Energy Audit Report

Kristu Jayanti College Autonomous, Bengaluru

PREPARED BY

NISARGA

eco CONSULTANTS

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ENERGY AUDIT REPORT

KRISTU JAYANTI COLLEGE AUTONOMOUS, BENGALURU

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CERTIFICATE
ENERGY AUDIT

Kristu Jayanti College Autonomous, Bengaluru

Our team of Environmental Engineers have analyzed Clean and Green Energy practices followed by the Institution during the period of 2023 to 2024.

This certificate was awarded by:

NISARGA ECO CONSULTANTS

NISARGA eco CONSULTANTS

PRADEEP NV

Environmental Engineer

AUDIT PERIOD: 2023 - 2024

NISARGA ECO CONSULTANTS * BELAGAVI *

ISO 9001:2015 CERTIFICATE NO. E20240510204
ISO 14001:2015 CERTIFICATE NO. E20240510205
ISO 17020:2012 CERTIFICATE NO. UQ-2024050701

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Acknowledgement

We express our gratitude for calling upon us for this audit, mainly the Kristu Jayanti College Management, Professor and Director Rev. Fr. Dr. Augustine George who was the driving force behind this work. Green Audit Committee members, Green Audit Committee and all the team members, who were ever helpful and supported us with all the inputs needed for this audit. We thank all the teaching, non-teaching and students for helping us in conducting this audit.

Green Audit Team

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About the Institute

Kristu Jayanti College, founded in 1999, is managed by "BODHI NIKETAN TRUST", formed by the members of St. Joseph Province of the Carmelites of Mary Immaculate (CMI).

The College is affiliated to Bengaluru North University and is reaccredited with grade 'A++' in 2021 by NAAC in the Third Cycle of Accreditation. The college is recognized by UGC under the category 2(f) & 12(B). The College has been accorded Autonomous Status since 2013 by the University Grants Commission, the Government of Karnataka & Bangalore University.

In the NIRF 2024, Our College has been ranked 60th place in the top 100 colleges in the country. The programmes of School of Management are internationally accredited by the Accreditation Council for Business Schools and Programs [ACBSP, USA]. The college was accorded 'DBT Star College status under the strengthening component' by the Department of Biotechnology, the Ministry of Science & Technology and the Government of India. The institution received first prize at the National Level for 'Clean and Smart Campus Award' from Shri. Dharmendra Pradhan, Minister of Education, Govt. of India.

In the India Today - MDRA survey 2024, Kristu Jayanti College, Bengaluru is consecutively ranked as the Best Emerging College of the Century at National Level for Commerce, Science, Arts and Social Work. At the National level, the survey ranked the college as 4th Best in BCA, 12th Best in MSW, and 20th Best in BBA, 21st Best in Commerce and Arts, 26th Best in Mass Communication, 28th Best in Science Programmes. The College is ranked as 2nd Best in MSW, 3rd Best in BCA and Commerce, 4th Best in Arts and Science, 5th Best in Mass Communication and 6th Best in BBA programmes among the colleges in Bengaluru.

Vision

'Light and Prosperity': To provide intellectual and moral leadership by igniting the minds of youth to realize their potential and make positive contributions leading to prosperity of the society and the nation at large.

Mission

To provide educational opportunities to all aspiring youth to excel in life by nurturing academic excellence, fostering values, creating civic responsibility, inculcating environmental concern and building global competencies in a dynamic environment.

Introduction to Energy Audit

An energy audit serves as a diagnostic tool to understand the energy flow within an organization. For educational institutions, which operate diverse facilities such as classrooms, laboratories, libraries, hostels, and cafeterias, energy demands are significant. An energy audit helps to systematically identify inefficiencies and propose cost-effective solutions. The audit process includes data collection, energy flow analysis, and the identification of energy-saving opportunities.

Phases of Energy Audit:

1. Preliminary Audit: Focuses on identifying major energy-consuming equipment and potential savings.
2. Detailed Audit: Involves in-depth analysis, measurements, and implementation strategies.

Need for Energy Auditing

Energy audits are essential for:

- Monitoring Energy Use: To understand consumption patterns and detect anomalies.
- Enhancing Operational Efficiency: By identifying outdated or inefficient systems.
- Reducing Carbon Footprint: Supporting the institution's commitment to sustainability.
- Improving Financial Management: By reducing energy-related expenses.
- Complying with Energy Standards: Adhering to national and international benchmarks for energy use in educational buildings.

Goals of Energy Audit

1. Energy Consumption Mapping: Track energy consumption across different facilities like classrooms, laboratories, hostels, and administrative blocks.
2. Detecting Inefficiencies: Identify systems or practices contributing to excessive energy use.
3. Renewable Integration: Evaluate potential for renewable energy adoption, like solar panels.
4. Stakeholder Engagement: Include staff and students in energy-saving initiatives.

Objectives of Energy Audit

1. Analyze Consumption Data: Detailed evaluation of energy bills, meter readings, and equipment usage.
2. Benchmark Performance: Compare institutional energy consumption with similar institutions or established norms.
3. Identify Conservation Opportunities: Propose upgrades like LED lighting, solar energy, and efficient HVAC systems.
4. Educate and Involve: Create awareness among students, faculty, and administrative staff about energy conservation.

Benefits of Energy Audit

1. Cost Optimization: Reduced electricity bills through strategic interventions.
2. System Longevity: Prolonging the life of equipment by maintaining optimal operation.
3. Regulatory Compliance: Ensuring adherence to government regulations on energy usage and environmental impact.

4. Behavioral Change: Instilling a culture of energy awareness among the institution's stakeholders.
5. Reputation Building: Gaining recognition for adopting green and sustainable practices.

Executive Summary of Energy Audit

The energy audit at the institution evaluated consumption patterns across its facilities, identified inefficiencies, and proposed interventions.

Key Findings:

1. Lighting Systems:
    - Current State: Conventional lighting (fluorescent/incandescent) is prevalent.
    - Recommendation: Transition to LED lighting for classrooms, libraries, and corridors, which could save up to 40% on lighting costs.
2. Air Conditioning and Ventilation:
    - Current State: Over-reliance on older HVAC systems leading to energy wastage.
    - Recommendation: Implement energy-efficient systems with programmable thermostats. Regular maintenance to optimize performance.
3. IT Equipment and Appliances:
    - Current State: Many computers, printers, and other appliances are left in standby mode.
    - Recommendation: Install automatic power management systems to cut energy wastage.
4. Renewable Energy Potential:
    - Current State: No utilization of renewable energy sources.
    - Recommendation: Install rooftop solar panels to supplement energy needs, potentially offsetting 20–30% of total consumption.

5. Water Heating:
    - Current State: High energy consumption for water heating in hostels.
    - Recommendation: Replace electric heaters with solar water heating systems.
6. Behavioral Practices:
    - Current State: Limited awareness about energy-saving habits.
    - Recommendation: Conduct workshops and campaigns to promote energy-conscious behaviors.

Projected Benefits:

- Cost Savings: Potential annual savings of 20–30% on energy costs.
- Environmental Impact: Reduction of the institution's carbon footprint by approximately 15–20%.
- Enhanced Infrastructure Efficiency: Reliable and energy-efficient systems leading to reduced maintenance costs.

Action Plan:

1. Conduct stakeholder meetings to discuss findings and recommendations.
2. Allocate a budget for priority interventions.
3. Implement changes in phases, starting with no-cost/low-cost options.
4. Monitor and evaluate improvements with periodic reviews.

Infrastructure and college details

- The college has sufficient infrastructure for curricular and co-curricular activities.
- Rooms - Classrooms, auditorium, library, department rooms, staffrooms, all labs, ladies' room etc.
- Sufficient reading materials for students.
- Administrative office, principal chamber, office room and department rooms are well located and ventilated.
- Borewell, Underground and overhead water tanks.
- Computers: 1253 desktops with internet facilities in office, principal chamber, department rooms and library with high-speed internet connectivity (400 MBPS).
- The institution is in area of 184735 sq. mt. and has a built-up area of 74702.2 sq. mt.
- Classrooms and staff rooms in the institute are 188 and 33 respectively.
- There are 59 lab with all the facilities and are well ventilated.
- There are a total of 32 halls (Auditoria, seminar halls, conference halls, conclave halls, plenary hall, senate etc.) with sufficient facilities.
- The campus has sports, yoga, gym rooms.

Energy Audit Details

Energy Audit:

Energy Audit is an important aspect in institutions. Saving of electric power is a major part to minimize the greenhouse gas emissions to the environment. This can be achieved by using 5-star electrical appliances. Renewable energy can be harvested and be used in the campus.

Observations:

- Solar rooftop harvesting is being implemented in the campus. This is greater step towards clean and green energy for the campus.
- 200 Solar panel has been installed on roof top of the institution. Energy generated from solar panels is used in college campus. Excess energy from solar panels is supplied to the grid.
- LED bulbs have been used extensively in the campus. Migration to LED tube lights and bulbs has been done in order to save electrical energy.
- Day light (Natural light) is the main source in the classrooms, staffrooms, and library and so on. Infrastructure is very well planned to harness maximum natural light in all the places.
- Automated sensor lights have been installed in the campus for saving energy.

Recommendations:

- Best practices have already been implemented in the institution for optimum use of energy.
- More Labels, poster regarding energy saving can been put in the classrooms.

Table No. 1: Basic information regarding power supply and its management

Sl. No.	**Parameters**	**Response**
1.	Source of electricity. HESCOM/Solar panels	BESCOM/Solar
2.	If Solar, Type of Solar system (On Grid/Off Grid/Hybrid)	On grid
3.	No. of Solar Panels	200 panels
4.	Capacity of Solar Panels	250 W
5.	Solar Power Specifications (Area covered/Solar plant Capacity/year of installation etc.)	Tata power solar 50 kWP and 10 kWP 30.01.2016
6.	Transformer Capacity	500 kVA, 11kV / 433 V. ONAN
7.	Capacity of back generators	200 kVA, 125 kVA and 250 kWA
8.	Contract Demand	500 kVA
9.	Power factor correction	70 kVAR capacitor
10.	Type of connection	HT2C2

Solar Radiation over Bengaluru

Monthly Average Daily Solar Radiation over Bengaluru, Karnataka refers to the amount of solar energy received per square meter of horizontal surface, averaged daily over a month. This parameter is crucial in understanding the solar potential of a location for applications like solar power generation, heating, and other solar-based technologies.

Solar Radiation:

It is the energy emitted by the sun in the form of electromagnetic waves. Solar radiation reaching the Earth's surface is measured in kilowatt-hours per square meter per day ($kWh/m^2/day$).

Monthly Average Daily Solar Radiation:

It represents the daily solar energy averaged over the days of a particular month. This value accounts for the variations in solar radiation due to factors such as cloud cover, atmospheric conditions, and seasonal changes.

Importance of Bengaluru's Solar Profile:

Located at approximately 12.97°N latitude, Bengaluru experiences a tropical savanna climate. Its geographic position offers significant potential for harnessing solar energy, making it an attractive location for solar installations.

Factors Affecting Solar Radiation in Bengaluru

Latitude:

Bengaluru's location near the equator ensures a relatively high amount of solar radiation throughout the year.

Seasonal Variations:

Solar radiation peaks during summer (March-May) due to longer daylight hours and minimal cloud cover.

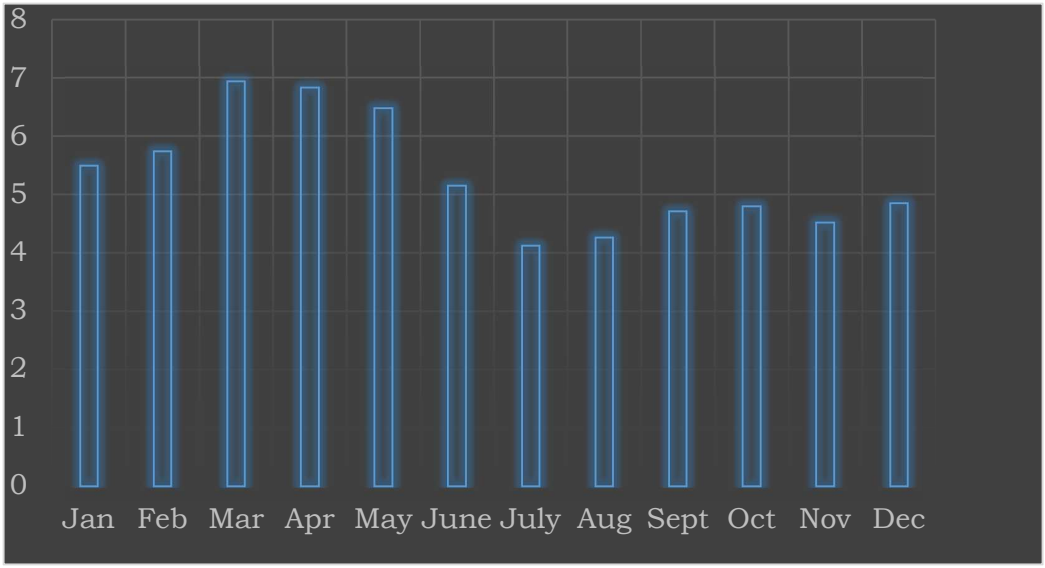
Monsoon months (June-September) witness reduced radiation due to dense cloud cover and frequent rainfall.

Atmospheric Conditions:

Air pollution, haze, and cloud density can reduce the amount of solar radiation reaching the surface.

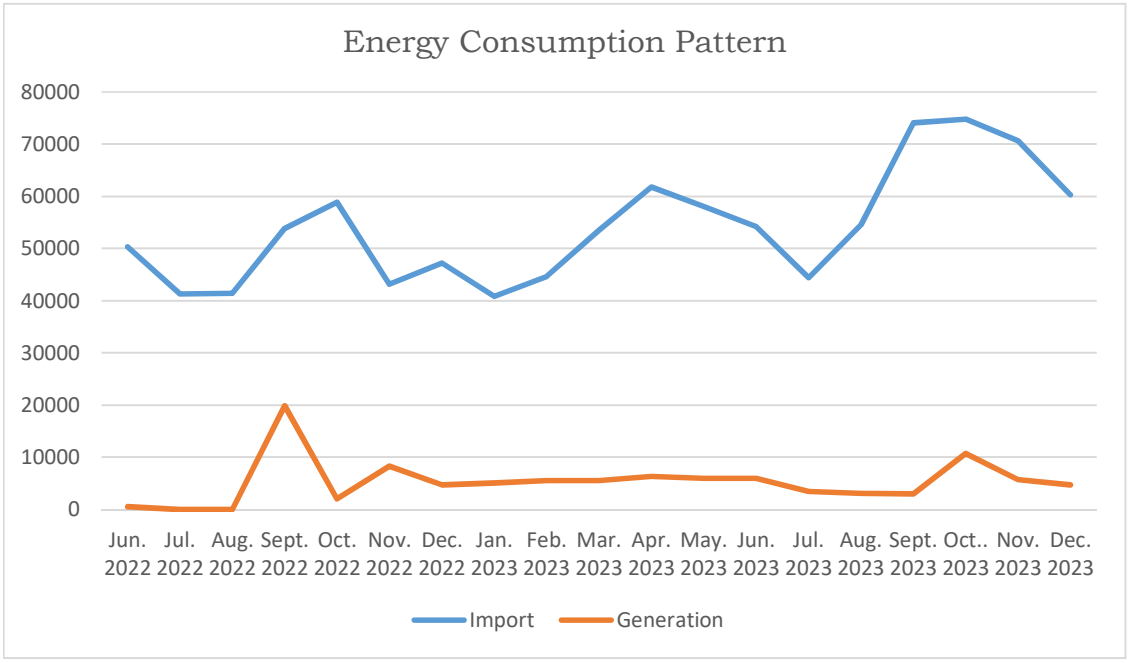
Typical Solar Radiation Values for Bengaluru

The average daily solar radiation for Bengaluru varies across the year. Below are approximate monthly values (kWh/m²/day):



Graph No. 1: Monthly average daily solar radiation over Bengaluru, Karnataka

(Ref.: Solar Radiation Resource Assessment, Solar Radiation DPR, Karnataka Renewable Energy Devolvement Ltd.)

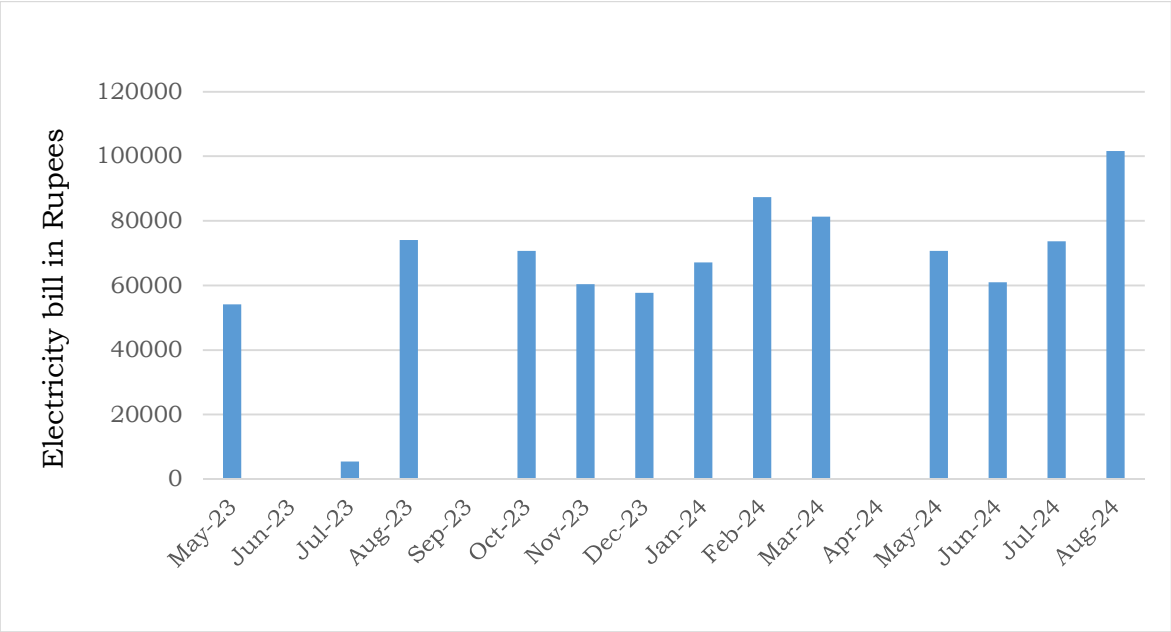


Graph No. 2: Energy Consumption Pattern

The above graph shows the detailed energy consumption patterns. Units imported from the grid and units generated from the institution has been represented above.

Power Consumed by the institution

The power consumption patterns from May 2023 to Aug 2024 has been depicted in the following graph.



Graph No. 3: Details of electricity consumed from May 2023 to Aug 2024

Energy consumption details for the period of June 2022 to Dec. 2023 has been attached in annexure.

The college consumes energy in primarily 5 areas namely Air conditioners, Lighting, Fans, Blower and pumps in STPs and Passenger lift among others. The total connected load is 679.69 KW. The college also has three captive DG sets of 200KVA, 125KVA and 250KVA. UPS with 69% of contract demand is also installed; Two Solar photovoltaic 50KW +10KW is installed in the roof top. It has successfully generated energy of 80700 KWh for 2022.

Power factor and Harmonics

Capacitors installed for the power factor correction is in line with the current demand 70kVAR capacitors are connected to circuit at the output of the transformer. For the present load and demand sufficient capacitive compensation has been provided.

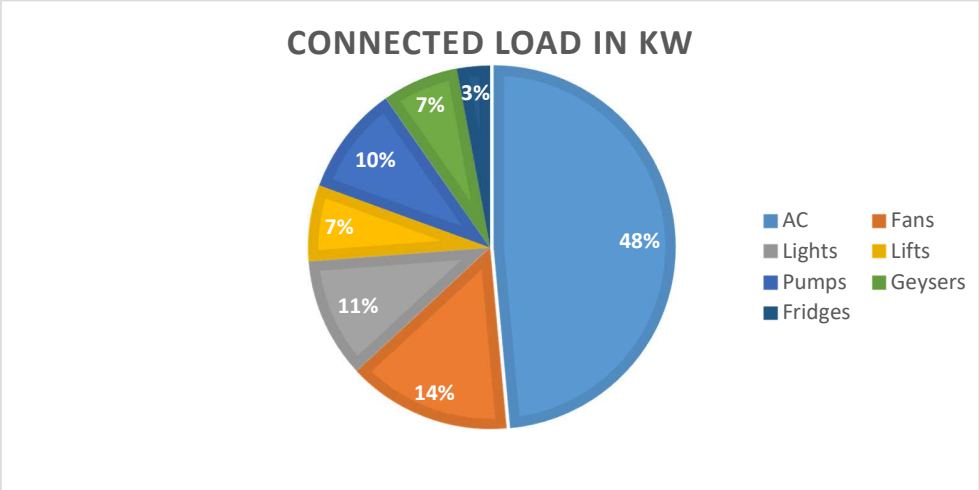
Following harmonics generating loads are connected to the system

1. Uninterruptible power supply units
2. LED Lights
3. Variable frequency drives of Lifts
4. Computers and related loads

The analysis of power factor and harmonics indicate that the institution has implemented adequate capacitive compensation. The Total Harmonics Distortion is less than 5% which is acceptable. The total annual energy consumed per student is 61.23 kWh and per unit area is 4.38 kWh /Sqm, which is appreciable.

Table No. 2: Segregated system with connected loads

Sl. No.	System	Actual Load kW
1	AC	351.65
2	Fans	103.07
3	Lights	78.09
4	Lifts	45.5
5	Pumps	69.38
6	Fridges	3



Graph No. 4: Connected load in KW

Transformer and Electrical Distribution System

The institution receives power from BESCOM grid at 11 kV and steps it down to 440 V using following transformer

Table No. 3: Transformer specifications

Sl. No.	Specification	Details
1	Rates kVA	500
2	Voltage	11,000 / 433
3	Type	ONAN
4	Phase	3
5	% Impedance	5%
6	Oil in Ltrs	400
7	Vector Group	Dyn - 11

The institute has made alternate arrangement during power cuts. Three captive DG sets of 200KVA, 125KVA and 250KVA have been installed and are used based on demand.

Load Analysis

Lighting Load

Table No. 4: Detailed list of lighting loads are presented below

Sl. No.	Particulars	Nos.	Gross W	Load in kW
1	Tube Lights	1000	36	36.00
2	LED Lights	2870	20	57.40
3	CFL Lights	152	22	3.344
4	Street lights	44	31	1.364

Air Conditioners

Table No. 5: Detailed of air conditioners and loads are presented below

Sl. No.	Location	Tonnage	Load in kW
1	Main block	40.5	52.65
2	PG block	119.5	155.35
3	Admin block	82.5	107.25
4	Guest house	28	36.4

Energy savings can be achieved by around 5%-8% by implementing

1. Proper door closures, heat insulation of roof.
2. Switching on the units 30 minutes before occupancy.
3. Periodic maintenance of thermal insulation of refrigerant pipes.
4. Room temperature to be set in the range of 23 – 24 ^{o}C.

Fans

Table No. 6: Detailed list of fans are presented below

Sl. No.	Location	Nos.	Load in kW
1	Main block	531	37.17
2	PG block	247	17.29
3	Admin block	424	29.68
4	Guest house	114	7.98
5	H block	334	23.38
6	Wall mounting fans	280	14.00

Energy savings can be achieved by replacing the regular fans with BLDC technology fans. BLDC fans has 60% power saving potential and payback can be achieved in 7-8 years.

Lifts

Total number of lifts in the campus is 13. Power load of each lift is 3.5 kW. The total load is 45.5 kW. Monthly average power utilization of lift load is about 1000 to 1100 units.

Water Pumps

Water is lifted with the help of electrical pumps in the campus.

Table No. 7: The details of the pumps are as below

Sl. No.	Particulars	Number	Power HP	Total power KW	Operating hours	Total energy
1	Submersible 90 m 550 lpm	4	10	30	3	90
2	Submersible pumps 75 m 450 lmp	5	7.5	28.13	6	168.78
3	Submersible pumps 28 m 80 lpm	3	5	11.25	2	22.5
	Total			69.38		281.28

Energy consumed is about 5500 to 6500 units.

Solar panels have been placed on the rooftop to convert solar energy into electrical energy

Diesel Generator (alternate source) during power cut

Green Protocol posters have been put across campus

Climate clock has been installed displaying temperature rise.

Electronic notice board has been put to display current event and achievements.

Electric vehicle

Electric vehicle charging station

Measurement of PM 1, PM 2.5, PM 10, Light intensity, Noise, EMR, HCOH, TVOC

Power supply room

Students using Institution Bus

The institution offers bus service to the students from various parts of Bangalore. Buses are shuttled around the city and students are picked from various points in the city. The institution bus service is committed to provide better service to the students and also decrease the load on the Environment.

Students using an institution's bus service can offer numerous environmental benefits:

1. Reduced Carbon Footprint: By using a shared transportation service, the carbon emissions per person decrease compared to each student using individual cars. Fewer vehicles on the road mean reduced greenhouse gas emissions, which contribute to global warming.

2. Decreased Air Pollution: Fewer individual vehicles lead to lower levels of air pollutants like nitrogen oxides, carbon monoxide, and particulate matter. This can improve air quality, especially in urban areas.

3. Lower Fuel Consumption: Buses are more fuel-efficient on a per-passenger basis compared to cars. Reduced fuel consumption helps conserve natural resources and decrease reliance on fossil fuels.

4. Reduced Traffic Congestion: With more students using buses, there are fewer cars on the road, which can help alleviate traffic congestion. This can lead to shorter travel times and less idling, further reducing emissions.

5. Minimized Urban Sprawl: By providing efficient transportation options, institutions can discourage the spread of urban sprawl. This leads to more sustainable land use and preservation of green spaces.

6. Enhanced Use of Public Transportation Infrastructure: Encouraging bus use can lead to better utilization and support of existing public transportation infrastructure, promoting a culture of public transit use and potentially leading to improvements and expansions in the system.

7. Promotion of Sustainable Practices: When students regularly use institution-provided buses, it fosters an awareness of and commitment to sustainable transportation practices. This can have a lasting impact on their choices and behaviors beyond their time at the institution.

Overall, the use of institution buses by students plays a significant role in promoting environmental sustainability and mitigating the negative impacts of transportation on the environment.

Annexure – 1

Detailed energy consumption statement by BESCOM

BANGALORE ELECTRICITY SUPPLY COMPANY LIMITED

(Wholly Owned Government of Karnataka Undertaking)

office of the
Assistant Executive Engineer (Ele),
E9 Sub-Division, Nagawara, Bengaluru.

Letter No: AEE/E9SD/AAO/A/ 511

Date: 28/05/2024

: DETAILED ENERGY CONSUMPTION STATEMENT :

RR NO- SRTPVE8HT3, NAME-THE PRINCIPAL , KRISTU JAYANTI COLLEGE CMI ASHRAM.KOTHANUR POST K.NARAYANAPURA, BANGALORE-77

SL	BILLING MONTH	TARIFF	CD (KVA)	IMPORT READING					EXPORT READING					NET IMPORT CONSUMPTION	GENERATION READING				
				PRESENT READING	PREVIOUS READING	DIFF	CONSTANT	CONSUMPTION	PRESENT READING	PREVIOUS READING	DIFF	CONSTANT	CONSUMPTION		PRESENT READING	PREVIOUS READING	DIFF	CONSTANT	CONSUMPTION
1	JUNE-2022	HT2C(ii)	480	1413.07	1392.95	20.1	2500	50300	13.79	13.79	0	2500	0	50300	8612	8601	11	50	550
2	JULY-2022	HT2C(ii)	480	1429.58	1413.07	16.5	2500	41275	13.79	13.79	0	2500	0	41275	8612	8612	0	50	0
3	AUG-2022	HT2C(ii)	480	1446.15	1429.58	16.6	2500	41425	13.79	13.79	0	2500	0	41425	8612	8612	0	50	0
4	SEP-2022	HT2C(ii)	480	1467.69	1446.15	21.5	2500	53850	13.79	13.79	0	2500	0	53850	9009	8612	397	50	19850
5	OCT-2022	HT2C(ii)	480	1491.24	1467.69	23.6	2500	58875	13.79	13.79	0	2500	0	58875	9050	9009	41	50	2050
6	NOV-2022	HT2C(ii)	480	1508.5	1491.24	17.3	2500	43150	13.79	13.79	0	2500	0	43150	9216	9050	166	50	8300
7	DEC-2022	HT2C(ii)	480	1527.39	1508.5	18.9	2500	47225	13.79	13.79	0	2500	0	47225	9310	9216	94	50	4700
8	JAN-2023	HT2C(ii)	480	1543.73	1527.39	16.3	2500	40850	13.79	13.79	0	2500	0	40850	9412	9310	102	50	5100
9	FEB-2023	HT2C(ii)	480	1561.59	1543.73	17.9	2500	44650	13.79	13.79	0	2500	0	44650	9523	9412	111	50	5550
10	MAR-2023	HT2C(ii)	480	1582.98	1561.59	21.4	2500	53475	13.79	13.79	0	2500	0	53475	9634	9523	111	50	5550
11	APR-2023	HT2C(ii)	480	1607.68	1582.98	24.7	2500	61750	13.79	13.79	0	2500	0	61750	9761	9634	127	50	6350
12	MAY-2023	HT2C(ii)	480	1630.92	1607.68	23.2	2500	58100	13.79	13.79	0	2500	0	58100	9880	9761	119	50	5950
13	JUNE-2023	HT2C(ii)	480	1652.6	1630.92	21.7	2500	54200	13.79	13.79	0	2500	0	54200	9999	9880	119	50	5950

SL	BILLING MONTH	TARIFF	CD (KVA)	IMPORT READING					EXPORT READING					NET IMPORT CONSUMPTION	GENERATION READING				
				PRESENT READING	PREVIOUS READING	DIFF	CONSTANT	CONSUMPTION	PRESENT READING	PREVIOUS READING	DIFF	CONSTANT	CONSUMPTION		PRESENT READING	PREVIOUS READING	DIFF	CONSTANT	CONSUMPTION
14	JULY-2023	HT2C(ii)	480	1670.37	1652.6	17.8	2500	44425	13.79	13.79	0	2500	0	44425	10068	9999	69	50	3450
15	AUG-2023	HT2C(ii)	480	1692.18	1670.37	21.8	2500	54525	13.79	13.79	0	2500	0	54525	10130	10068	62	50	3100
16	SEP-2023	HT2C(ii)	480	1721.8	1692.18	29.6	2500	74050	13.79	13.79	0	2500	0	74050	10190	10130	60	50	3000
17	OCT-2023	HT2C(ii)	480	1751.72	1721.8	29.9	2500	74800	13.79	13.79	0	2500	0	74800	10405	10190	215	50	10750
18	NOV-2023	HT2C(ii)	480	1779.97	1751.72	28.3	2500	70625	13.79	13.79	0	2500	0	70625	10520	10405	115	50	5750
19	DEC-2023	HT2C(ii)	480	1804.09	1779.97	24.1	2500	60300	13.79	13.79	0	2500	0	60300	10614	10520	94	50	4700

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DISCLAIMER

The audit team has prepared this report for Kristu Jayanti College Autonomous, Bengaluru based on the input data provided by the Kristu Jayanti College Autonomous representatives, supplemented by the expert team's best judgment.

While every effort has been made to ensure accuracy, the details in this report have been compiled in good faith based on the information gathered. The recommendations are made using our best judgment; however, no representation, warranty, or undertaking, express or implied, is made. The audit team accepts no responsibility for any direct or consequential loss arising from the use of the information, statements, or forecasts in this report.

For NISARGA ECO CONSULTANTS

PROPRIETOR

NISARGA ECO CONSULTANTS * BELAGAVI *