

# 2022

## Campus Environmental Audit- BalGanga Degree College Sendul Kemar Tehri Garhwal



Navy Blue Energy  
NavyBlue Resources Integration  
and Solutions Pvt Ltd

## ABBREVIATION

A-Ampere  
AC- Air conditioner  
ASHRAE – American Society of Heating, Refrigeration, and Air conditioning  
BEE – Bureau of Energy Efficiency  
BMS – Building Management System  
CFL – Compact Fluorescent Lamp  
CFM – Cubic feet per minute  
DB – Distribution Board balance  
DBT – Dry bulb temperature  
DG – Diesel Generator  
ECO – Energy Conservation Opportunities  
EER- Energy Efficiency Ratio  
HT- High Tension  
IEEE- Institute of Electrical and Electronic Engineers  
IT – Information Technology  
KW – Kilowatt  
KVA – Kilo Volt Ampere  
LED – Light Emitting Diode  
LPD – Lighting Power Density  
LT – Low tension  
NBC- National Building Code  
ODU – Outdoor units  
PAC – Precision Air Conditioning  
PDU – Power Distribution Board  
PF – Power factor  
PSI- Pound per square inch  
TR – Tonne of refrigeration  
UoM – Unit of Measurement  
UPS – Uninterrupted power supply  
V - Voltage  
VFD – Variable frequency drive  
VRV – Variable Refrigerant volume  
WBT – Wet Bulb Temperature

## TABLE OF CONTENTS

Abbreviation .....	1
Acknowledgement .....	4
Introduction .....	6
Audit Study Team Members.....	7
Instruments used for Measurements and Analysis- .....	7
Executive Summary.....	8
1. Energy Audit.....	8
Water Audit.....	9
Waste Disposal Audit.....	9
Greenery- .....	9
Carbon Footprint-.....	9
Objective of Audit - .....	10
Scope of Work-.....	10
Energy Audit: .....	10
Water Audit:.....	10
Waste Disposal Audit:.....	10
Environmental Quality Audit: .....	10
Renewable Energy Feasibility .....	10
Carbon accounting:.....	10
Goals of the College .....	11
Energy Audit.....	12
Billing Analysis-.....	12
Energy Balance.....	12
Energy Conservation Measures .....	13
Energy Conservation Opportunity by replacing existing Ceiling fan by BLDC fan.....	13
Energy Conservation MEASURE BY Replacing old Tube lights with new efficient Lights .....	14
Energy Generation Opportunity by Installing Solar Power plant.....	15
Water audit.....	16
Water balance.....	16
Water Conservation Opportunities.....	17
Water saving Opportunity by Conventional Tap Replacement with new efficient taps .....	17
Water saving opportunities with Dual flushing technique in toilet .....	18
Greenery Survey .....	19
Waste Disposal Audit.....	22
Carbon Accounting / Foot Print .....	25
List of tables	
Table 1 Audit Team Members.....	7
Table 2 Executive Summary .....	8
Table 3 Water Conservation Measures .....	9

Table 4 Campus Open Ground Area.....	11
Table 5 Energy Balance .....	12
Table 6 Energy Savings Calculations by replacing fan with BLDC Fans .....	13
Table 7 Replacing FTL with LED Lights ECM.....	14
Table 8 Solar PV Feasibility .....	15
Table 9 Water Balance .....	16
Table 10 Water conservation opportunities by replacing taps. ....	17
Table 11 Water conservation opportunity by replacing flush with dual flush system. ....	18
Table 12 List of Plant species in the campus.....	19
Table 13 Campus Greenery Survey.....	19
Table 14 Waste Disposal Practice in the Campus .....	23

## ACKNOWLEDGEMENT


Energy Audit team of M/s. Navy Blue Resources Integration & Solutions Pvt Ltd (NBRI) conducted Campus Environmental Audit of BalGanga Degree college Sendul (Kemar) Tehri Garhwal. Between– 7<sup>th</sup> March 2022- 10<sup>th</sup> March 2022



We would like to thank Hon. Principal and Management for providing us an opportunity to carry out Campus Environmental Audit at your Facility and would also like to thank all other staff of facility for providing all the support during audit and report preparations.

The purpose of this assessment is to conduct a complete energy performance assessment Mechanical & Electrical Equipment, Water Audit, Renewable Energy Feasibility, Waste Management and Green Audit within the said site to identify whether the existing systems can sufficiently handle the loads required by your operations and seeking improved workplace efficiently.

## CERTIFICATE

We here by certify that we carried out Green Audit in the BalGanga Degree college Sendul (Kemar) Tehri Garhwal, between 7<sup>th</sup> to 10<sup>th</sup> March and following Observations were presented below. The Management is pro-active towards Green Initiative by rainwater harvesting, Solar Energy project planning, Planting Trees, Better water conservation, Waste Management, Carbon Footprint; A continual improvement in Green Initiative is appreciated. We appreciate the efforts of the campus management this regard.

  
Pravin J. Awatade  
BEE-CEM/CEA  
EA-28824

## INTRODUCTION

Balganga Degree College is situated at Sendul, Tehri Garhwal at the confluence of Balganga and Bhilangana River. College is named after Balganga, which flows nearby college. Balganga Siksha Prasar Samiti is the mother institute of Balganga Degree College Sendul Kemar, Tehri Garhwal. Balganga Siksha Prasar Samiti was established in 1966 – 67 at village Kemra, Tehri Garhwal by Dr. Bachaspati Maithani a social activist, learned and educationist with local educationist and social activist to provide the educational facilities to the locality.

Since 2021 college is affiliated to Sri Dev Suman Uttarakhand University Badshahithaul, Tehri Garhwal. In present 840 students are getting the benefits of higher education. Teachers are well qualified and dedicated to teaching. Presently college is the successful educational institution of this region. The college organises and conducts various events and co – curricular activities such as quiz, speech, debates, group discussion, lecture series, workshops, seminar, sports and games and cultural programme every year for the students. College feels proud on its alumni as they are working in different field. College has been proved a boon for the poor students of this region.

**Figure 1 Map Location**



Facility gets LT power supply from the state electricity grid Power.

## AUDIT STUDY TEAM MEMBERS

The Audit team comprised of following members from Navy Blue Energy.

**Table 1 Audit Team Members**

Sr. No	Name of Members	Designation
1	Pravin Awatade CEA-28824	Team Leader-Energy Auditor
2	Harun Sutar – CEA- 28328	Energy Manager
3.	Nehal Gupta	Energy Engineer

## INSTRUMENTS USED FOR MEASUREMENTS AND ANALYSIS-

1. Three Phase Load Manager- With CT, PT
2. Ultrasonic Flowmeter
3. Single phase Instantaneous power Meters
4. Lux Meter
5. Psychrometer

## EXECUTIVE SUMMARY

### 1. ENERGY AUDIT

Navy Blue Energy Audit team observed some energy conservation opportunity in the premises. Facility can minimize its energy consumption by executing following Energy Conservation measures.

**Table 2 Executive Summary**

Energy Conservation Measures (ECM)	Estimated Energy Saving	Estimated Monetary Saving	Estimated Investment	Simple Payback Period	Priority
	kWh/Year	Rs/Year	Rs	Month	
Energy conservation Measures by Replacing Old Fans with new Energy Efficient Fans	383.25	3449.25	50000	174	very low
Energy Conservation Measure by Replacing old Tube lights with new efficient Lights	131	1177	1600	16.31	Medium
<b>Total</b>	514.066	4626.594	51600		

Navy Blue Energy Audit team has thoroughly assessed the complete facility Performance, Team has been observed that there will be around **27%** of Energy Savings Can be Achieved further by implementing the above-mentioned ECM's.

## WATER AUDIT

**Table 3 Water Conservation Measures**

<b>Water Conservation Measures</b>	<b>Water savings Potential kl/Year</b>
<b>Water conservation potential by using water efficient taps</b>	192
<b>Water saving opportunities with Dual flushing technique in toilet</b>	292
<b>Total</b>	484

Navy Blue Water Audit team has thoroughly assessed the complete facility Performance, Team has been observed that there will be around **29.6%** of Water Savings Can be Achieved further by implementing the above-mentioned WCM's.

## WASTE DISPOSAL AUDIT

Presently institute is practicing the waste segregation on site only- good practice.

## GREENERY-

Presently the campus has greenery is around the boundary, need to add some more in available areas.

## CARBON FOOTPRINT-

Total 590 kg of CO2 getting emitted by the campus per day.

## OBJECTIVE OF AUDIT -

1. The objective of carrying out Green Audit is securing the environment and cut down the threats posed to human health.
2. To make sure that rules and regulations are taken care of
3. To avoid the interruptions in environment that are more difficult to handle and their correction requires high cost.
4. To suggest the best protocols for adding to sustainable development.

## SCOPE OF WORK-

Scope of Green Audit shall consider following steps;

### ENERGY AUDIT:

It deals with the energy conservation and methods to reduce its consumption and the related pollution. The auditor targets at the energy consuming methods adopted and find whether these methods are using the energy in a conservative way or not.

### WATER AUDIT:

Evaluating the facilities of raw water intake and determining the facilities for water treatment. Water harvesting is one of the best techniques that can be adopted by simply storing the water and using it at the time of scarcity. The concerned auditor investigates the relevant method that can be adopted and implemented to balance the demand and supply of water

### WASTE DISPOSAL AUDIT:

The waste clearance measures associated to hazardous wastes and recycling are reviewed. The auditor diagnoses the prevailing waste disposal policies and suggests the best way to combat the problems.

### ENVIRONMENTAL QUALITY AUDIT:

It analyses the air quality, noise level and the programs undertaken by the institute for plantation. The Green Belt should be maintained to reduce the pollution level by decreasing the Carbon dioxide level.

### RENEWABLE ENERGY FEASIBILITY

Resources which can be replenished should be used such as rain, sunlight, wind, tides, etc. These resources are more advantageous as they cause least pollution. The importance of these resources is explained by the Audit team.

### CARBON ACCOUNTING:

It undertakes the measure of bulk of carbon dioxide equivalents exhaled by the organization through which the carbon accounting is done. It is necessary to know how much the organization is contributing towards the sustainable development. The auditor considers several efforts practiced by the institute to lower the Green House Gases in the atmosphere in order to make the campus more environmentally friendly.

## GOALS OF THE COLLEGE

In the effort to Enhancing an environmentally literate campus where students can learn the idea of protection of environment and stay healthy. The college Management is proactively working on the several facets of “Green Campus” including Plantation of more trees, Water Conservation, Efficient water usage by eliminating leaking water taps, Water Harvesting Pits and interconnecting them to Recharge the Ground Water table. Effective Waste Management which includes Food Waste, Plastic, Paper, Metal Work, Renewable Energy, carbon footprints etc.

1. To create a green campus with focus on above concepts
2. To Harness Solar Power
3. To Conserve Water by eliminating the water leakages, wastage, Rainwater Harvesting
4. To Reduce Waste management through reduction of Food waste generation, Plastic/Paper/Metal waste generation and effective disposal
5. To Reduce the Carbon Footprint
6. Enhancement of college profile

**Table 4 Campus Open Ground Area**



## ENERGY AUDIT

### BILLING ANALYSIS-

Audit team observed that the Electricity is supplied by state electricity board with 5kW of connected load and the average monthly billing is Rs.1800/- only since the college campus is at hilly area and low temperature area, so no major ventilation or AC requirements. And there is good use of daylights, and outdoor lights are solar operated, so college campus is very low energy intensive facility.

### ENERGY BALANCE

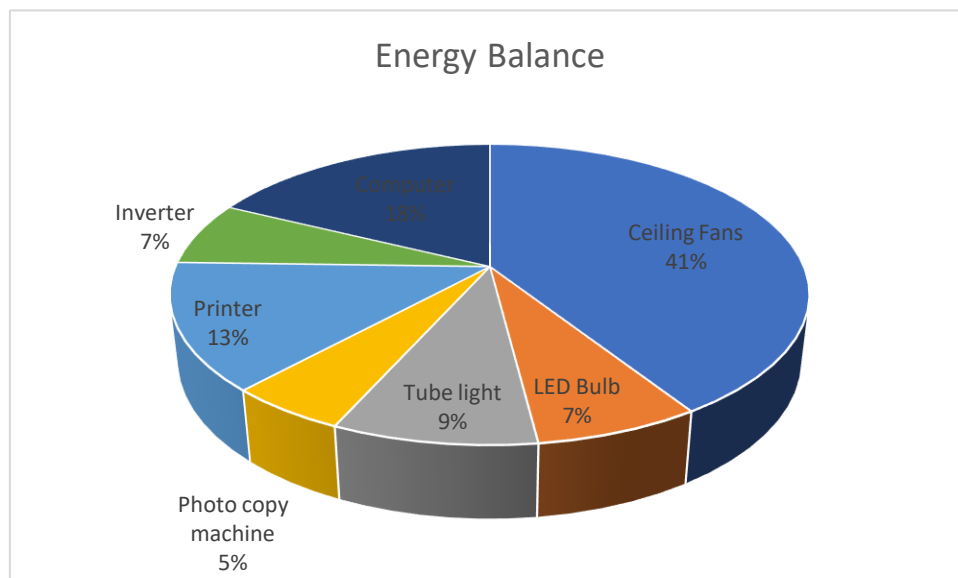
Audit team prepared the energy balance of the facility.

Load Details	QT Y	Rated Wattage	Operating Hours	Usage diversity	Energy kWh/Day
Ceiling Fans	50	60	7	10%	2.10
LED Bulb	26	20	7	10%	0.36
Tube light	16	40	7	10%	0.45
Photocopy machine	3	250	7	5%	0.26
Printer	10	200	7	5%	0.70
Inverter	1	5000	7	1%	0.35
Computer	13	100	7	10%	0.91
<b>Total</b>					<b>5.1</b>

Table 5 Energy Balance

The major energy is consumed by fans followed computers and Printers.

Chart 1 Energy Balance



## ENERGY CONSERVATION MEASURES

### ENERGY CONSERVATION OPPORTUNITY BY REPLACING EXISTING CEILING FAN BY BLDC FAN

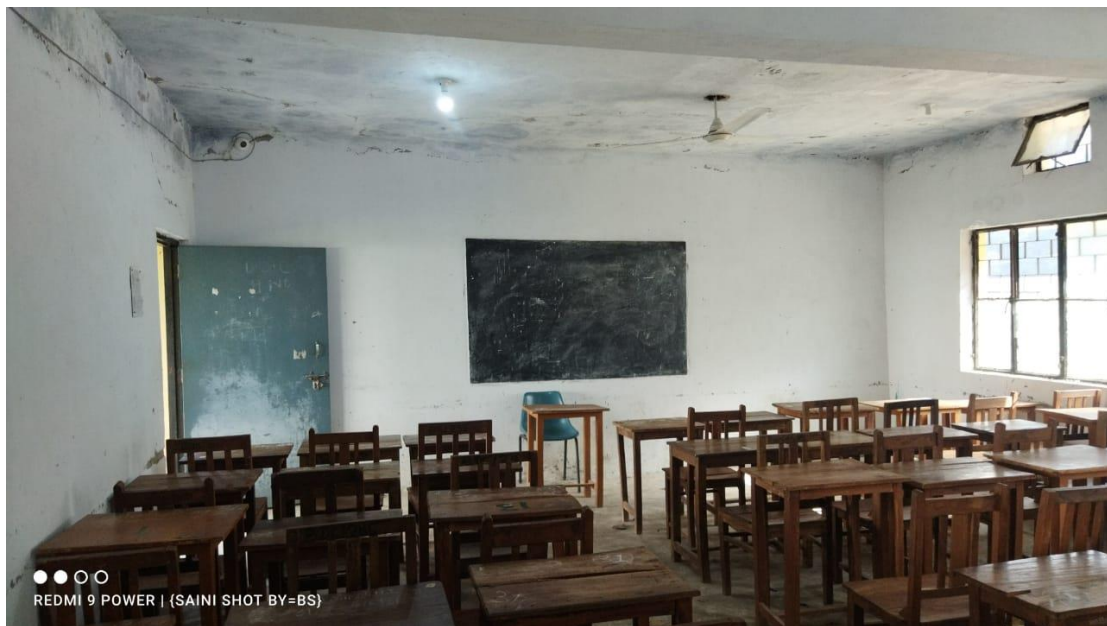
Observation- It is observed that at present facility have conventional Fans which consumes almost double the energy than energy efficient BLDC Fans.

Recommendation- it is recommended to replace the old fans with new energy efficient BLDC Fans, the energy savings potential along with cost benefit analysis mentioned in the table below.

**Table 6 Energy Savings Calculations by replacing fan with BLDC Fans**

Parameter	UoM	Value
Present Fan Rated Capacity	W	60
Present Fan Energy Consumption	kWh/Year	766.5
Total Number of fans	Nos.	50
Proposed Capacity of fans	W	30
Energy savings Potential	kWh/Year	383.25
Monetary savings Potential	Rs/Year	3449.25
Estimated Investment	Rs.	50000
Simple Payback Period	Months	174

**Site photograph 1 Classroom conventional fan**



## ENERGY CONSERVATION MEASURE BY REPLACING OLD TUBE LIGHTS WITH NEW EFFICIENT LIGHTS

Presently at facility there are few old FTL Lights installed, which can be replaced with new LED, the potential savings and cost benefit analysis is mentioned in the table below.

**Table 7 Replacing FTL with LED Lights ECM**

Parameter	UoM	Value
Light capacity	W	40
Qty	Nos	16
Present Energy consumption	kWh/Year	164
Proposed Energy Consumption	kWh/Year	33
Energy savings Potential	kWh/Year	131
Monetary Energy Savings Potential	Rs./Year	1177
Estimated Investment	Rs	1600
Simple Payback Period	Months	16.31

**Site photograph 2 Old FTL Lights**



## ENERGY GENERATION OPPORTUNITY BY INSTALLING SOLAR POWER PLANT

It is proposing to install a 2 kWp Solar Grid tied rooftop system to get green energy from solar. Here is the cost benefit analysis of the same.

**Table 8 Solar PV Feasibility**

Parameter	UoM	Value
Present Energy consumption	kWh/Year	1874
Proposed Solar capacity	kWp	2
Energy savings Potential	kWh/Year	1874
Monetary Energy Savings Potential	Rs./Year	16867
Estimated Investment	Rs	93705
Simple Payback Period	Months	67

**Site photograph 3 Main Electrical Meter Incomer Installation**



**Site photograph 4 Solar Campus outdoor lights- good practice**



## WATER AUDIT

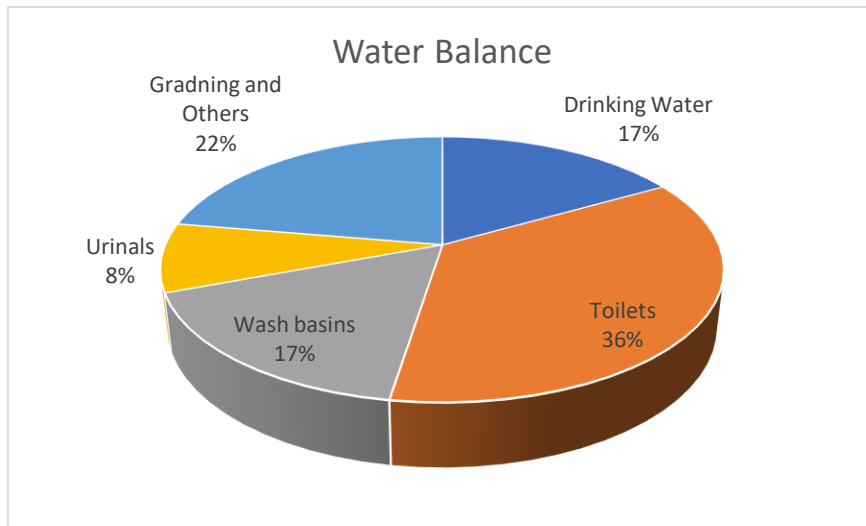
Campus Consuming around 5m<sup>3</sup>/day water.

## WATER BALANCE

Table 9 Water Balance

Consumption	Liters/Day
Drinking Water	752
Toilets	1600
Wash basins	752
Urinals	376
Gardening and Others	1000
<b>Total</b>	<b>4480</b>

Chart 2 Water Balance



The major water is got by toilets.

Site photograph 5 Water Storage Open Tank in Campus



## WATER CONSERVATION OPPORTUNITIES

### WATER SAVING OPPORTUNITY BY CONVENTIONAL TAP REPLACEMENT WITH NEW EFFICIENT TAPS

Conventional water taps consume more water than the new water efficient taps, it is recommending replacing conventional taps with new taps.

Here are the savings calculations.

**Table 10 Water conservation opportunities by replacing taps.**

Parameter	UoM	Value
Present TAP Water Consumption	Liters/Day	752
Proposed Water consumption	Liters/Day	225.6
Savings potential	Liters/Day	526.4
Savings potential	%	70%



Normal Tap



Water Efficient Tap

## WATER SAVING OPPORTUNITIES WITH DUAL FLUSHING TECHNIQUE IN TOILET

Conventional water Flush consume more water than the new water efficient Flushing system, it is recommending replacing conventional Flush with new Double tap system.

Here are the savings calculations.

**Table 11 Water conservation opportunity by replacing flush with dual flush system.**

Parameter	UoM	Value
Present Toilet Water Consumption	Liters/Day	1600
Proposed Toilet consumption	Liters/Day	800
Savings potential	Liters/Day	800
Savings potential	%	50%

**Site photograph 6 Campus Toilets**



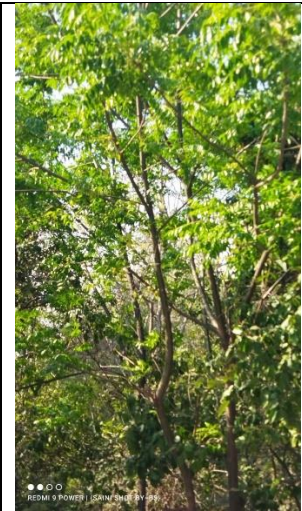
## GREENERY SURVEY

Campus having varieties of plants as its geo location is in hilly and jungle area.

**Table 12 List of Plant species in the campus**

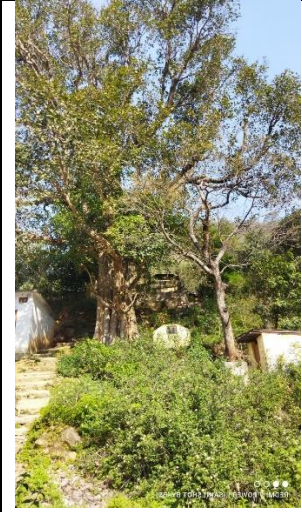
Sr. No.	List of Plant species in the campus
1	Amala
2	Malta
3	Bottle Brush
4	Paiya Padom tree
5	Aranucaria
6	Morhpankhi
7	Kachnar
8	Khair
9	Malltus
10	Shisham
11	Shtoot
12	silver oak
13	Sanden
14	Peach
15	Pipal
16	Daikan

**Table 13 Campus Greenery Survey**

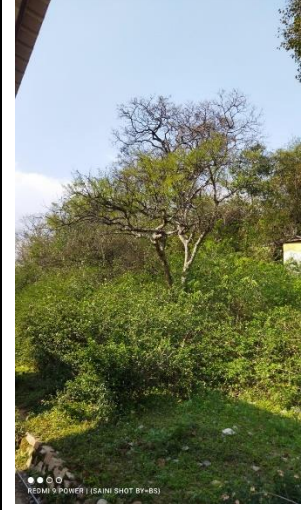
		Campus Plants 01
---	--	------------------



Campus plant 2



Campus plant 3



Campus plant 4



Campus Plant 5



Campus plant 6



Campus plant 7

### **Waste Management:**

1. **Bio Waste** – Mostly Food Waste is generated from the cooked food at the campus in the canteen. It is proposed to install Bio Gas plant in the campus to generate Bio Gas from the food waste, which can be used in the Food Cooking. The Procurement is in process and is installed shortly.
2. **Non-Bio Waste** – Plastic Bottles / Waste Paper / Cardboards/ Batteries etc

Non- biodegradable waste, which cannot be decomposed by biological processes, is called non-biodegradable waste. These are of two types - Recyclable: waste having economic values but destined for disposal can be recovered and reused along with their energy value. e.g. Plastic, paper, old cloth etc. Non-recyclable: waste which do not have economic value of recovery. e.g. Carbon paper, thermo coal, tetra packs etc. Disposal of non-biodegradable waste is a major concern, not just plastic, a variety of waste being accumulated. There are a few ways to help non-biodegradable waste management. The impact of non-biodegradable waste on the environment and also focus on its safe disposal for sustainable environment.

Present Status: Dust bins were provided for the waste disposal the same is collected daily once and handed over the Municipal corporation.

### **3. E Waste Management**

Waste Electrical and Electronic Equipment (WEEE) or E-waste is one of the fastest growing waste streams in the world. In developed countries, it equals 1% of total solid waste on an average. In developing countries, it ranges from 0.01% to 1% of the total municipal solid waste generation. In countries like China and India, though annual generation per capita is less than 1 kg, it is growing at an exponential pace.

Campus admitted a good practice of waste disposal from segregation stage, campus having dedicated bin to collect the dry, wet and electronics waste.

**Table 14 Waste Disposal Practice in the Campus**



There are multiple waste bins with Dry, Wet and electronic waste tags



Wet/Organic Waste Bin at building floor



Dry/Paper and Electronic Waste bins in the campus



Green Campus Initiative by college- Good Practice

CARBON ACCOUNTING / FOOT PRINT

Emission Source	Quantity	CO2 Emission Factor	total Emission per Day (kg)
Teaching and Non-teaching	55	700 gram/person/day	38.5
Two Wheelers	25	5 gram/km	3.1
Students	732	700 gram/person/day	512.4
Four-Wheeler	10	130 gram/km	32.5
Electricity Consumer	5.1345	800 gram/kWh	4.1
<b>Total kg/Day</b>			<b>590.6</b>

Note: Assume each member travel 25 kms to college and 25 kms return to home.

Mode of Transit	CO <sub>2</sub> released (per km driven per person)	CO <sub>2</sub> released during production of vehicle
Car	271 g	313 g
Bus	101 g	---
Bicycle	16 g (This is from the fuel of the rider – food)	16 g

	Pounds CO <sub>2</sub>	Kilograms CO <sub>2</sub>	Pounds CO <sub>2</sub>	Kilograms CO <sub>2</sub>
Carbon Dioxide (CO <sub>2</sub> ) Factors:	Per Unit of Volume or Mass	Volume or Mass	Million Btu	Million Btu
<b>FOR HOMES AND BUSINESSES</b>				
Propane	12.70/gallon	5.76/gallon	139.05	63.07
Butane	14.80/gallon	6.71/gallon	143.2	64.95
Butane/Propane Mix	13.70/gallon	6.21/gallon	141.12	64.01
Home Heating and Diesel Fuel (Distillate)	22.40/gallon	10.16/gallon	161.3	73.16
Kerosene	21.50/gallon	9.75/gallon	159.4	72.3
Coal (All types)	4,631.50/short ton	2,100.82/short ton	210.2	95.35
Natural Gas	117.10/thousand cubic feet	53.12/thousand cubic feet	117	53.07
Gasoline	19.60/gallon	8.89/gallon	157.2	71.3
Residual Heating Fuel (Businesses only)	26.00/gallon	11.79/gallon	173.7	78.79
<b>OTHER TRANSPORTATION FUELS</b>				
Jet Fuel	21.10/gallon	9.57/gallon	156.3	70.9
Aviation Gas	18.40/gallon	8.35/gallon	152.6	69.2
<b>INDUSTRIAL FUELS AND OTHERS NOT LISTED ABOVE</b>				
Flared natural gas	120.70/thousand cubic feet	54.75/thousand cubic feet	120.6	54.7
Petroleum coke	32.40/gallon	14.70/gallon	225.1	102.1
Other petroleum & miscellaneous	22.09/gallon	10.02/gallon	160.1	72.62
<b>NONFUEL USES</b>				
Asphalt and Road Oil	26.34/gallon	11.95/gallon	166.7	75.61

Lubricants	23.62/gallon	10.72/gallon	163.6	74.21
Petrochemical Feedstocks	24.74/gallon	11.22/gallon	156.6	71.03
Special Naphthas (solvents)	20.05/gallon	9.10/gallon	160.5	72.8
Waxes	21.11/gallon	9.57/gallon	160.1	72.62
<b>COAL BY TYPE</b>				
Anthracite	5,685.00/short ton	2,578.68/short ton	228.6	103.7
Bituminous	4,931.30/short ton	2,236.80/short ton	205.7	93.3
Subbituminous	3,715.90/short ton	1,685.51/short ton	214.3	97.2
Lignite	2,791.60/short ton	1,266.25/short ton	215.4	97.7
Coke	6,239.68/short ton	2,830.27/short ton	251.6	114.12
<b>OTHER FUELS</b>				
Geothermal (average all generation)	NA	NA	16.99	7.71
Municipal Solid Waste	5,771.00/short ton	2,617.68/short ton	91.9	41.69
Tire-derived fuel	6,160.00/short ton	2,794.13/short ton	189.54	85.97
Waste oil	924.0/barrel	419.12/barrel	210	95.25
Source: U.S. Energy Information Administration estimates.				
Note: To convert to carbon equivalents multiply by 12/44. Coefficients may vary slightly with estimation method and across time.				
Carbon Dioxide Emissions Coefficients by Fuel				
Detailed factors (discontinued)				

Site photograph 7 Power back up and Fire Extinguishers at right place- good Practice



Site photograph 8 Clean and Cool Drinking Water





Report Compiled By:  
Energy Audit Team,  
M/s. Navy Blue Resources Integration and Solutions Pvt Ltd.  
B-46- 1<sup>st</sup> Floor MIDC- Airoli Navi Mumbai-400708  
[www.nbri.in](http://www.nbri.in) | [sales@nbri.in](mailto:sales@nbri.in) | +91-9764047776.

