Green & Environmental Audit Report

FOR MKSSS'S K.B. JOSHI INSTITUTE

Prepared by:

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Executive Summary

Considering the depleting resources, global warming, and other rampant environmental hazards affecting us, it is imperative that we take effective measures to safeguard the environment. This detailed Green & Environmental Audit of K. B. Joshi Institute was conducted for the academic years 2019-21. The audit conducted to ensure optimum utilization of resources and instill awareness amongst students so that they can spread this understanding further in the society.

The Green audit has various advantages such as:

- Green Audit could help to shield the environment
- Recognize the cost saving methods through waste minimizing and managing strategies
- Help organizations to frame a better environmental performance
- Enhance the alertness for environmental guidelines and duties

Green Audit is a systematic examination of the interactions between any operation and its surroundings. The methodology followed for the audit comprised of an onsite survey to collect data for the audit. This comprised of thoroughly analyzing the management systems in place and studying how processes work on a regular basis. This was accompanied by a holistic questionnaire form that was shared with students as well as staff personnel containing questions to determine resource consumption, recycling patterns, and more. Based on the data collected, and the onsite analysis, findings were recorded and initiatives were suggested. This will help college to align its further activities toward environment friendly actions.

1. Introduction

Introduction to Environmental Auditing

Environmental auditing is a process whereby an organization's environmental performance is tested against its environmental policies and objectives. These policies and objectives need to be clearly defined and documented (Department of Environmental Affairs and Tourism, 2004). Auditing is a methodological examination, involving analyses, tests and confirmations of a facility's procedures and practices with a goal of verifying whether they comply with legal requirements and internal policies and evaluating whether they conform to good environmental practices (Roy, 2002).

Environmental audit is intended to identify environmental compliance and management system implementation gaps, along with related corrective actions.
Environmental auditing is used to

- Investigate
- Understand
- Identify

These actions are much helpful in reducing any adverse effects on the environment, by improving the existing human activities. The audit is also helpful in conserving natural resources, controlling pollution, increasing safety & health, and improved production. This is why achieving sustainable development can be considered as the overall objective of the environmental audit. However, it is imperative that the objectives must be defined clearly before performing an industrial audit, or else the procedure may be subject to varying interpretations. This may in turn influence the end result by contributing to differences in approaches.

The auditing approach is very helpful in safeguarding the environment. It not only indicates the existing or potential risks that must be addressed, but also enables organizations to build on good performance, highlight deficiencies and give credit where it deems fit. Practices involved in environment auditing such as waste minimization also help in identifying potential cost saving opportunities. For larger enterprises, audit assists the exchange & comparison of information between plant or subsidiary companies, demonstrate commitment of environmental protection to employees, authorities, and the public. Last but not the least, it also helps organizations understand how they can meet legal requirements, improve performance and save money.

Green Audit

"Environmental Auditing can be also referred to as "Green Auditing", where GREEN can be acronymically called as 'Global Readiness in Ensuing Ecological Neutrality".
Green Audit can be defined as systematic identification, quantification, recording, reporting and analysis of components of environmental diversity. The 'Green Audit' aims to analyze environmental practices within and outside the college campus, which will have an impact on the eco-friendly ambience. It was initiated with the motive of inspecting the work conducted within the organizations whose exercises can cause risk to the health of inhabitants and the environment. Through Green Audit, one gets a direction as how to improve the condition of environment and there are various factors that have determined the growth of carrying out Green Audit (Gurukula Kangri Vishwavidyalaya, 2020).

About the K.B. Joshi Institute

K.B. Joshi Institute of IT established in the year 2003. Joshi foundation has given generous donation for the construction of Institute in the name of Pioneering business man Late K.B. Joshi who was founding member of serval trade groups & trade associations including Maharashtra Chamber of Commerce.
Institute's meticulous thinking in framing up the curriculum, state of art infrastructure with innovative back-up, interactive exposure to the key happenings in the world of IT, makes students understand the contemporary and future scenario. They are ready to meet pre-requisites of IT world. The Institute is basically interested in issues related to women in IT. It is committed to develop young women IT professionals for the avenues opened up due to tremendous growth of IT sector in every field of Business and day life.

Institute is housed in a spacious building. It is located in lush green, pollution free surroundings. It is connected with the most happening zones of the city infrastructure.
A spacious set up exquisitely designed with futuristic & forward looking infrastructure, makes it an educational experience par excellence. It consists of 310 students and 18 faculty members.

Vision
"Empowerment of Women through IT Education"

Mission

"To develop competent young women IT professionals with capability to contribute effectively in the challenging IT environment".

Objectives

- To provide skilled manpower to industry by imparting quality education to women in IT field
- Serving the community by educating girl students who are poor, needy, socially and economical weaker
- Educating women on health, sports and cultural aspects along with academics to face the challenging environment

College Facilities:


College building


Office


Classrooms

Library

Green Initiatives by College:

Go Green: "Save Paper, Save Trees & Save Environment" College is taking "Green –Initiative" by developing & using following application s/w-

- Online Library.
- e-sources from SNDT Website are available.
- Students can refer Syllabus, Question Bank & Question Papers.
- Online Feedback System- for faculty feedback.
- All e-journals from SNDT website are available.
- Paperless assignment submission.

2. Green Audit

2.1 Aim

Aim of the audit was to conduct Green Audit & Carbon footprint of MKSSS's K. B. Joshi institute.

2.2 Objectives

- To assess the institute's current energy and waste generation & water usage patterns.
- To study the current methods of waste disposal.
- To study the flora fauna in the campus
- Find carbon footprint of the institute
- Find Carbon sinks in the campus.
- Identify the gaps between best practices and institute's current practices.
- Suggest strategies to minimize environmental impact caused by various resource usages.

2.3 Target areas of Green Auditing:

2.3.1 Auditing for carbon foot printing of the institute:

Climate change or global warming is a serious issue. Countries all over the world have implemented policies for adaptation to climate change. As society moves towards GHG emissions reduction, institutions play a leading role in solving these problems as they consume large amounts of energy and emit large amounts of carbon. Education plays a vital role in inculcating the ideologies of sustainability in young minds and simultaneously making aware about the same. A large number of educational institutions are undertaking and implementing strategies of sustainable development. Such initiatives would help in building capacity to manage environmental, societal, economic and technical obstructions in order to achieve sustainable development. It is important to monitor and evaluate the GHG emissions of the higher educational institutes to achieve the goal towards sustainable development.

Institute's carbon footprint audit was conducted for Scope 1, scope 2 and scope 3 emissions which were studied at building level. The GHG gases reporting and accounting approach carried out in the auditing follows the guidelines mentioned in GHG protocol. It will help to understand key emission sources so that it can be identified and necessary mitigation measures can be adopted for carbon reduction. Identified Responsible sources
and areas for emission will help to formulate and implement the strategies for carbon sink sequestration.

2.3.2 Auditing for Green campus management:

K.B. Joshi institute is a part of MKSSS campus. Flora and fauna in the campus is audited. Various green infrastructure services like biogas plant, solar PV etc. in the campus are also audited.

The audit was completed in three stages:

Pre-audit – At the initial stage, data collection was the primary activity conducted to ensure a solid foundation of the study. Data such as floor plan, occupancy detail, occupancy schedule and energy bills was collected.

Onsite Analysis – This stage comprised of field works. The site was analysed through frequent visits and a number of activities were carried out. A detailed user analysis was conducted to study user behavior patterns and check various fixtures, their load performance, types of waste generated and their disposal methods. The detailed site inspection was followed with a holistic questionnaire that was shared with staff members and students.

Post-audit – A comprehensive review was conducted based on the collected data in the onsite analysis & suggestions were made based on the assessment to reduce resource consumption and to perform building.

Participants and sampling procedures –

For performing onsite audit, the teaching staff, non-teaching staff and students acted as research participants. This was helpful in understanding the psychology of users and conduct a detailed user analysis. For this, random sampling is done from each typology. The questionnaire is performed in 2 ways – 1. Questionnaire was shared with students and teaching staff that was circulated through Google Forms. 2. Onsite interviews were conducted with non-teaching staff, teaching staff .

SCOPE	EMISSION CATEGORY	REQUIRED ACTIVITY DATA	METHOD FOR COLLECTING / CALCULATING ACTIVITY DATA
Scope 1	LPG consumption	Data of LPG use, Data can be in term of kg, no of cylinders.	The amount of LPG consumption is calculated by total number of LPG cylinders use in one year multiplied by weight of cylinder.
Scope 1	Use of Diesel/Petrol for electricity generator	Data of diesel use. Data can be in term of liter, no of barrels, etc.	The amount of diesel required is calculated by adding all quantities from 12 months/year
Scope 2	Purchased electricity	Data of amount of KWh energy consumed in a year.	The amount of purchased electricity calculated by adding all units from 12 months/year
Scope 3	Use of Diesel/Petrol for hired vehicles for guests / students/ faculty for official work purpose.	Data of the total km travelled and type of vehicle used for travel.	Data sheets with all the travels and destinations are gathered from source person.
Scope 3	Paper consumption	Total amount spent or purchase of paper or weight of paper	Sources are required for Paper consumption: Paper used by faculties, staff members and students. This amount of paper is required to calculate the weight of used papers.
Scope 3	Pens and markers	Total amount spend or weight of pens or no of pens and markers used.	For the pens and markers, data contained is number of pens and markers used by faculty in one year. These numbers are used to calculate total weight of pens and markers.
Scope 3	Files	Total amount spend or purchase or weight or number of files used.	Data contained is number of files used in one year. These numbers are used to calculate total weight of files used in a year.
Scope 3	Post it notes	Total amount spend or purchase or weight of post it notes used	Data contained total number of post it notes used in a year. This is used to calculate total weight of post it notes.
Scope 3	Employee travelling	Data of total amount of passenger km travelled per transportation mode and mode of transport.	Employee to fill their mode of travelling, distance and days of travelling. The estimated total distance to be calculated for entire year. This distance is the used to calculate average distance for all the employees.
Scope 3	Student travelling	Data of total amount of passenger km travelled per transportation mode and mode of transport.	Same as employee travelling
Scope 3	Air travel	Data of total amount of passenger and distance travelled.	Aerial distance between destinations to be calculated.
Scope 3	Residential Electricity	Data of amount of KWh energy consumed in a year.	The amount of consumed electricity during online classes is calculated by adding all quantities from 12 months/year
Scope 3	Waste	Data of amount of waste generated in a year.	The amount of waste generated is calculated by adding all quantities from 12 months/year

3 Auditing for carbon foot printing of the institute:

3.1 Calculations for K B Joshi institute (IT dept) at building level

Scope 1 – Fuel consumption, LPG consumption

Scope 2 – Electricity consumption

Scope 3 – Emissions from Travel, consumables, waste, online lectures

3.1.1 Scope 1: Fuel consumption

Scope1: Emissions from Diesel required For Electricity Generator(lit)

Usage of petrol/diesel for 2019-2020(lit) Regular condition	Total emission for 2019-2020 (tCO2eq)	Usage of petrol/diesel for 2020-2021	Total emission for 2020-2021 (tCO2eq)	Emission factor(tCO2eq/lit)
6000	18	2400	7.2	0.003
Emission	0.45	Emission	0.18	

Scope1: Emissions from LPG consumption

LPG consumption/ cylinder(kg)	LPG consumption for 1year regular conditions	Total emission for year 2019-2020	LPG consumption for 1year (during lockdown)	Total emission for year 2020-2021	Emission factor (tCO2eq/kg)
18	864	2.592	108	0.324	0.003

3.1.2 Scope 2: Electricity Consumption

Scope 2: Emissions from Electricity Consumption (KWh)

Month	Electricity (KWh)	Monthly emission (tCO2eq)
Mar-19	5600	5.376
Apr-19	5600	5.376
May-19	5600	5.376
Jun-19	5600	5.376

Jul-19	5600	5.376
Aug-19	5600	5.376
Sep-19	5600	5.376
Oct-19	5600	5.376
Nov-19	5600	5.376
Dec-19	5600	5.376
Jan-20	5600	5.376
Feb-20	5600	5.376
Total (Kwh)	67200	Total emission 2019-2020 64.512
Total (MWh)	67.2	

Month	Electricity(KWh)	Monthly emission(tCO2eq)
Mar-20	5600	5.376
Apr-20	200	0.192
May-20	200	0.192
Jun-20	200	0.192
Jul-20	280	0.2688
Aug-20	600	0.576
Sep-20	2160	2.0736
Oct-20	2160	2.0736
Nov-20	2160	2.0736
Dec-20	2160	2.0736
Jan-21	2160	2.0736
Feb-21	2160	2.0736
Total (Kwh)	20040	Total emission 2020-2021 19.2384
Total (MWh)	20.04	

3.1.3 Scope 3: Waste generation, consumables, travel

Scope 3 : Emissions from Waste for years 2019-2020 & 2020-2021

Food wastage	Food wastage(kg)/day	Food wastage(kg)/week	Food wastage(kg)/year	Food wastage ton/year	Emission factor tCO2eq/ton
Food waste	7	35	1680	1.68	0.175
Total emission tCO2eq					0.294
Other wastage	wastage(kg)/day	wastage(kg)/week	wastage(kg)/year	Food wastage ton/year	Emission factor tCO2eq/ton
Other waste(sanitary)	3	15	720	0.72	0.175
TOTAL EMISSION tCO2eq					0.126

Plastic bottles	No. of bottles/day	No. of bottles/week	Weight of 1 bottle	weight of bottles ton/year	Emission factor kg/CO2e for recycled plastic
Plastic bottles	15	75	0.01	0.036	3.5
Total emission tCO2eq					0.126
Total emission from all sources for year 2019-2020 (tCO2eq)					0.546

Food wastage	Food wastage(kg)/day	Food wastage(kg)/week	Food wastage(kg)/year	Food wastage ton/year	Emission factor tCO2eq/ton
Food waste	0.35	1.75	84	0.084	0.175
Total emission tCO2eq					
Other wastage	wastage(kg)/day	wastage(kg)/week	wastage(kg)/year	Food wastage ton/year	Emission factor tCO2eq/ton
Other waste(sanitary)	0.15	0.75	36	0.036	0.175
TOTAL EMISSION tCO2eq					0.0063

Plastic bottles	No. of bottles/day	No. of bottles/week	Weight of 1 bottle	weight of bottles ton/year	Emission factor kg/CO2e for recycled plastic
Plastic bottles	1	5	0.01	0.0024	3.5
Total emission tCO2eq					0.0084
Total emission from all sources for year 2020-2021 (tCO2eq)					0.0294

Scope 3 : Emissions from faculty consumables for 2019-2020

2.26kg/ream					
PAPER	WEIGHT	QUANTITY	EMISSION FACTOR kg/CO2e for virgin paper	TOTAL EMISSION kgCO2eq	TOTAL EMISSION tCO2eq
Paper ream/month	11	5	2.58	350	0.350
Paper ream/yr	136	60			

Cardboard	Quantity/year	Weight (kg)/cardboard	Weight(kg) for 1 year	Emission factor kg/CO2e for virgin paper	Total emission kgCO2eq	Total emission tCO2eq
Box files	20	0.2	4	2.62	10.48	0.01048
Cardboard	Quantity/year	Weight(kg)/file	Weight(kg) for 1 year	Emission factor kg/CO2e for virgin paper	Total emission kgCO2eq	Total emission tCO2eq
Files	70	0.1	7	2.62	18.34	0.01834
Pen	quantity/year	weight(kg)/pen	weight(kg) for 1 year	Emission factor kg/CO2e for virgin plastic	Total emission kgCO2eq	Total emission tCO2eq
Plastic pen	120	0.005	0.6	5.09	3.054	0.003054

Marker	quantity/year	weight(kg)/marker	weight(kg) for 1 year	Emission factor kg/CO2e for virgin plastic	Total emission kgCO2eq	Total emission tCO2eq
Marker	100	0.01	1	5.09	5.09	0.00509
Post it notes	quantity/year	weight(kg)/marker	weight(kg) for 1 year	Emission factor kg/CO2e for virgin paper	Total emission kgCO2eq	Total emission tCO2eq
Post it notes	20	0.01	0.2	2.58	0.516	0.000516
Total emission from all sources (tCO2eq)					0.387	

Scope 3 : Emissions from faculty consumables for 2020-2021

2.26kg/ream					
Paper	Weight	Quantity	Emission factor kg/CO2e for virgin paper	Total emission kgCO2eq	Total emission tCO2eq
Paper ream/month	1	0.5	2.58	35	0.035

Paper ream/yr	14	6			

Cardboard	Quantity/year	Weight(kg)/cardboard	Weight(kg) for 1 year	Emission factor kg/CO2e for virgin paper	Total emission kgCO2eq	Total emission tCO2eq
Box files	4	0.2	0.8	2.62	2.096	0.002096
Cardboard	Quantity/year	Weight(kg)/file	Weight(kg) for 1 year	Emission factor kg/CO2e for virgin paper	Total emission kgCO2eq	Total emission tCO2eq
Files	14	0.1	1.4	2.62	3.668	0.003668
Pen	Quantity/year	Weight(kg)/pen	Weight(kg) for 1 year	Emission factor kg/CO2e for virgin plastic	Total emission kgCO2eq	Total emission tCO2eq
Plastic pen	36	0.005	0.18	5.09	0.9162	0.0009162
Marker	Quantity/year	Weight(kg)/marker	Weight(kg) for 1 year	Emission factor kg/CO2e for virgin plastic	Total emission kgCO2eq	Total emission tCO2eq
Marker	20	0.01	0.2	5.09	1.018	0.001018

Post it notes	Quantity/year	Weight(kg)/marker	Weight(kg) for 1 year	Emission factor kg/CO2e for virgin paper	Total emission kgCO2eq	Total emission tCO2eq
Post it notes	4	0.01	0.04	2.58	0.1032	0.0001032
Total emission from all sources (tCO2eq)						**0.043**

Scope 3 : Emissions from student consumables for 2019-2020

Journal paper	Number of students	Weight(kg) Journal paper per student	Total weight (kg)	Emission factor kg/CO2e for recycled paper	Total emission kgCO2eq	Total emission tCO2eq
Journal paper	310	3.5	1085	2.85	3092.25	3.09225
Plastic file	Number of students	Weight(kg) plastic file per student	Total weight (kg)	Emission factor kg/CO2e	Total emission kgCO2eq	Total emission tCO2eq
Files	310	0.6	186	5.09	946.74	0.94674
Pen	Number of students	Weight(kg) plastic pen per student	Total weight (kg)	Emission factor kg/CO2e for virgin plastic	Total emission kgCO2eq	Total emission tCO2eq

Plastic pen	310	0.4	124	5.09	631.16	0.63116
Post it notes	Number of students	Weight(kg) post it note per student	Total weight (kg)	Emission factor kg/CO2e for virgin paper	Total emission kgCO2eq	Total emission tCO2eq
Post it notes	310	0.5	155	2.58	399.9	0.3999
Total emission from all sources (tCO2eq)					5.070	

Scope 3 : Emissions from student consumables for 2020-2021

Journal paper	Number of students	Weight(kg) Journal paper per student	Total weight (kg)	Emission factor kg/CO2e for recycled paper	Total emission kgCO2eq	Total emission tCO2eq
Journal paper	310	1.4	434	2.85	1236.9	1.2369
Plastic file	Number of students	Weight(kg) plastic file per student	Total weight (kg)	Emission factor kg/CO2e	Total emission kgCO2eq	Total emission tCO2eq
Files	310	0.06	18.6	5.09	94.674	0.094674
Pen	Number of students	Weight(kg) plastic pen per student	Total weight (kg)	Emission factor kg/CO2e for virgin plastic	Total emission kgCO2eq	Total emission tCO2eq
Plastic pen	310	0.12	37.2	5.09	189.348	0.189348
Post it notes	Number of students	Weight(kg) post it note per student	Total weight (kg)	Emission factor kg/CO2e for virgin paper	Total emission kgCO2eq	Total emission tCO2eq
Post it notes	310	0.1	31	2.58	79.98	0.07998
Total emission from all sources (tCO2eq)					1.601	

Scope 3 : Emissions from Online lectures for year 2020-2021

Electronic device	Duration (hours)	Usage	Total usage (kwh)	Emission factor (tCO2eq /mwh)	Total emission per student	Number of students	Total emission (800 students) per day	Total emission (800 students) per year
Mobile phone	2	0.005	0.01	0.96	0.0000	125	0.0012	0.2880
	6	0.005	0.03	0.96	0.0000	174	0.0050	1.2027

	8	0.005	0.04	0.96	0.0000	11	0.0004	0.1014
Laptop	2	0.07	0.14	0.96	0.0001	247	0.0332	7.9672
	6	0.07	0.42	0.96	0.0004	52	0.0210	5.0319
	8	0.07	0.56	0.96	0.0005	11	0.0059	1.4193
Desktop	2	0.3	0.6	0.96	0.0006	292	0.1682	40.3661
	6	0.3	1.8	0.96	0.0017	18	0.0311	7.4650
Total emissions from students (tCO2eq)							0.2660	63.8415

Electronic device	Duration (hours)	Usage	Total usage (kwh)	Emission factor tco2eq /mwh	Total emission per faculty	Number of members	Total emission (18 members) per day	Total emission (18 members) per year
Mobile phone	2	0.005	0.01	0.96	0.0000	14	0.0001	0.0323
	6	0.005	0.03	0.96	0.0000	4	0.0001	0.0276
Laptop	2	0.07	0.14	0.96	0.0001	16	0.0022	0.5161
	6	0.07	0.42	0.96	0.0004	2	0.0008	0.1935
Desktop	2	0.3	0.6	0.96	0.0006	14	0.0081	1.9354
	6	0.3	1.8	0.96	0.0017	4	0.0069	1.6589
Total emissions from faculty (tCO2eq)							0.0182	4.3638
Total emissions by students and faculty (tCO2eq)								68.2053

Scope 3 : Emissions from study visit travel for Year 2019-2020

Type of vehicle: 45 seater bus. Mileage of vehicle: 7kmpl. Emission factor (tco2eq/litre) :0.003

Route of travel	Total distance (km) per trip	Number of trips	Diesel for 1 trip	Emission for 1 trip (tco2eq)	Total emission (tco2eq)
College to Hinjewadi Campus- Hinjewadi Campus to College	56	2	8	0.024	0.048
College to Satara BCA College - Satara BCA College to College	216	1	30.86	0.093	0.093
Total emission (tCO2eq)					0.141

Scope 3: Emissions from faculty travel from residence to college for 2019-2020(bike and car)

Emission factor: 0.003 (tCO2eq/litre). Mileage of vehicle(kmpl): Honda Activa: 45kmpl. Mileage of vehicle(kmpl): Tata Indica: 25kmpl. Route of travel: Residence to college - college to residence. Total distance per trip: 10km. Considerations: Rarely = 5%, Sometimes= 50%, Most of the time= 80%, Always= 100% of the total days. Total working days for faculty members: 265 days

Frequency	Number of trips by faculty	Type of vehicle	Petrol for 1 trip(litre)	Emission for 1 trip (tCO2eq)	Total emission (tCO2eq)	Annual total emission (tCO2eq)
Always	16	Honda Activa	0.22	0.00067	0.0107	2.8267
Total emission by bike for year 2019-2020 (tCO2eq)						2.827
Frequency	Number of trips by faculty	Type of vehicle	Petrol for 1 trip(litre)	Emission for 1 trip (tCO2eq)	Total emission (tCO2eq)	Annual total emission (tCO2eq)
Sometimes	2	Tata Indica	0.40	0.00120	0.0024	0.3192
Total emission by car for year 2019-2020 (tCO2eq)						0.319

Scope 3: Emissions from student travel from residence to college for 2019-2020(bike)

Emission factor: 0.003 (tCO2eq/litre). Mileage of vehicle(kmpl): Honda Activa: 45kmpl. Route of travel: Residence to college - college to residence. Total distance per trip: 10km. Considerations: Rarely = 5%, Sometimes= 50%, Most of the time= 80%, Always= 100% of the total days. Total working days for faculty members: 220 days.

Frequency	Number of trips by students	Petrol for 1 trip(litre)	Emission for 1 trip (tCO2eq)	Total emission (tCO2eq)	Annual total emission (tCO2eq)
Rarely	55	0.22	0.00067	0.0367	0.4033
Sometimes	67	0.22	0.00067	0.0447	4.9133
Most of the time	26	0.22	0.00067	0.0173	3.0507
Always	22	0.22	0.00067	0.0147	3.2267
Total trips	170	Total emission by students for year 2019-2020 (tCO2eq)			11.594

Scope 3: Emissions from student travel from residence to college for 2019-2020(car)

Emission factor: 0.003 (tCO2eq/litre). Mileage of vehicle(kmpl): Tata Indica: 25kmpl

Route of travel: Residence to college - college to residence. Total distance per trip: 10km.

Frequency	Number of trips by students	Petrol for 1 trip(litre)	Emission for 1 trip (tCO2eq)	Total emission (tCO2eq)	Annual total emission (tCO2eq)
Rarely	52	0.40	0.00120	0.0624	0.6864
Sometimes	18	0.40	0.00120	0.0216	2.3760
Most of the time	7	0.40	0.00120	0.0084	1.4784
Always	4	0.40	0.00120	0.0048	1.0560
Total trips	81	Total emission by students for year 2019-2020 (tCO2eq)			5.597

Scope 3: Emissions from faculty travel from residence to college for 2020-2021(bike and car)

Emission factor: 0.003 (tCO2eq/litre) . Mileage of vehicle(kmpl): Honda Activa: 45kmpl.

Mileage of vehicle(kmpl): Tata Indica: 25kmpl

Frequency	Number of trips by faculty	Type of vehicle	Petrol for 1 trip(litre)	Emission for 1 trip (tCO2eq)	Total emission (tCO2eq)	Annual total emission (tCO2eq)
Always	10	Honda Activa	0.22	0.00067	0.0067	1.7667
Total emission by faculty for year 2020-2021 (tCO2eq)						**1.767**
Frequency	Number of trips by faculty	Type of vehicle	Petrol for 1 trip(litre)	Emission for 1 trip (tCO2eq)	Total emission (tCO2eq)	Annual total emission (tCO2eq)
Most of the time	1	Tata Indica	0.40	0.00120	0.0012	0.2544
Total emission by faculty for year 2020-2021 (tCO2eq)						**0.254**

Emissions from student travel from residence to college for 2020-2021(bike)

Emission factor: 0.003 (tCO2eq/litre)

Mileage of vehicle(kmpl): Honda Activa: 45kmpl

Frequency	Number of trips by students	Petrol for 1 trip(litre)	Emission for 1 trip (tCO2eq)	Total emission (tCO2eq)	Annual total emission (tCO2eq)
Rarely	13	0.22	0.00067	0.0087	0.0953
Sometimes	17	0.22	0.00067	0.0113	1.2467
Most of the time	12	0.22	0.00067	0.0080	1.4080
Always	13	0.22	0.00067	0.0087	1.9067
Total trips	55	Total emission by students for year 2020-2021 (tCO2eq)			4.657

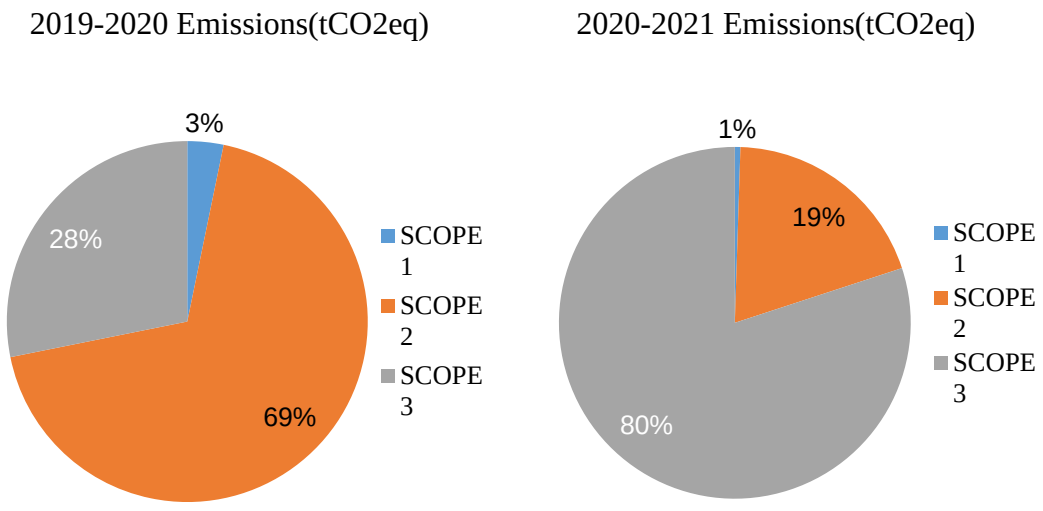
Scope 3: Emissions from student travel from residence to college for 2020-2021(car)

Emission factor: 0.003 (tCO2eq/litre). Mileage of vehicle(kmpl): Tata Indica: 25kmpl

Route of travel: Residence to college - college to residence. Total distance per trip: 10km.

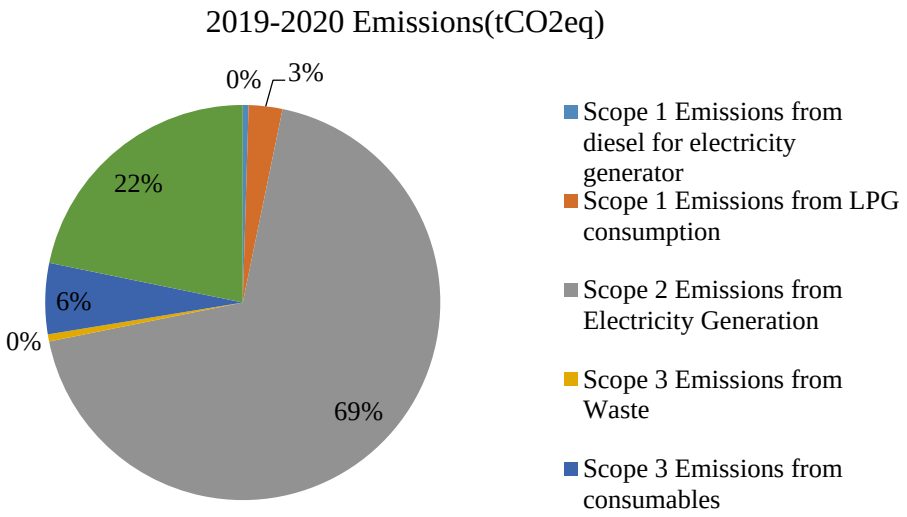
Frequency	Number of trips by students	Petrol for 1 trip(litre)	Emission for 1 trip (tCO2eq)	Total emission (tCO2eq)	Annual total emission (tCO2eq)
Rarely	11	0.40	0.00120	0.0132	0.1452
Sometimes	8	0.40	0.00120	0.0096	1.0560
Most of the time	4	0.40	0.00120	0.0048	0.8448
Always	2	0.40	0.00120	0.0024	0.5280
Total trips	25	Total emission by students for year 2020-2021 (tCO2eq)			2.574

3.2 Results and findings

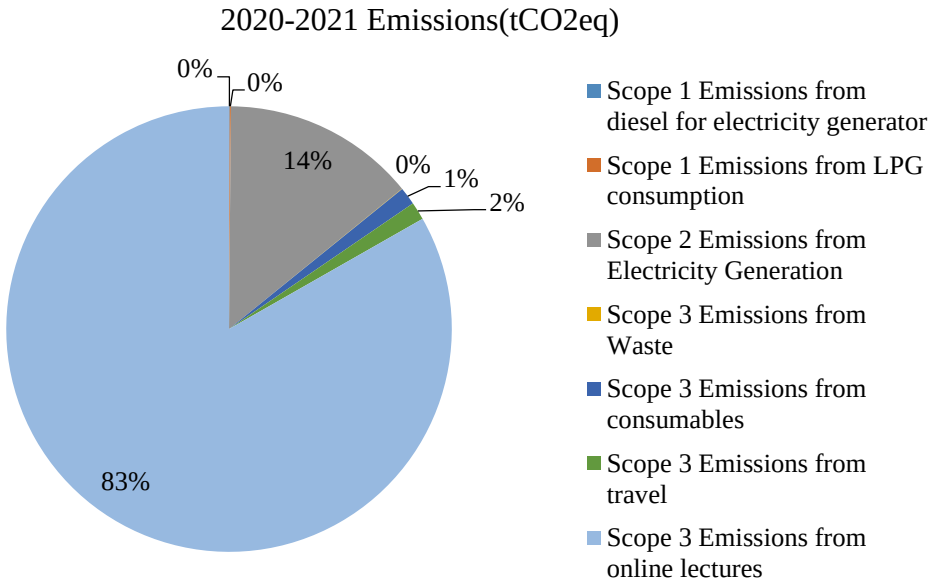


Graph :Year wise emissions

Building	Scope	Year 2019-2020 (tCO2eq)	Year 2020-2021(tCO2eq)	Increased percentage
K B Joshi institute	Scope 1	3.042	0.504	4.89 %
	Scope 2	64.512	19.238	
	Scope 3	26.481	79.125	
Total emissions(tCO2eq)		94.035	98.867	



Graph :Year2019-2020 Emissions



Graph :Year2020-2021 Emissions

- Emissions from Diesel required For Electricity Generator

  The total emissions from Diesel required For Electricity Generator for year 2019-2020 and year 2020-2021 are about 0.45 tCO2eq and 0.18 tCO2eq respectively. Reduction of 0.27 tCO2eq ie 60% has been observed in the year 2020-2021.

- Emissions from LPG consumption

  The total emissions from LPG consumption for year 2019-2020 and year 2020-2021 are about 2.592 tCO2eq and 0.324 tCO2eq respectively. Reduction of 2.268 tCO2eq ie 87.5% has been observed in the year 2020-2021. The total emissions from Scope 1 for year 2019-2020 and year 2020-2021 are about 3.042 tCO2eq and 0.504 tCO2eq respectively. Reduction of 2.538 tCO2eq ie 83.43% has been observed in the year 2020-2021.

- Emissions from Electricity Consumption

  The total emissions for year 2019-2020 and year 2020-2021 are about 64.512 tCO2eq and 19.2384 tCO2eq respectively. The reductions are caused due to the change in the working method adapted during lockdown.

- Emissions from Waste

  The total emissions from waste for year 2019-2020 and year 2020-2021 are about 0.546 tCO2eq and 0.0294 tCO2eq respectively. Reduction of 0.517 tCO2eq ie 95% has been observed in the year 2020-2021.

- Emissions from Consumables Of Students, Staff And Faculty

  The emissions from consumables of staff ,faculty and students for year 2019-2020 and year 2020-2021 are about 5.457 tCO2eq and 1.644 tCO2eq respectively. Reduction of 3.813 tCO2eq ie 70% has been observed in the year 2020-2021.

- Emissions from online lectures (Year 2020-2021)

  The emissions from students and faculty online lectures are about 63.8415 tCO2eq and 4.3638 tCO2eq respectively. Hence the total emission is 68.20 tCO2eq.

- Emissions from Waste

  The emissions from waste for year 2019-2020 and year 2020-2021 are about 0.546 tCO2eq and 0.029 tCO2eq respectively. Reduction of 0.517 tCO2eq ie 95% has been observed in the year 2020-2021.

- Emissions from Travel

  The emissions from travel (study visit) by hired vehicles for students and faculty and travel by staff, faculty and students from to residence to college for year 2019-2020 and year 2020-2021 are about 20.478 tCO2eq and 9.252 tCO2eq respectively. Reduction of 11.226 tCO2eq ie 55% has been observed in the year 2020-2021 as no visits were conducted and the classes were conducted online due to the lockdown.

- Total Emissions From Scope 3 sources

  The total emissions from Scope 3 sources for year 2019-2020 and year 2020-2021 are about 26.481 tCO2eq and 79.125 tCO2eq respectively. Increase of 52.644 tCO2eq ie 53% has been observed in the year 2020-2021. Highest emissions from electricity generation due to high usage of electronic devices during study hours in 2019-2020 are replaced by emissions from online lectures during pandemic ie year 2020-2021. Emissions from travel are lesser as the students avoid vehicles for travelling to the college and prefer walking.

3.3 Carbon offset through solar PV

A carbon offset is a reduction in emissions of carbon dioxide or other greenhouse gases made in order to compensate for emissions made elsewhere. Offsets are measured in tonnes of carbon dioxide-equivalent (CO2e). One tonne of carbon offset represents the reduction of one tonne of carbon dioxide or its equivalent in other greenhouse gases. Carbon offset are of two types: 1. Within boundary 2. Outside boundary. 1) Within Boundary: within boundary includes technology interventions that are leading to directly replacing either electricity or fossil use present. Eg: rooftop solar PV electricity supply to reduce electricity consumption, biogas plant to reduce cooking fuel consumption. 2) Outside boundary: This involves either tree plantation or ecosystem restoration funded by the institution outside the boundary, or some technology interventions funded by the institution but implemented outside the boundary. This cannot replace electricity or fuel directly use within boundary.

Within boundary carbon offset initiatives are undertaken by the buildings in order to reduce the emissions from the anthropogenic activities.

Table 1 Carbon offset

Building name	Total emissions (tCO2eq)	Capacity in KWp (kilowattspeak)	CO2 emissions reduced (Tons per year)	Offset percentage
K B Joshi institute	94.035	60	65.7	69.87

4 Auditing for Green campus management:

4.1 Flora and Fauna inventory

Trees on the campus help in shaping microclimate and they also act as carbon sinks. Plants can store carbon within their structures or absorb CO2 through photosynthesis. But once they reach the end of the lifecycle and die, they re-emit all absorbed carbon back into the system. The storage potential of each carbon sink is important as it denotes the possibility of each sink to be utilized in the intentional sequestration of carbon.

The carbon sequestration rate depends on the growth characteristics of the tree species, the density of its wood, the location's conditions for growth, and the plant stage of the tree.

Details of tree species in the campus:

Species	No. Of trees (n)	Diameter of the trunk in inches	Height of the tree in feet	Wabove-ground (D>11)	Wtotal green weight	Wdry weight	Wcarbon	Wcarbon-dioxide	CO2 sequestration in tCO2eq	Average age of tree cover (in year)(Ac)	Yearly CO2 sequestration
Spathodea campanulata	27	23.62	39.37	3295.28	3954.34	2866.90	1433.45	5260.75	71.02	15	4.73
Dalbergia sisso	3	31.50	39.37	5858.28	7029.94	5096.70	2548.35	9352.45	14.03	15	0.94
Azadirachta indica	22	23.62	32.81	2746.07	3295.28	2389.08	1194.54	4383.96	48.22	15	3.21
Tamarindus indica	8	27.56	32.81	3737.70	4485.25	3251.80	1625.90	5967.06	23.87	15	1.59
Pithecellobium dulce	8	23.62	32.81	2746.07	3295.28	2389.08	1194.54	4383.96	17.54	15	1.17
	3	5.91		228.84	274.61	199.09	99.54	365.33	0.55		0.04

Psidium guajava			26.25							15	
Millingtonia hortensis	24	23.62	65.62	5492.14	6590.56	4778.16	2389.08	8767.92	105.22	15	7.01
Polyalthia longifolia	57	11.81	49.21	1029.78	1235.73	895.90	447.95	1643.99	46.85	15	3.12
Ficus religiosa	7	78.74	65.62	61023.74	73228.49	53090.66	26545.33	97421.36	340.97	35	9.74
Eucalyptus globulus	64	11.81	52.49	1098.43	1318.11	955.63	477.82	1753.58	56.11	25	2.24
Gmelina arborea	1	11.81	39.37	823.82	988.58	716.72	358.36	1315.19	0.66	15	0.04
Delonix regia	21	39.37	49.21	11441.95	13730.34	9954.50	4977.25	18266.50	191.80	25	7.67
Syzygium cumini	40	7.87	32.81	508.53	610.24	442.42	221.21	811.84	16.24	15	1.08
Cascabela thevetia	6	9.84	114.83	2781.03	3337.24	2419.50	1209.75	4439.78	13.32	15	0.89
Grevillea robusta	8	31.50	246.06	36614.25	43937.10	31854.39	15927.20	58452.81	233.81	15	15.59
Ficus benjamina	23	7.87	32.81	508.53	610.24	442.42	221.21	811.84	9.34	15	0.62
Terminalia catapa	12	39.37	32.81	7627.97	9153.56	6636.33	3318.17	12177.67	73.07	15	4.87

Acacia horrida	1	31.50	26.25	3905.52	4686.62	3397.80	1698.90	6234.97	3.12	15	0.21
Tectona grandis	3	23.62	26.25	2196.85	2636.23	1911.26	955.63	3507.17	5.26	15	0.35
Cocos nucifera	4	9.84	39.37	953.50	1144.20	829.54	414.77	1522.21	3.04	15	0.20
Ficus benghalensis	9	59.06	49.21	25744.39	30893.27	22397.62	11198.81	41099.63	184.95	60	3.08
Mangifera indica	58	7.87	32.81	508.53	610.24	442.42	221.21	811.84	23.54	15	1.57
Ficus racemosa	16	23.62	49.21	4119.10	4942.92	3583.62	1791.81	6575.94	52.61	35	1.50
Casuarina equisetifolia	9	7.87	32.81	508.53	610.24	442.42	221.21	811.84	3.65	15	0.24
Annona reticulata	1	7.87	16.40	254.27	305.12	221.21	110.61	405.92	0.20	15	0.01
Jacaranda Mimosifolia	10	23.62	32.81	2746.07	3295.28	2389.08	1194.54	4383.96	21.92	15	1.46
Peltophorum Pterocarpum	8	39.37	32.81	7627.97	9153.56	6636.33	3318.17	12177.67	48.71	15	3.25
Ficus elastica	6	78.74	39.37	36614.25	43937.10	31854.39	15927.20	58452.81	175.36	35	5.01
Areca Palm	5	5.91		228.84	274.61	199.09	99.54	365.33	0.91		0.06

			26.25							15	
Plumeria alba	1	5.91	13.12	114.42	137.30	99.54	49.77	182.67	0.09	15	0.01
Caryota urens	3	9.84	39.37	953.50	1144.20	829.54	414.77	1522.21	2.28	15	0.15
Bauhinia tomentosa	2	7.87	13.12	203.41	244.09	176.97	88.48	324.74	0.32	15	0.02
Callistemon	1	11.81	22.97	480.56	576.67	418.09	209.04	767.19	0.38	15	0.03
Plumeria	9	7.87	8.20	127.13	152.56	110.61	55.30	202.96	0.91	15	0.06
Saraca ashoka	3	7.87	16.40	254.27	305.12	221.21	110.61	405.92	0.61	15	0.04
Tabebuia	6	5.91	8.20	71.51	85.81	62.22	31.11	114.17	0.34	15	0.02
Cassia fistula	6	5.91	22.97	200.23	240.28	174.20	87.10	319.66	0.96	15	0.06
Samanea saman	7	39.37	49.21	11441.95	13730.34	9954.50	4977.25	18266.50	63.93	15	4.26
Roystonea regia	23	11.81	11.48	240.28	288.34	209.04	104.52	383.60	4.41	25	0.18
Caesalpinia pulcherrima	7	15.75	9.84	366.14	439.37	318.54	159.27	584.53	2.05	15	0.14

Putranjiva roxburgii	1	19.69	22.97	1334.89	1601.87	1161.36	580.68	2131.09	1.07	15	0.07
Cassia grandis	1	19.69	65.62	3813.98	4576.78	3318.17	1659.08	6088.83	3.04	15	0.20
Plumeria rubra	7	15.75	16.40	610.24	732.28	530.91	265.45	974.21	3.41	15	0.23
Araucaria columnaris	3	31.50	32.81	4881.90	5858.28	4247.25	2123.63	7793.71	11.69	15	0.78
Calliandra haematocephala	1	19.69	59.06	3432.59	4119.10	2986.35	1493.17	5479.95	2.74	15	0.18
Tabernaemontana divaricata	1	5.91	9.84	85.81	102.98	74.66	37.33	137.00	0.07	15	0.00
Eucalyptus tereticornis	15	11.81	52.49	1098.43	1318.11	955.63	477.82	1753.58	13.15	15	0.88
Ficus elastica	5	39.37	32.81	7627.97	9153.56	6636.33	3318.17	12177.67	30.44	15	2.03
Bauhinia variegata	7	9.84	13.12	190.70	228.84	165.91	82.95	304.44	1.07	15	0.07
Erythrina indica	1	15.75	49.21	1830.71	2196.85	1592.72	796.36	2922.64	1.46	15	0.10
Musa acuminata	2	5.91	26.25	228.84	274.61	199.09	99.54	365.33	0.37	15	0.02
				549.21	659.06	477.82	238.91	876.79	15.34		1.02

Gliricidia Sepium	35	11.81	26.25							15	
Aiphanes erosa	1	7.87	22.97	355.97	427.17	309.70	154.85	568.29	0.28	15	0.02
sandulum album	1	7.87	16.40	254.27	305.12	221.21	110.61	405.92	0.20	15	0.01
Leucaena leucocephala	1	15.75	32.81	1220.47	1464.57	1061.81	530.91	1948.43	0.97	15	0.06
Holoptelia integrifolia	1	19.69	49.21	2860.49	3432.59	2488.62	1244.31	4566.63	2.28	15	0.15
Artocarpus heterophyllus	8	11.81	29.53	617.87	741.44	537.54	268.77	986.39	3.95	15	0.26
Moringa oleifera	3	23.62	39.37	3295.28	3954.34	2866.90	1433.45	5260.75	7.89	15	0.53
Hardwickia binata	1	354.33	59.06	1112157.74	1334589.28	967577.23	483788.62	1775504.22	887.75	15	59.18
Plumeria obtusa	3	7.87	24.61	381.40	457.68	331.82	165.91	608.88	0.91	15	0.06
Tecoma stans	3	7.87	13.12	203.41	244.09	176.97	88.48	324.74	0.49	15	0.03
Carpentaria acuminata	1	11.81	45.93	961.12	1153.35	836.18	418.09	1534.39	0.77	15	0.05
Albizia lebbeck	1	23.62	26.25	2196.85	2636.23	1911.26	955.63	3507.17	1.75	15	0.12

seena siamea	3	11.81	39.37	823.82	988.58	716.72	358.36	1315.19	1.97	15	0.13
Michelia champaca	1	35.43	98.43	18535.96	22243.15	16126.29	8063.14	29591.74	14.80	15	0.99
Khaya senegalensis	3	31.50	39.37	5858.28	7029.94	5096.70	2548.35	9352.45	14.03	15	0.94
Senna spectabilis	1	11.81	32.81	686.52	823.82	597.27	298.63	1095.99	0.55	15	0.04
Tabernaemontana coronaria	3	5.91	9.84	85.81	102.98	74.66	37.33	137.00	0.21	15	0.01
Wrightia tinctoria	1	19.69	32.81	1906.99	2288.39	1659.08	829.54	3044.42	1.52	15	0.10
Pongamia pinnatia	2	19.69	59.06	3432.59	4119.10	2986.35	1493.17	5479.95	5.48	15	0.37
Murraya koenegi	1	5.91	19.69	171.63	205.96	149.32	74.66	274.00	0.14	15	0.01
Areca catechu	1	5.91	65.62	572.10	686.52	497.72	248.86	913.33	0.46	15	0.03
Casabella thevetia	1	7.87	39.37	610.24	732.28	530.91	265.45	974.21	0.49	15	0.03
TOTAL CARBON SEQUESTRATION								2283398.79	2892.92		155.21

- Carbon sequestered in trees (tCO2eq): 2892.92
- Carbon sequestration in tree cover during accounting 1 year(tCO2eq): 155.21

- Amount of Carbon sequestered from 660 trees is around 7.5% of total campus emissions which includes emissions from scope 1 and scope 2.

4.2 Green Infrastructure

The campus follows 3 R principles while using resources. A 600kwp solar pv system installed in the campus. The solar hot water system generates 3000ltrs of hot water daily. Biogas generated is used for canteen to reduce LPG usage. Rain water is harvested and reused for landscape purposes. All landscape waste is treated in the campus and converted to manure. All paper waste is reused. Bowls are made out of paper which are used in canteen. And campus has more than 660 big trees acting as a carbon sink. The campus try to achieve the highest possible Standards of sustainability IN DAY-TO-DAY Activities through academic Practices and facilities and Operations.

solar PV system

18 kW solar hot water system, Around 3000 ltr/day hot water

25 kg daily Gas generation

Rain Water Harvesting system capacity 4,20,000 ltrs

Bio-Sanitizer (Vermicompost) - Total 107 pits

Reuse of Paper Waste: Bowls for Canteen use

More than 660 trees. Helping conserve biodiversity

4.3 Waste Audit

The waste generated in the institute on a daily basis is around 2.1 kilo grams. Various types of waste generate on a daily basis is mentioned in the table below. The waste generated across different rooms is collected, and properly segregated at one place. The biomedical waste is sent to the incineration plant for proper disposal. The organic waste is sent to the biogas plant which contributes a small part in generating energy to save 30 cylinders in a month. The paper waste generated is reused in the campus for various purposes.

Daily waste	Kg
Paper	0.7
Plastic	0.3
Organic	0.5
Biomedical waste	0.6
Total	2.1

Table 05: Daily Waste generation

Yearly Waste	Kg
E Waste	10.5

Table 06: E-Waste generation

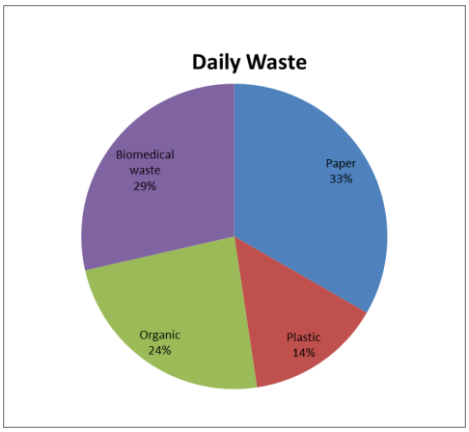


Figure 02: percentage of different type of waste generated in institute |Source: Author

During the data analysis of waste management in 2019-20 in the institute, 60% students admitted to recycling papers on a regular basis. The rest of the paper waste generated in the campus was observed to being reused for various purposes. Finally, as per the observation of the daily waste management process, waste was found to be collected & segregated before being sent for further processing. The biomedical waste was sent to the incineration plant, while the organic waste to the bio gas plant. During lockdown period as occupancy was very less, the waste generated was negligible.

5 Conclusion and recommendations:

Various parameters such as energy, waste, flora fauna were assessed under this green audit of K.B. Joshi institute. It has been observed that the institute is already working on the principal of 3Rs- Reduce, Reuse, Recycle. It is observed that the energy (scope2) consumed in the facilities of the institutional campus is the biggest contributor to the carbon footprint at institute level. Years 2019-2020 and 2020-2021 were considered for evaluation as major change was observed in the emissions of the institutional campus due to the advent of pandemic.

The total emissions of the institute for the year 2019-2020 and year 2020- 2021 are about 94.035 tCO2eq and 98.867 tCO2eq respectively. Difference of 4.89% has been observed in the year 2020-2021 as regular working conditions came to an end.

Initiatives have been taken at the campus to reduce the emissions caused from the anthropogenic activities. For example: by planting trees within the campus, by providing solar panels, biogas plant etc.

To increase the environmental performance, the institute can take actions across all three major domains, respectively 'Energy', Water, and 'Waste'. Wastage of electricity can be curbed by increasing awareness amongst students and staff to use the electricity optimally, and also as an additional option, occupancy sensors can also be installed to keep electricity usage in check.

They have installed solar PV installation of 60 KWp capacity on rooftop. This will help reduce carbon footprint of the Institute and Campus. The institute can further follow the above-mentioned recommendations to achieve sustainability and better resource consumption.