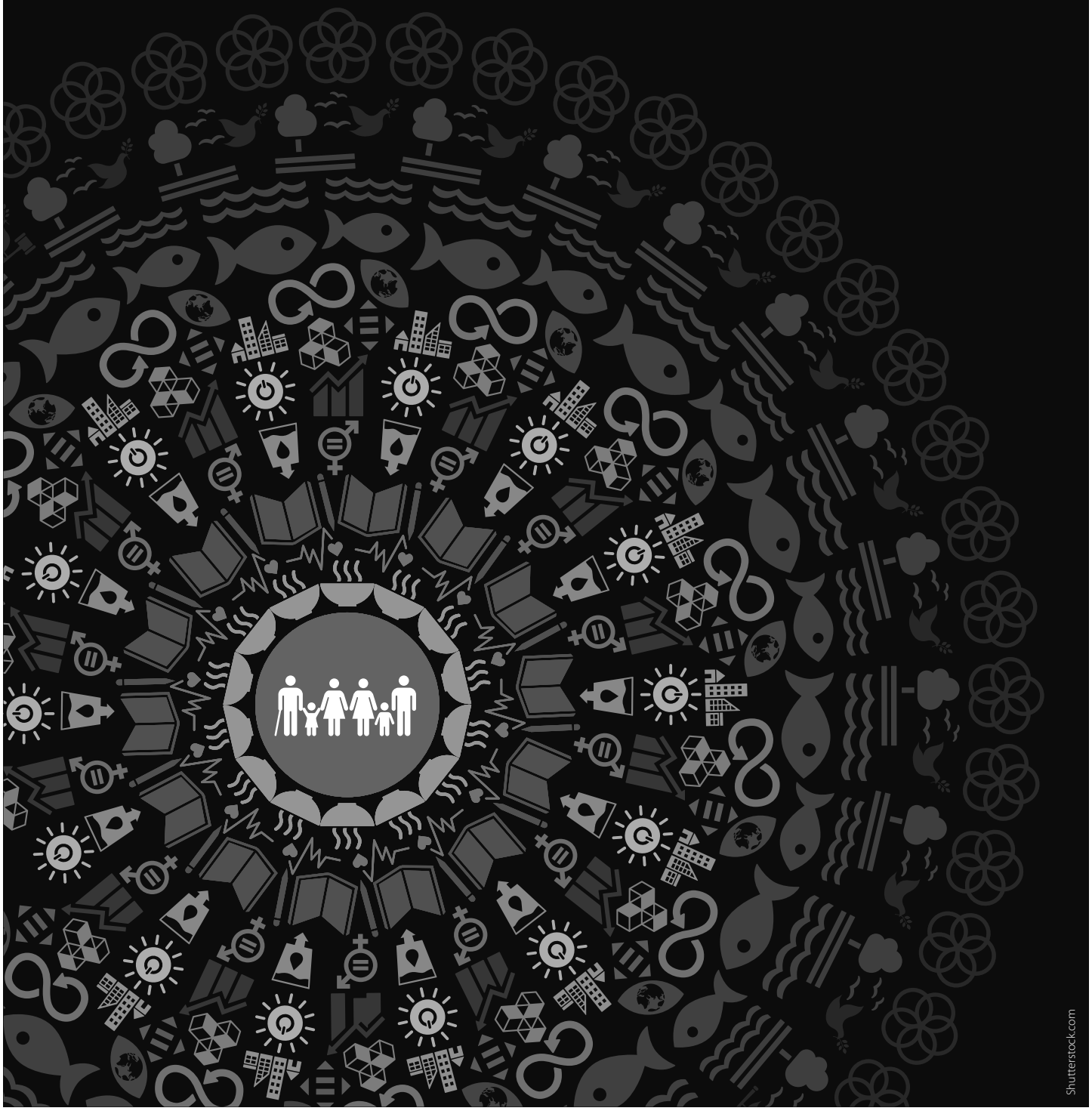
UNIVERSITY OF JOHANNESBURG

2023 ANNUAL REPORT

Our Future Reimagined

Section SIX



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Statement on Environmental Sustainability

OVERVIEW

UJ has committed itself to improving on its sustainable practices in all University activities. The development of the UJ Strategic Plan 2025, anchored in the overarching goal of global excellence and stature (GES), has placed a requirement on the institution to improve on its sustainability footprint.

Strategic Objective Six

Strategic Objective Six, fitness for global excellence and stature, states that "We will also minimise harmful impact on our environment through managing our carbon footprint, reducing energy and water wastage, encouraging paperless communication, and overall fostering of a culture of responsible stewardship".

UJ has seen a growing commitment towards the goal of being a sustainable institution that strives to implement improvements and actions across all spheres of its campus activities. UJ firmly believes that sustainable development is a long-term commitment and aims to contribute to sustainability by reducing its environmental footprint, while enhancing its contributions to the social and economic development of South Africa.

This report highlights some of the specific focus areas, as well as improvements achieved during 2023.

ENERGY MANAGEMENT

Carbon footprint

UJ's carbon footprint analysis is based on its actual 2023 energy consumption. The total carbon footprint for 2023, based on energy consumption from various sources, is approximately 49 546 tons of CO_2 compared to the 44 986 tons reported during 2022 (refer to Tables 18 and 19, respectively). This indicates an increase of approximately 10,14%. This can be attributed largely to the increased full year use of the SWC fourth residence, the increased number of students and staff on campus as work from home reduces, and especially the substantially increased number of national and international flights undertaken by staff and students. In a sense, this is a return to the more normal carbon footprint figures of 2019 (54 642 tons), and from that perspective UJ is still showing a substantial reduction in carbon generation (a reduction from 2019 to 2023 of 9,32%).

In considering this figure, the following should be noted:

- UJ has increased its built area footprint by 13,43% since 2013 and by a further 3,23% in 2023.
- The Auckland Park Kingsway Campus continued to contribute significantly to the overall carbon footprint with a nett 27 444 tons of CO_2 compared to the overall University footprint of 49 546 tons.
- The methodology of measuring the carbon footprint is based on absolute consumption on main campus areas, but now also includes UJ-owned properties such as off-campus residences as well as JBS Park and UJ on Empire, with these facilities now properly accounted for.

- The reported solar photovoltaic power generation has led to a measurable decrease in the carbon generated by UJ – a decrease of approximately 4,79%. This is a reduction from the savings of 5,53% in 2022 and must, as mentioned above, be seen against the overall increase in electricity consumption experienced in 2023. It is also worth noting that the APK solar plant suffered losses due to a significant vehicle accident in November 2023 that stopped a full solar PV string from producing outputs for almost three months.

Table 18: Carbon footprint based on 2023 actual consumption

Emission Source	Kingsway Campus (APK)	Bunting Road Campus (APB)	Doorn-fontein Campus (DFC)	Soweto Campus (SWC)	Non-academic campuses (UJoE & Atrium)	Total CO_2	Total tons of CO_2
Electricity (kWh)	21 873 377	5 949 418	8 637 554	4 203 875	265 373	40 929 596	**40 930**
Natural Gas (GJ)	1 001 568	389 846	190 801	–	–	1 582 215	**1 582**
Catbot	–	–	–	–	–	–	**–**
Petrol (Fleet)	367 079	15 726	248 272	10 298	–	641 375	**641**
Diesel (Fleet)	277 647	7 220	102 288	9 692	–	396 847	**397**
Diesel generators	952 162	519 333	785 433	132 493	–-	2 389 421	**2 389**
Inter-campus bus	337 982	66 335	145 902	66 231	5 085	621 536	**622**
Staff and student work-related flights	2 133 692	402 583	966 200	442 842	80 517	4 025 834	**4 026**
Paper used by UJ/KMSA sites	500 550	98 242	216 080	98 089	7 531	920 493	**920**
Total kg of CO_2	**27 444 056**	**7 448 704**	**11 292 531**	**4 963 520**	**358 506**	**51 507 317**	**51 507**
Total tons of CO_2	**27 444**	**7 449**	**11 293**	**4 964**	**359**	**51 507**	**Reduction of electrical power**
Solar PV generation	**776**	**418**	**389**	**378**	**–**	**1 961**	**4,79%**
						Total tons of CO_2	**49 546**

This highlights an increase of 10,14% as compared to the usage in 2022, depicted in table 19.

Table 19: Carbon footprint based on 2022 actual consumption (revised)

Emission Source	Kingsway Campus (APK)	Bunting Road Campus (APB)	Doorn-fontein Campus (DFC)	Soweto Campus (SWC)	Total CO_2	TOTAL tons of CO_2
Electricity (kWh)	22 585 453	6 187 774	8 145 035	4 018 067	40 936 329	**40 936**
Natural gas (GJ)	1 008 634	414 773	163 847	0	1 587 254	**1 587**
Catbot	0	0	0	0	0	**0**
Petrol (fleet)	185 489	64 417	108 452	89 484	447 842	**448**
Diesel (fleet)	119 498	58 049	64 026	96 963	338 536	**339**
Diesel generators	308 809	236 643	161 542	323 459	1 030 453	**1 030**
Intercampus bus and staff flights	1 054 371	218 832	477 451	238 726	1 989 379	**1 989**
Paper used by UJ / KMSA sites	504 232	98 242	216 080	101 938	920 493	**920**
TOTAL kg of CO_2	**25 766 486**	**7 278 731**	**9 336 433**	**4 868 636**	**47 250 286**	**47 250**
TOTAL tons of CO_2	**25 766**	**7 279**	**9 336**	**4 869**	**47 250**	**Reduction of electrical power**
Solar PV generation (tons CO_2)	**1 035**	**406**	**427**	**396**	**2 264**	**5,53%**
					Total tons of CO_2	**44 986**

The 2023 carbon footprint breakdown is as according to Figures 2 and 3 depicted.

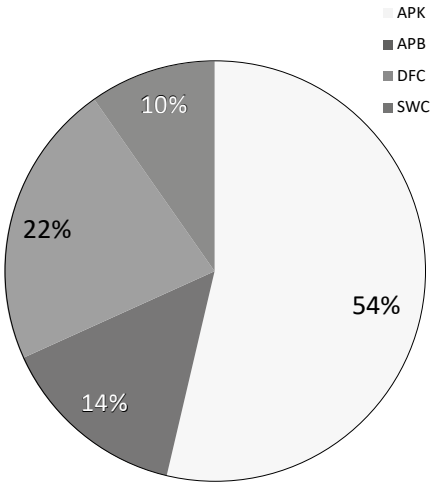


Figure 2: CO_2 production per campus

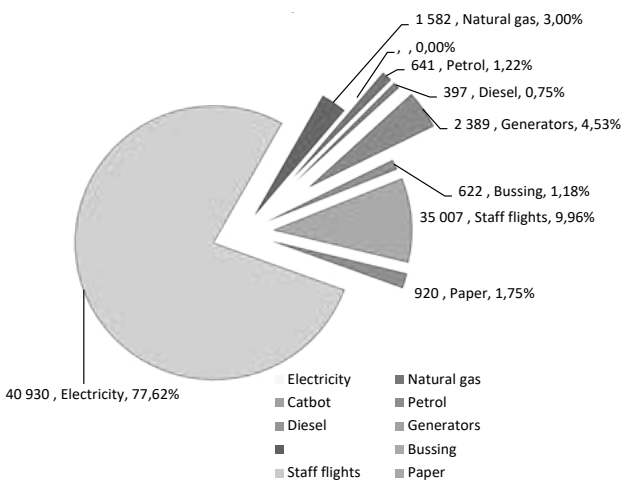


Figure 3: January to December 2023 YTD tons of CO_2 per emission source

Electricity

For January to December 2023, UJ achieved an electrical energy savings of 29,4%, compared to the 2015 baseline (which is the initial value against which we are required to report going forward) for all properties, based on an absolute measurement methodology. The measurement methodology makes no allowance for infrastructure changes or fluctuations in student or staff numbers. This saving was achieved partially due to a 0,02% reduction in consumption from the 2022 figure.

The various energy savings initiatives that have started showing positive results are the following:

- The own generation of power through the solar photovoltaic (PV) plants now operating on all four campuses.
- The implementation of energy saving lights (LEDs).
- Occupancy sensors (implementation still ongoing).
- The increased use of gas for water heating at residences on the APB and DFC Campuses.
- The further installation of heat pumps, especially in new and refurbished residences.
- The installation of energy efficient shower heads.
- The installation of load control ripple relays.

Continuing with these types of initiatives, including the introduction of further PV systems, together with awareness campaigns, will further improve on savings. Since 2018, overall savings have been lowest on APK, due to increased HVAC and the growth in specialist research equipment on the campus. In 2024, a new main chiller installation on the APK Campus with substantially better energy efficiency and no water use will change the energy and water figures there substantially. Table xx identifies the 2023 energy savings expressed as a percentage. Savings compared to the last normal year (2019) and last year (2022) show how dramatic the impact of the low attendance numbers on the campuses was in terms of energy consumption. As more staff and students return full time to the campus, we can expect growing consumption requirements but will hopefully offset this with increasing use of solar PV and other renewables.

Table 20: Electrical energy savings (2023) based on 2019 consumption (includes own generation)

MONTH	APK	APB	DFC	SWC	TOTAL
Jan 23	-20,66%	-41,18%	-35,54%	-34,38%	**-27,05%**
Feb 23	-21,38%	-38,85%	-24,79%	-9,56%	**-23,40%**
Mar 23	-25,77%	-31,45%	-8,80%	-17,89%	**-22,34%**
Apr 23	-31,68%	-42,97%	-27,70%	-10,61%	**-30,29%**
May 23	-11,10%	-31,06%	-17,65%	-6,23%	**-14,65%**
Jun 23	-11,95%	-18,39%	0,27%	-10,74%	**-9,63%**
Jul 23	-14,20%	-24,74%	-10,81%	-35,14%	**-16,59%**
Aug 23	-14,70%	-1,04%	-0,49%	-6,62%	**-8,12%**
Sep 23	-22,79%	-26,01%	-18,55%	-19,12%	**-21,62%**
Oct 23	-25,16%	-18,99%	-4,93%	-11,76%	**-18,34%**
Nov 23	-36,84%	-23,56%	-17,57%	-21,46%	**-29,47%**
Dec 23	-26,95%	-5,07%	-3,46%	-22,42%	**-18,49%**
TOTALS	**-21,89%**	**-25,65%**	**-13,66%**	**-16,53%**	**-19,82%**

Natural gas

Sasol natural gas (Egoli gas) now contributes 3,2% to UJ's total carbon footprint. Natural gas is used mainly in student centres for the purposes of food preparation, as well as in residences for the generation of hot water, and in small quantities at the laboratories for experiments. The saving achieved on gas reduction for 2023 compared to 2015 is 53,6% (again reiterating that the baseline is the 2015 figure for gas consumption).

Table 21: Electrical energy savings (2023) in comparison to 2022 consumption (includes own generation)

Savings compared to 2022					New measures separately		
Month	**APK**	**APB**	**DFC**	**SWC**	**JBS Park**	**Non-campus**	**TOTAL**
Jan 23	28,48%	2,09%	-17,80%	-15,03%	-100%	4,15%	**8,22%**
Feb 23	11,15%	-4,63%	-6,48%	3,16%	-100%	-30,23%	**2,71%**
Mar 23	-12,09%	-14,71%	-4,05%	-7,24%	-100%	-6,42%	**-11,60%**
Apr 23	-6,71%	-20,14%	-15,04%	259,46%	-100%	-7,34%	**-3,02%**
May 23	5,95%	-15,73%	-9,52%	50,23%	-100%	5,86%	**1,18%**
Jun 23	-8,90%	-13,58%	1,26%	-14,62%	-100%	52,10%	**-9,72%**
Jul 23	13,51%	-2,70%	7,47%	-33,57%	-100%	83,05%	**1,99%**
Aug 23	-3,15%	29,21%	3,88%	3,37%	-100%	48,68%	**2,07%**
Sep 23	-2,04%	7,94%	22,20%	-13,32%	-100%	-4,78%	**0,81%**
Oct 23	-0,53%	23,09%	50,00%	0,76%	-100%	-3,32%	**9,33%**
Nov 23	-7,49%	3,96%	22,98%	5,41%	-100%	-22,38%	**-1,38%**
Dec 23	-5,68%	31,16%	54,71%	7,30%	-100%	-1,76%	**6,77%**
TOTALS	**0,19%**	**0,17%**	**6,05%**	**4,62%**	**-100%**	**6,76%**	**-0,02%**

Egoli natural gas has a lower CO_2 footprint per gigajoule (GJ) of energy when compared to coal and is therefore a cleaner source of energy. Egoli natural gas will in future be used at a number of residences for heating water and cooking. Since much of the gas is used for heating on the APB Campus, a plan is being developed to trial a 2 000kW combined heat and power (CHP) power generation facility to simultaneously reduce dependence on Eskom power and to reduce the campus carbon footprint further – as well as potentially exporting energy to other UJ campuses. The continuing diversification of energy sources, from 2019 onwards, will result in a small but measurable continual reduction in the carbon footprint, especially at the residences.

Petrol, diesel, and travel-related usage

Petrol and diesel fuels are primarily consumed as fuel sources for UJ's vehicle fleet as well as for diesel generators across its main campuses. There are currently 92 generators installed at various points within the UJ infrastructure. Petrol and diesel contribute a small amount to the total carbon footprint, namely 4,8%. It must be noted that increasing occurrence of Eskom load shedding has already produced a substantial increase in diesel usage, and this may result in further substantial CO_2 generation in future, since liquid fuels have higher CO_2 generation per GJ of energy consumed. The diesel used for backup generators as well as diesel for maintenance vehicles used as standby vehicles increased from 2022 by 131,88%, directly because of the increase in load shedding in 2023.

There was a very substantial increase in local and international travel during 2023. Since 2019, UJ has been reporting energy consumption and CO_2 generation resulting from the extensive student bus service operated between campuses, as well as the effective CO_2 generation due to national and international flights by staff. In 2023, the further increase in staff flights as well as a full return to the normal student bussing situation resulted in more than 337% increase in carbon generation. For 2023, this carbon generation source was now 8,1% of the total UJ generation.

Catbot fuel

Catbot fuel is used for the purposes of generating hot water during the five winter months for the central air conditioning plant on APK. Catbot fuel is used to run two hot water generators for the generation of hot

water, which is distributed and circulated through the air conditioning system on APK. At present, the catbot fuelled boilers are being repaired, and no catbot fuel was used in 2023 at all.

WATER MANAGEMENT

Using water sparingly has become a necessity at UJ. During 2023, a significant number of days were experienced on all major campuses where due to either load shedding or infrastructure failure no water was supplied to campuses at all. This resulted in significant direct water purchases from commercial suppliers – more than 7 million litres at a cost of more than R7.5 million. In addition to this, UJ also moved 14.2 million litres of water between campuses using its own water tankers to save on water purchases (this savings amounted to an estimated R15 million). Water consumption increased by 35,9% in 2023 – partly due to the first full year of new buildings but also in part due to increased numbers on campuses. Notwithstanding the 2023 increase, UJ still shows a reduction of more than 37,65% in water use compared to 2015. The SWC water consumption in 2023 showed an 82,21% decrease from the 2022 values and this is being investigated. As far as possible, borehole water is now used on all campuses, and the four new boreholes for supply subvention from 2022 are now in operation and are primarily used for gardening purposes.

A number of initiatives implemented in 2023 contributed to some water savings – but the major reduction was due to non-supply by the CoJ. The key focus areas in the reduction of water consumption for 2023 were as follows:

- Achieving 100% installation of water restricting showerheads in residences.
- Reducing gardening water usage and moving some of this to boreholes.
- Reducing water usage due to reduced supply by the CoJ as a direct result of the Eskom load shedding processes.

The key focus areas in the reduction of water consumption for 2024 are as follows:

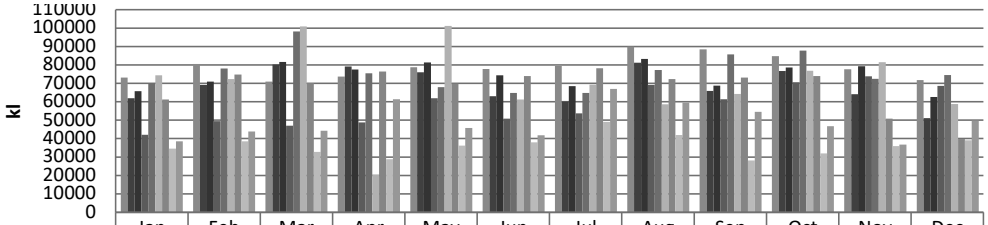
- Facilities Management had meant to start replacing existing taps with push-taps at all points – but this will only now gather momentum in 2024.
- Additional drilling for water on other UJ properties – this is an ongoing process.
- Conducting further awareness campaigns on campuses and in residences to achieve water savings.
- In 2024, the first trial waterless urinals will be installed to reduce water consumption in areas where use and performance and user response can be managed – possibly in one of the off-campus buildings, such as UJ on Empire or the Atrium.
- Facilities Management will investigate a waste concentration system on the APK Campus to reduce sewage costs and allow for substantial water recovery for irrigation purposes.
- The first grey water trial system is already installed on the APB Campus for two large residences – this is expected to save more than five million litres of water per annum on that campus. As soon as this is shown to work, Facilities Management intends to roll out similar solutions to six other high-rise residences where the technology is best suited.

WASTE MANAGEMENT

Table 22 provides an overview of total waste generation compared to recycled waste. An analysis of the different types of waste generated in the reporting year is depicted below. Interestingly, Table xx makes it clear that, in 2023, UJ recycled approximately the same level of waste as in 2022. It must be noted that although the absolute amount of waste generated increased after the very reduced values in 2020 and 2021, it still has not yet reached the pre-pandemic levels of 2019. As the total waste generated returns to pre-pandemic levels, the percentage recycled is reducing and becoming in line with the pre-pandemic levels as well. In terms of a comparison with the 2019 recycling, we are now back to a level of 39,3% compared to the 2022 level of 40,25%.

CONCLUSION AND WAY FORWARD

As mentioned at the outset of this report, the development of the UJ Strategic Plan 2025, anchored in the single strategic goal of global excellence and stature (GES), has placed a requirement on the institution to improve on its sustainability footprint.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2015	73158	80544	70927	73669	78822	77771	79440	90022	88473	84743	77708	71791
2016	61918	69125	80266	79138	75987	62988	60147	81248	65956	76664	64064	51098
2017	65786	70927	81654	77476	81403	74447	68537	83248	68746	78597	79358	62587
2018	42141	49537	47030	48802	61999	50861	53777	69197	61327	70617	73860	68653
2019	70094	78093	98118	75430	68003	64769	64862	77256	85798	87729	72424	74550
2020	74413	72395	100929	20310	101147	61281	69309	58591	64269	76802	81562	58781
2021	61316	74745	70154	76470	69898	73921	78271	72378	73155	74038	50912	39746
2022	34588	38559	32824	28822	36229	38063	49060	42029	28137	32011	35993	39077
2023	38544	43911	44367	61430	45743	41906	67034	59660	54527	46782	36835	49767

Figure 4: UJ total water consumption comparison from 2015 to 2023

Table 22: Waste generated versus waste recycled – 2011 to 2023

YEAR	GENERATED	RECYCLED	PERCENTAGE RECYCLED
2011	4 838.48	188.71	3,90%
2012	3 559.19	288.27	8,10%
2013	2 361.88	416.64	17,64%
2014	1 551.27	539.71	34,79%
2015	1 773.81	506.52	28,56%
2016	1 818.89	513.60	28,24%
2017	2 333.52	456.66	19,57%
2018	2 312.87	521.48	22,55%
2019	1 858.48	625.33	33,65%
2020	1 409.30	673.86	47,82%
2021	1 749.37	895.02	51,16%
2022	2 097.93	844.33	40,25%
2023	**2 082.45**	**818.28**	**39,30%**

The expanding nature of the campuses, increasing student numbers as well as cost containment pressures will create a challenging environment for the institution to meet its sustainability goals. However, a good foundation has been established to measure and manage our sustainability goals into the future.

During 2024, the first UJ Sustainability Report using the methodology for environmental reporting (specifically the G4 Sustainability Reporting Guidelines of the global reporting initiative) will be published, and this will showcase the environmental impact of areas presently not measured and reported on in this statement (such as waste carbon generation but not yet all Scope 3 carbon generation areas). The initiative to report via an effective tenant model for energy and resource usage will be introduced, and unit-based reporting will become the norm for per capita reporting of all utility and carbon generation figures. This will normalise results and allow for more sensible comparison of figures across years when demographics and numbers change. The analysis of figures, given actual campus attendance, is also on the horizon – allowing for an accurate understanding of work from home as a driver for change.

The focus areas for 2024 will be to extend sustainability projects, such as the fifth wave of new solar photovoltaic installations on the APK and APB Campuses and the finalisation of specifications and designs for a substantial

Table 23: Different types of waste recycled from January 2011 to December 2023

YEAR	COM PAPER	WHITE PAPER	PLASTIC	CANS	E WASTE F TUBES	CARDBOAR BOXES	GLASS	SCRAP METAL	WET WASTE	GARDEN REFUSE	TOTAL	%
2011	22.452T	26.934T	26.689T	13.742T	0.14T	37.427T	28.74T	29.803T	0	0	**188.71T**	3,9
2012	42.385T	41.505T	18.797T	9.45T	1.7T	56.417T	30.38T	11.108T	7.671T	0	**288.27T**	8,1
2013	39.46T	40.142T	18.028T	10.005T	1.21T	37.805T	18.793T	7.364T	14.2T	136.5T	**416.63T**	17,64
2014	40.088T	36.855T	19.615T	9.964T	1.44T	48.274T	13.93T	6.768T	36.22T	325.5T	**538.7T**	34,75
2015	31.579T	51.725T	20.335T	7.117T	0.17T	63.932T	31.521T	4.071T	15.16T	329.14T	**506.51T**	28,55
2016	53.681T	21.877T	34.056T	6.347T	0.11T	52.574T	16.218T	17.048T	18.68T	293T	**513.6T**	28,89
2017	40.667T	17.526T	42.149T	8.189T	6.08T	59.824T	27.062T	0.552T	4.61T	250.98T	**456.66T**	19,56
2018	37.016T	45.997T	44.592T	5.5515T	1.91T	40.346T	5.102T	1.34T	8.82T	263.14T	**521.48T**	22,54
2019	32.614T	43.121T	25.062T	5.908T	3.385T	41.16T	47.057T	4.051T	15.23T	407T	**625.33T**	33,65
2020	21.63T	17.98T	12.68T	2.58T	2.72T	31.58T	19.77T	10.26T	30.66T	524T	**673.86T**	47,81
2021	13.952T	17.34T	6.31T	1.408T	3.112T	23.877T	22.317T	14.194T	12.506T	780T	**895.016T**	51,16
2022	32.158T	16.746T	13.811T	2.728T	2.862T	29.423T	19.771T	5.03T	2.629T	719.2T	**844.33T**	40,25
2023	24.31T	25.14T	24.99T	5.53T	2.60T	35.13T	19.06T	5.86T	12.64T	663.1T	**818.3T**	39,30

solar photovoltaic installation on the UJ Island. The replacement of geysers with more efficient reverse heat pump solutions in the larger residences will continue. The previous electric bus initiative, begun in 2022 with two buses and with a third bus introduced in 2023, will be expanded to as many as seven buses, and this will reduce diesel transport-based generation figures favourably. Specific additional areas of focus will also include stakeholder engagement, especially with students, the diversification of energy sources with a greater emphasis on renewables, including micro-wind and solar thermal for storage and natural gas, and further technology advancements within sustainability in terms of the building renovation and improvement programmes.

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