GREEN AUDIT

REPORT 2021-22

of

NETAJI NAGAR DAY COLLEGE

Members of the Green Audit Committee of Netaji Nagar Day College:

1. Dr.Sonali Banerjee Jash, Principal
2. Dr. Krishna Gangopadhyay (IQAC coordinator)
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Members of the Green Audit Team of Nandi Resources Generation Technology Pvt. Ltd.

1. Dr. Paritosh Nandi
2. Atish Ranjan Sen
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Green Energy Audit key steps:

• Planning completed	6th September, 2022
• Field work completed	14th November, 2022
• Draft report completed and sent for management response	27th November, 2022
• Management response received	4th December, 2022
• Final report completed	9th December, 2022
• Report presented to the Management	13th December, 2022

Certificate by Auditor

This is to certify that Green Audit work of Netaji Nagar Day College for the period 2021-22 was assigned to us. During this period following activities have been audited by us:

- Fundamentals of Energy Audit
- Load hour Calculations
- Measurement of Installed Capacity
- Energy Conservations
- Rain Water Harvesting
- Potential of harnessing Renewable Energy sources
- Wastes Recycling
- Efforts for carbon neutrality
- E-wastes Managements
- Plantations and gardening
- Minimum use of paper,plastics etc

Nandi Resources Generation Technology Pvt. Ltd.
Paritosh Nandi
Director

Dr. Paritosh Nandi
Director

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Certificate by Principal

Our Green Audit Committee along with Certified Energy Auditor from Nandi Resources Generation Technology Pvt. Ltd. appointed by us has done a commendable work in framing out a green policy in our college. We strive to comply with Energy Conservation Act 2001 and other relevant standards, such as ISO 14001, Green Audit Framework etc.

I hereby accept all the recommendations and observations mentioned in the Green Audit Report and undertake to implement the same.

Dr. Sonali Banerjee Jash
Principal
Netaji Nagar Day College

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Regent Estate, Kolkata-700 092

PRELUDE

Green Audit team of Netaji Nagar Day College conducted a green audit of the college in 2022 in consultation with Kolkata based Nandi Resources Generation Technology Private Limited. The company is promoted by Certified Energy Auditors by Ministry Power, Government of India. The objective of the Green Audit is to ensure that the carbon and water foot prints are optimised in line with the environmental sustainability as mandated by National Accreditation Council. The objectives of the audit were to evaluate the adequacy of the management control framework of Environment Sustainability as well as the degree to which the Departments are in compliance with the applicable regulations, policies and standards. In order to assess on the carbon footprint issue, a detailed energy audit was conducted to determine how and where energy is used and to identify methods for energy savings. There is now a universal recognition of the fact that new technologies and much greater use of some that already exist provide the most hopeful prospects for the future. The opportunities lie in the use of existing renewable energy technologies, greater efforts at energy efficiency and the dissemination of these technologies and options. Considerations of efficiency, accountability, transparency and ethics are important in both the public and private sector. However, it is arguable that they are more so in the public sector and government, as their primary purpose is to promote the public good. Public assets of the whole society, including natural and social goods, are entrusted to the state and, therefore, the need to protect them in the long term is more pressing than for businesses which have a more limited responsibility to their shareholders. Governments are responsible for the outcomes for society in general, as well as their own direct policy or organisational impacts on them. For these reasons, existing sustainability reporting frameworks for the private sector are not adequate to the needs of the public sector or national government. There are certainly lessons to be learnt, but these are not one-way. Sustainability reporting in any sector should also draw on the planning, monitoring and reporting frameworks in the private sector to understand where and how elements of sustainability are already addressed, perhaps under a different name and, hence, where the gaps may be. Measurement Sustainability planning, action and reporting have grown greatly in recent years. Environmental sustainability has received the most attention as there is growing evidence of an urgent need for change in this area. But there is also general consensus that environmental sustainability cannot be achieved except in tandem with social and economic change. The measurement of environmental sustainability in isolation, then, does not seem sufficient. Greater attention needs to be paid to understanding how other elements of sustainability could also be measured, in order to ensure they also receive action and attention. This measurement could be, but does not necessarily need to be, in financial terms.

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1. Introduction

Mission and Vision of Netajinagar Day College

- VISION

The vision of the College is to be a leading College in Kolkata, providing a well-resourced strongly academic, holistic education to boys and girls in such a way that it will create an environment, “Where the mind is without fear, the head is held high and knowledge is free”.

- MISSION

• It offers equal opportunity of access to all.
• A differentiated approach to teaching that encourages all students to participate fully in the process of learning.
• It encourages and motivates students to achieve their full potential whilst recognizing and commenting their efforts, achievements and success.
• A safe and caring environment is to be provided that will promote interaction between the three sections of the academic community such as Students, Teachers and Non-teaching employees.
• A value based system of education is provided so that students will participate in all such co-curricular activities which will improve their health and mind and also encourage them to participate in welfare activities having ‘Community Orientation’.

1.1 About the college

The trifurcation of Netaji Nagar College in 1986 gave birth to Netaji Nagar Day College. It is a Government aided institution affiliated to the University of Calcutta. Though primarily an undergraduate institution offering Honours and General courses in Science, Humanities and Commerce streams, the college also offers a Post Graduate course in commerce since 2006.

The college has a rich tradition of excelling in sports and games and in outreach activities. The overall atmosphere in the campus is conducive to the active participation of young learners in curricular, co-curricular and extra-curricular activities throughout the year.

Netaji Nagar Day College has been accredited by the National Assessment and Accreditation Council (NAAC) with B++ grade in 2017 in second cycle accreditation.

1.2 Objective of Green Audit

Energy Audit is aimed at obtaining a detailed idea about the various end use energy consumption activities and identifying, enumerating and evaluating the possible energy savings opportunities.The green audit practically involves use of renewable sources, conservation of the energy, rain water harvesting program, and efforts of carbon neutrality, plantation of trees, E-waste management and hazardous waste management.The target of Green Audit is to achieve savings in the electrical energy consumption to the extent of 20%. For the college this Green Audit assumes all the more significance due to the fact that its combined electricity bill was Rs. 3.81 lakh during the year 2019-20. The Green Audit was also aimed at giving the students a feel of the practical problems and difficulties in carrying out audit activities.

The objective of the Green Audit is emphatically embodied in the vision statement of the college which states thatthe College aspires to be a leading college in Kolkata, providing a well-resourced, strongly academic, holistic education to boys and girls in such a way that it will create an environment “where the mind is without fear, the head is held high and knowledge is free”.

1.3 Green Building: A global development

Green Building is a structure that is efficient in resources throughout its life cycle which are designed to lessen down the overall impact of the built environment on the natral environment and human health. They are also known as high performance building or sustainable building. Green Building’s main objective:-

- Energy Efficiency
- Structure Efficiency
- Water Efficiency
- Material Efficiency
- Waste and Reduction

Shortly a Green Building is that which uses less water, conserve natural resources, produces less water, uses eco-friendly ways, optimization of energy efficiency and by doing all these providing healthier space for living for the occupants in comparison with conventional building.

GBC or Green Building Council is an umbrella organisation for all the developing, existing and growing GBCs around the world. GBC is a non-governmental, non-profit, national organization that is a part of global network recognized by the World Green Building Council. GBC's goal is to form buildings, towns and cities which are sensitive to environment, economically feasible, culturally just and socially just. Green buildings around the- at least 19 nations has established GBCs, 7 recognized as growing members and many more is in the process of development. The 19 established councils are:-

- Argentina Green Building Council
- Green Building Council of Australia
- Green Building Council Brazil
- Peru Green Building Council
- Canada Green Building Council
- Dutch Green Building Council
- Emirates Green Building Council
- France Green Building Council
- German Sustainable Building Council
- Indian Green Building Council
- Italy Green Building Council
- Japan Green Building Consortium
- Korea Green Building Council
- Mexico Green Building Council
- New Zealand Green Building Council
- Pakistan Green Building Council
- Green Building Council of South Africa
- Sweden Green Building Council
- Taiwan Green Building Council

- Romania Green Building Council
- United Kingdom Green Building Council
- U.S. Green Building Council
- Vietnam Green Building Council

1.4 Netaji Nagar Day College Energy Scenario

The energy consumption on campus is mainly in the form of electricity, apart from the use of LPG as cooking fuel in the college canteen. The college campus has a connected electrical load of 94 kW as on December 2022 and a contract demand of 45.6 kVA. The Electricity meter details along with contract demand and connected load for the year 2021-22 is given in Fig.1.

Building	Consumer ID.	Meter No.	Connected Load (kW)	Demand (kW)
Main building	85000009568	3305506 01	28	45.6
New building			65	
New building (Computer center)	08000474314	--	--	--

Fig 1: Campus Meter details with demand and connected load

- The college has one 15 kVA DG set for emergency uses

1.5 Specific Energy Consumption (SEC)

The Specific Energy Consumption (SEC) is defined as the energy consumption per unit of product output. The specific energy consumption considering students, faculty and staff members were calculated which forms the college SEC and was taken as reference for comparison. The SEC was calculated to be annual energy cost /person (for 2021-2022) for the academic area and Rs. 149.00 per person per annum.

1.6 Segmentation

This energy audit report has segmented the energy consumption patterns both by building/ offices and by end use activities (lighting, cooling and pumping etc.). The details are provided in the subsequent chapters.

2. Energy Audit

2.1 Energy Audit Methodology

The methodology adopted for this audit was

- Visual inspection and data collection
- Observations on the general condition of the facility and equipment and quantification
- Identification / verification of energy consumption and other parameters by measurements
- Detailed calculations and analyses
- Validation
- Potential energy saving opportunities
- Recommendation

2.1.1 Data Collection

For suggesting any corrective measures to reduce power consumption, it is first necessary toknow the power consumption pattern in detail. For this, the exhaustive data collection exercisewas performed at all the departments, controller of section and other supporting entitiessuch as library, computer lab etc.

Following steps were taken for data collection:

- The audit team went to each department, laboratories, library etc.

- Information about the general electrical appliances was collected from its manual or nameplate sticker.
- Load hour calculation was done by interview of the Head of the Departments and the very experienced staff who have been working for decade a or so.
- The power consumption of appliances was measured using power analyzer when there is nothing visible from the nameplate.
- Light intensity was measured using Lux meter at the college classrooms, computer lab, library and the other departmental laboratories.
- External electrical insulation was measured with Infrared Thermometer.
- Air-conditioners and their insulation was checked with visual inspection.
- Quality of power is measured with Power Analyser.

2.2 Primary Data Building-Wise

Main Building

Room Name or No.	Floor	Instrument Name	Nos	Rating (W)	Total Load (kW)	Uses time (hr)	kW h
Office Room (MB 5)	G. Floor	Tube Light	21	40	0.84	7	5.88
		CFL light	3	18	0.054	7	0.378
		Ceiling Fan	11	75	0.825	7	5.775
		LED Desktop	5	200	1	7	7
		Printer	3	250	0.75	3	2.25
		Xerox Machine	1	1100	1.1	2	2.2
		CCTV	2	12	0.024	24	0.576
		Water filter	1	45	0.045	7	0.315
Office Toilet		Blub	1	60	0.06	7	0.42
Class Room (MB 1)	G. Floor	Tube light	27	40	1.08	7	7.56

		Ceiling Fan	14	75	1.05	7	7.35
Boys Common Room (MB 2)	G. Floor	Tube Light	11	40	0.44	7	3.08
		Ceiling fan	3	75	0.225	7	1.575
		Avg. Light level	130 lx				
Boys Union Room (MB 3)	G Floor	Tube light	7	40	0.28	7	1.96
		Ceiling fan	5	75	0.375	7	2.625
		LED desktop	1	200	0.2	7	1.4
		Exhaust fan	1	90	0.09	7	0.63
Gents Toilet	G. Floor	Tube light	3	40	0.12	7	0.84
		LED light	3	20	0.06	7	0.42
Generator Room (MB 6)	G. Floor	Tube light	2	40	0.08	7	0.56
		Water pump	2	2000	4	2.5	10
Common area	G. Floor	Tube light	4	40	0.16	10	1.6
		LED blub	1	10	0.01	10	0.1
		LED light	2	20	0.04	10	0.4
		CCTV	2	12	0.024	24	0.576
		Automatic Hand Sanitizer Machine	1	10	0.01	5	0.05
		Water filter with cooler	1	500	0.5	5	2.5

Class room (MB 8)	1st Floor	Tube Light	17	40	0.68	7	4.76
		LED Light	8	20	0.16	7	1.12
		Ceiling Fan	10	75	0.75	7	5.25
		Projector	1	300	0.3	4	1.2
		Sound Box & amplifier	2	50	0.1	5	0.5
ITC Room (MB 9)	1st Floor	LED Light	6	20	0.12	7	0.84
		LED Desktop	5	200	1	7	7
		Ceiling fan	2	75	0.15	7	1.05
		Identity Card Printer	1	30	0.03	2	0.06
		Projector	1	300	0.3	4	1.2
		Lux	240				
Ladies Common Room	1st Floor	Tube Light	6	40	0.24	7	1.68
		LED Light	1	20	0.02	7	0.14
		Ceiling Fan	2	75	0.15	7	1.05
Ladies Toilet		Tube Light	3	40	0.12	7	0.84
		LED Light	2	20	0.04	7	0.28
Common area	1st Floor	Tube Light	5	40	0.2	10	2
		LED blub	2	10	0.02	10	0.2
		CCTV	3	12	0.036	24	0.864
		Water filter with cooler	1	500	0.5	5	2.5
		Water filter	1	45	0.045	5	0.225
		Automatic Hand Sanitizer Machine	1	10	0.01	4	0.04

Teachers Room (MB 20)	2nd Floor	Tube Light	5	40	0.2	7	1.4
		LED Light	6	20	0.12	7	0.84
		Ceiling Fan	6	75	0.45	7	3.15
Teachers Toilet		LED blub	1	10	0.01	7	0.07
Marketing Hons (MB 18)	2nd Floor	Tube light	9	40	0.36	7	2.52
		Ceiling fan	2	75	0.15	7	1.05
Class room (MB 14)	2nd Floor	Tube light	11	40	0.44	7	3.08
		Ceiling fan	6	75	0.45	7	3.15
Common Area	2nd Floor	Tube light	5	40	0.2	10	2
		CCTV	2	12	0.024	24	0.576
		Water filter with cooler	1	500	0.5	5	2.5

Geography Lab (MB 24)	3rd Floor	Tube Light	7	40	0.28	7	1.96
		Ceiling Fan	4	75	0.3	7	2.1
		LED Desktop	6	200	1.2	7	8.4
		Printer	1	250	0.25	3	0.75
Geography Lab 2 (MB 25)	3rd Floor	Tube Light	10	40	0.4	7	2.8
		Ceiling fan	4	75	0.3	7	2.1

Class room (MB 23)	3rd Floor	Tube light	4	40	0.16	7	1.12
		Ceiling Fan	1	75	0.075	7	0.525
Class Room (MB 21)		Tube light	9	40	0.36	7	2.52
		Ceiling fan	6	75	0.45	7	3.15
Class Room (MB 22)		Tube light	1	40	0.04	7	0.28
		LED light	7	20	0.14	7	0.98
		Ceiling fan	4	75	0.3	7	2.1
Co-Operative	3rd Floor	Tube light	1	40	0.04	3	0.12
		Ceiling fan	1	75	0.075	3	0.225
Common Area	3rd Floor	LED blub	2	10	0.02	10	0.2
		CCTV	2	12	0.024	24	0.576
		Water flter with cooler	1	500	0.5	5	2.5

Class room (MB 29)	4th Floor	Tube light	8	40	0.32	7	2.24
		Ceiling fan	3	75	0.225	7	1.575
Class room (MB 27)	4th Floor	Tube light	4	40	0.16	7	1.12
		Ceiling fan	1	75	0.075	7	0.525

Class room (MB 28)	4th Floor	Tube light	12	40	0.48	7	3.36
		Ceiling fan	6	75	0.45	7	3.15
Staff Quarter	4th Floor	Tube light	2	40	0.08	18	1.44
		Ceiling fan	2	75	0.15	18	2.7
Common Area	4th Floor	Tube light	1	40	0.04	10	0.4
		LED light	3	20	0.06	10	0.6
		LED blub	4	10	0.04	10	0.4
		CCTV	2	12	0.024	24	0.576

New Building

Room Name or No.	Floor	Instrument Name	Nos	Rating (W)	Total Load (kW)	Uses time (hr)	kW h
Accounts office	G. Floor	Tube light	5	40	0.2	7	1.4
		Ceiling fan	2	75	0.15	7	1.05
		LED desktop	4	200	0.8	7	5.6
		Printer	4	250	1	3	3
		Exhaust fan	1	90	0.09	7	0.63
		CCTV	1	12	0.012	24	0.288
Office toilet	G. Floor	Tube light	1	40	0.04	7	0.28
		Exhaust fan	1	90	0.09	7	0.63

IQAC office	G. Floor	Tube light	3	40	0.12	7	0.84
		Ceiling fan	2	75	0.15	7	1.05
		Exhaust fan	1	90	0.09	7	0.63
Room (NB 2)	G. Floor	Tube light	4	40	0.16	7	1.12
		Ceiling fan	2	75	0.15	7	1.05
		LED desktop	1	200	0.2	7	1.4
Physics Lab (NB 07)	G. Floor	Tube light	14	40	0.56	7	3.92
		LED light	6	20	0.12	7	0.84
		Ceiling fan	10	75	0.75	7	5.25
		LED desktop	1	200	0.2	7	1.4
		Fridge	1	80	0.08	9	0.72
		Table lamp	7	100	0.7	3	2.1
		Electronics circuit kit	41	18	0.738	4	2.952
		Power supply	4	250	1	4	4
		Oscilloscope	3	250	0.75	4	3
		Function generator	7	40	0.28	4	1.12
		Other lab kit	10	30	0.3	4	1.2
		Exhaust fan	2	90	0.18	7	1.26
Electronics lab (NB 06)	G Floor	LED light	8	20	0.16	7	1.12
		Ceiling fan	4	75	0.3	7	2.1
		LED desktop	8	200	1.6	7	11.2
		Electric kettle	1	1500	1.5	2	3
		Exhaust fan	2	90	0.18	7	1.26
		Electronics circuit kit	19	18	0.342	4	1.368
		Power supply	7	250	1.75	4	7
		Oscilloscope	3	300	0.9	4	3.6
		Function generator	2	40	0.08	4	0.32
		Other lab kit	3	18	0.054	4	0.216

Chemistry lab (Hons) (NB 05)	G Floor	Tube light	6	40	0.24	7	1.68
		LED light	13	20	0.26	7	1.82
		Ceiling fan	2	75	0.15	7	1.05
		Exhaust fan	2	90	0.18	7	1.26
Toilet	G. Floor	Tube light	3	40	0.12	7	0.84
		LED light	7	20	0.14	7	0.98
Computer center building	G. Floor	Tube light	4	40	0.16	7	1.12
		Ceiling fan	1	75	0.075	7	0.525
		Exhaust fan	1	90	0.09	7	0.63
Common area	G. Floor	Tube light	3	40	0.12	10	1.2
		LED light	5	20	0.1	10	1
		LED blub	1	10	0.01	10	0.1
		CCTV	1	12	0.012	24	0.288

CC1 (Computercenter building)	Measuring floor	Tube light	23	40	0.92	7	6.44
		Ceiling fan	10	75	0.75	7	5.25
		Air conditioner	1	1000	1	7	7
		Projector	1	300	0.3	4	1.2

Chemistry lab (Gen.) (NB 21)	1st Floor	Tube light	17	40	0.68	7	4.76
		LED light	5	20	0.1	7	0.7

		Ceiling fan	5	75	0.375	7	2.625
		LED desktop	3	200	0.6	7	4.2
		Exhaust fan	2	90	0.18	7	1.26
Class room (Ecom) (NB 23)	1st Floor	Tube light	4	40	0.16	7	1.12
		Ceiling fan	1	75	0.075	7	0.525
IT Lab (Comm.) (NB 14)	1st Floor	Tube light	11	40	0.44	7	3.08
		Ceiling fan	4	75	0.3	7	2.1
Library (NB 15)	1st Floor	Tube light	16	40	0.64	7	4.48
		LED light	32	20	0.64	7	4.48
		Ceiling fan	16	75	1.2	7	8.4
		Stand fan	3	60	0.18	7	1.26
		Exhaust fan	2	90	0.18	7	1.26
		LED desktop	7	200	1.4	7	9.8
		CCTV	12	12	0.144	24	3.456
		Avg. Light level	130lx				
Principle room	1st Floor	Tube light	12	40	0.48	7	3.36
		Ceiling fan	7	75	0.525	7	3.675
		LED desktop	3	200	0.6	7	4.2
		Printer	3	250	0.75	3	2.25
		Xerox machine	1	1100	1.1	2	2.2
		CCTV	2	12	0.024	24	0.576
		CCTV setup with 1 display	1	80	0.08	10	0.8
		Avg. Light level	180lx				

Class room (NB 18)	1st Floor	Tube light	11	40	0.44	7	3.08
		Ceiling fan	4	75	0.3	7	2.1
Class room (NB 17)	1st Floor	Tube light	4	40	0.16	7	1.12
		LED light	1	20	0.02	7	0.14
		Ceiling fan	2	75	0.15	7	1.05
Toilet	1st Floor	Tube light	2	40	0.08	7	0.56
Common area	1st Floor	Tube light	5	40	0.2	7	1.4
		LED light	3	20	0.06	7	0.42
		CCTV	3	12	0.036	24	0.864
		Automatic Hand Sanitizer Machine	1	10	0.01	4	0.04
		Water filter with cooler	1	500	0.5	5	2.5
Computer center building CC2	1st Floor	Tube light	4	7	0.028	7	0.196
		Ceiling fan	2	7	0.014	7	0.098
Computer center building CC3	1st Floor	Tube light	4	7	0.028	7	0.196
		Ceiling fan	2	7	0.014	7	0.098
Computer center building CC4	1st Floor	Tube light	4	7	0.028	7	0.196

		Ceiling fan	2	7	0.014	7	0.098
Common area (Computer center building)	1st Floor	CFL	6	7	0.042	7	0.294

Class room (M. Com. 1st yr) (NB 25)	2nd Floor	Tube light	11	40	0.44	7	3.08
		Ceiling fan	6	75	0.45	7	3.15
Computer Science lab (NB 26/1)	2nd Floor	Tube light	7	40	0.28	7	1.96
		Ceiling fan	4	75	0.3	7	2.1
		LED desktop	13	200	2.6	7	18.2
		Windowns air condition	2	1500	3	5	15
		Water filter	1	45	0.045	5	0.225
		Electric kettle	1	1500	1.5	2	3
Math lab (NB 26A)	2nd Floor	Tube light	6	40	0.24	7	1.68
		Ceiling fan	6	75	0.45	7	3.15
		LED desktop	5	200	1	7	7
		Exhaust fan	1	90	0.09	7	0.63
Class room (NB 27)	2nd Floor	Tube light	4	40	0.16	7	1.12
		Ceiling fan	1	75	0.075	7	0.525

Class room Gen. (NB A1)	2nd Floor	Tube light	19	40	0.76	7	5.32
		Ceiling fan	5	75	0.375	7	2.625
		Sound Box	2	20	0.04	7	0.28
		Amplifier	1	50	0.05	7	0.35
		Exhausted fan	3	90	0.27	7	1.89
Classroom Gen. (NB A2)	2nd Floor	Tube light	18	40	0.72	7	5.04
		Ceiling fan	8	75	0.6	7	4.2
		Sound Box	3	10	0.03	7	0.21
		Amplifier	1	50	0.05	7	0.35
		Exhaust fan	2	90	0.18	7	1.26
Botany lab Hons. (NB 28)	2nd Floor	Tube light	5	40	0.2	7	1.4
		LED light	5	20	0.1	7	0.7
		Ceiling fan	4	75	0.3	7	2.1
		Desktop	1	200	0.2	7	1.4
		Printer	1	250	0.25	3	0.75
		Reg. water bath	1	1000	1	2	2
		Fridge (190lt)	1	80	0.08	9	0.72
		Exhaust fan	1	90	0.09	7	0.63
		Avg. Light level	230 lx				
Botany lab Gen. (NB 29)	2nd Floor	Tube light	6	40	0.24	7	1.68
		LED light	1	20	0.02	7	0.14
		Ceiling fan	4	75	0.3	7	2.1
		Hot air oven	2	1100	2.2	1	2.2
		Incubator	1	400	0.4	2	0.8

		Autoclave Machine	2	1500	3	2	6
Class room (NB 30)	2nd Floor	Tube light	8	40	0.32	7	2.24
		Ceiling fan	4	75	0.3	7	2.1
Toilet	2nd Floor	Tube light	2	40	0.08	7	0.56
Common area	2nd floor	Tube light	1	40	0.04	10	0.4
		LED light	8	20	0.16	10	1.6
		LED blub	1	10	0.01	10	0.1
Class room (Computer Cemter Building)	2nd Floor	Tube light	22	40	0.88	7	6.16
		Ceiling fan	7	75	0.525	7	3.675
		Sound Box	4	10	0.04	7	0.28
		Amplifier	1	60	0.06	7	0.42

Zoology lab (NB 31)	3rd Floor	Tube light	15	40	0.6	7	4.2
		LED light	3	20	0.06	7	0.42
		Ceiling fan	6	75	0.45	7	3.15
		LED desktop	1	200	0.2	7	1.4
		Printer	1	250	0.25	3	0.75
		Fridge	1	80	0.08	9	0.72
		Exhaust fan	2	90	0.18	7	1.26
		Avg. Light level	160 lx				

Physiology lab (NB 32)	3rd Floor	Tube light	22	40	0.88	7	6.16
		LED light	4	20	0.08	7	0.56
		Ceiling fan	8	75	0.6	7	4.2
		LED desktop	1	200	0.2	7	1.4
		Fridge	1	80	0.08	9	0.72
		Heater	2	1500	3	1	3
		Bacteriological Incubator	1	400	0.4	3	1.2
		Experiment kit	3	18	0.054	3	0.162
		Avg. Light level					
		Lab table	60 lx				
		Table	160 lx				
Common area	3rd floor	LED blub	4	10	0.04	7	0.28

3. Quantification by End Use

The loads were segregated based on the end use as lighting and fans, air conditioning, computers, printers, water pumping, instruments in the laboratories. Quantification, types and necessary measurements were carried out. The details are given here.

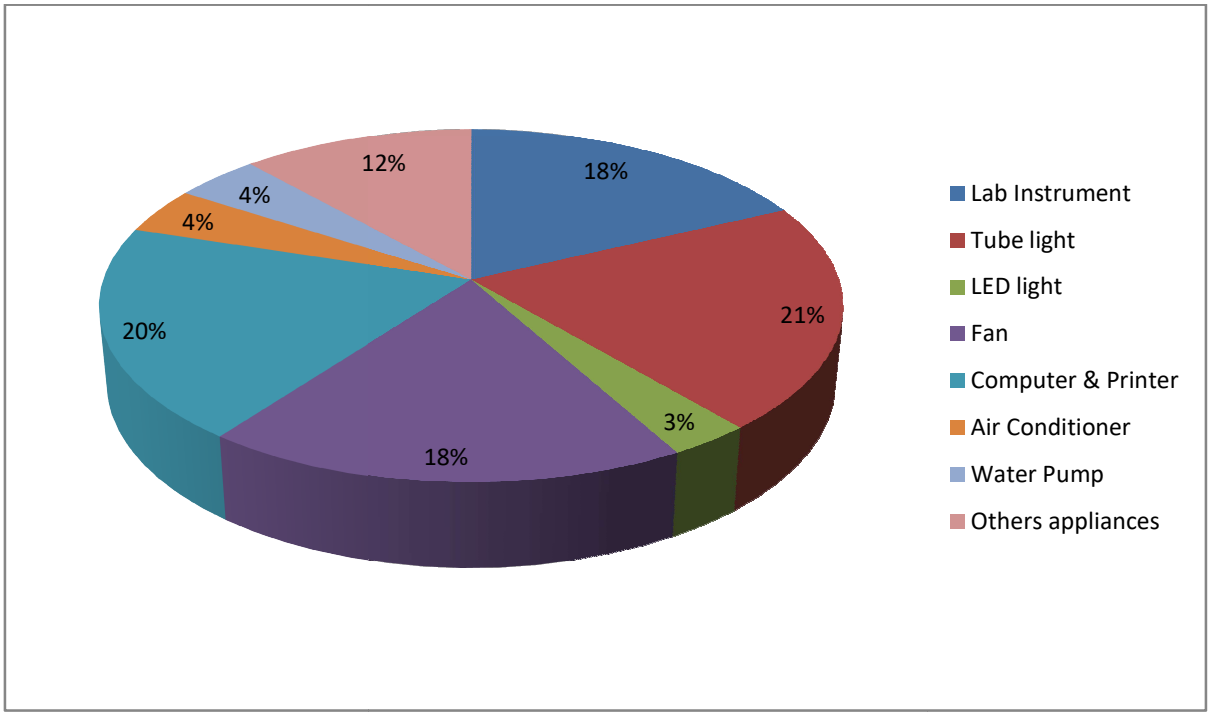

Fig. 3.1 Distribution of connected load in percentage by end use in Netaji Nagar Day College

Connected Load is also given in the Fig 3.2

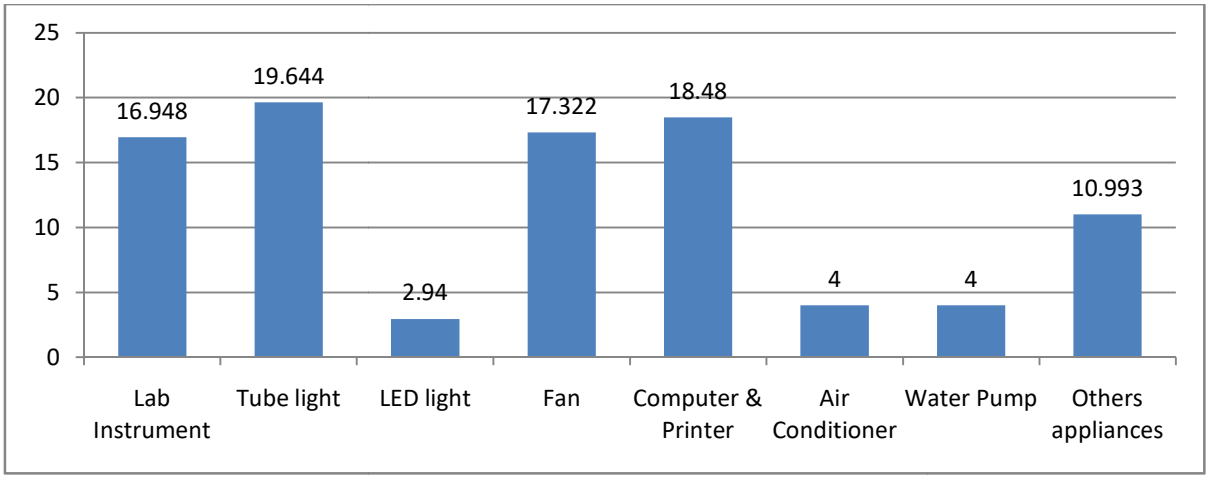

Fig 3.2: Conncted Load (kW) in theNetaji Nagar Day College

4. Benchmarking

Energybenchmarkinginvolvesthedevelopmentofquantitativeandqualitativeindicatorsthrough the collection and analysis of energy related data and energy management practices. Benchmarking in simplistic terms is the process of comparing the performance of a given process with that of the best possible process and to try to improve the standard of the process toimprove quality of the system, product, services etc. It allows organizations to develop plans onhow to adopt such best practices, usually with the aim of increasing some aspect of performance.Benchmarking may be a one-off event, but is often treated as a continuous process in which organizations continually seek to challenge their practices. Benchmarking is a method which should be used on a continual basis as best practices are always evolving.

Benchmarking of energy consumption is a powerful tool for performance assessment and logical evolution of avenues for improvement. Historical data, well documented, helps to bring outenergy consumption and cost trends month-wise / daily. Trend analysis of energy consumption,cost, relevant production features, specific energy consumption, help to understand effects of capacity utilizationon energy use efficiency and costs on a broader scale.The basis for benchmarking the energy consumption at Netaji Nagar Day College is energy consumed per person(includes teaching staff and students).The benchmarking parameters are hereunder.

- Departmental energy performance
- Consumed per sq.m of area and
- Per capita consumption

4.1 Building Energy Performance

The details of the daily energy consumption in two building are as shown here in Fig. 4.1.

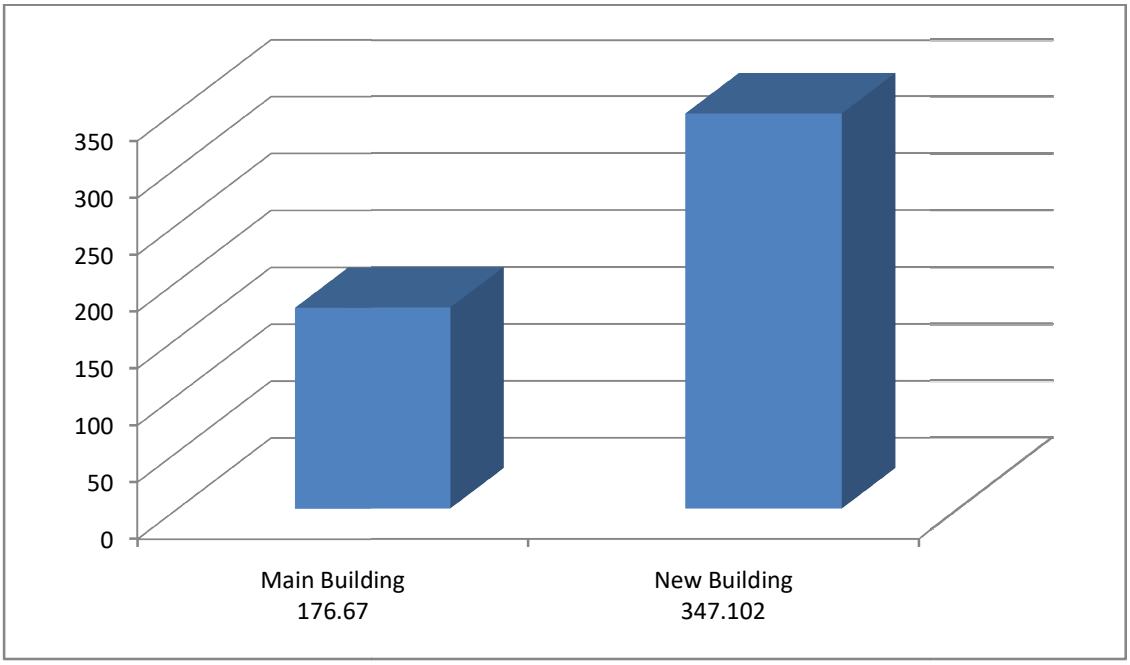

Fig 4.1.1: Daily energy consumption in (kWh) in 2021

Building wise daily energy consumption in percentage is also given in fig 4.1.2

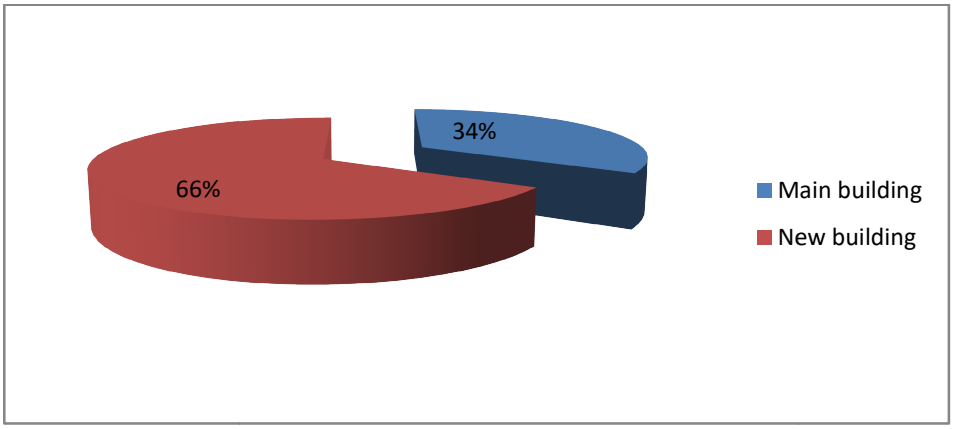

Fig 4.1.2: Building wise daily energy consumption in persentage (kWh)

4.2 Equipment Wise Consumption

Electrical gadgets wise per day consumption has been given in Fig 4.2

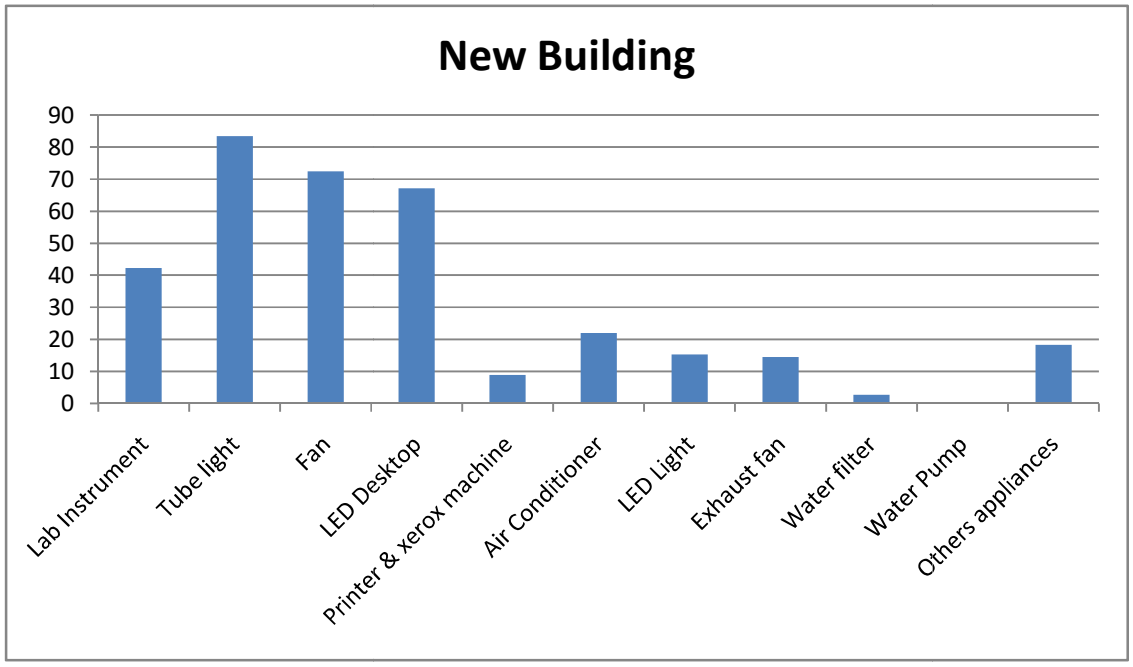

Fig 4.2.1: Daily average consumption (kWh) (New Building)

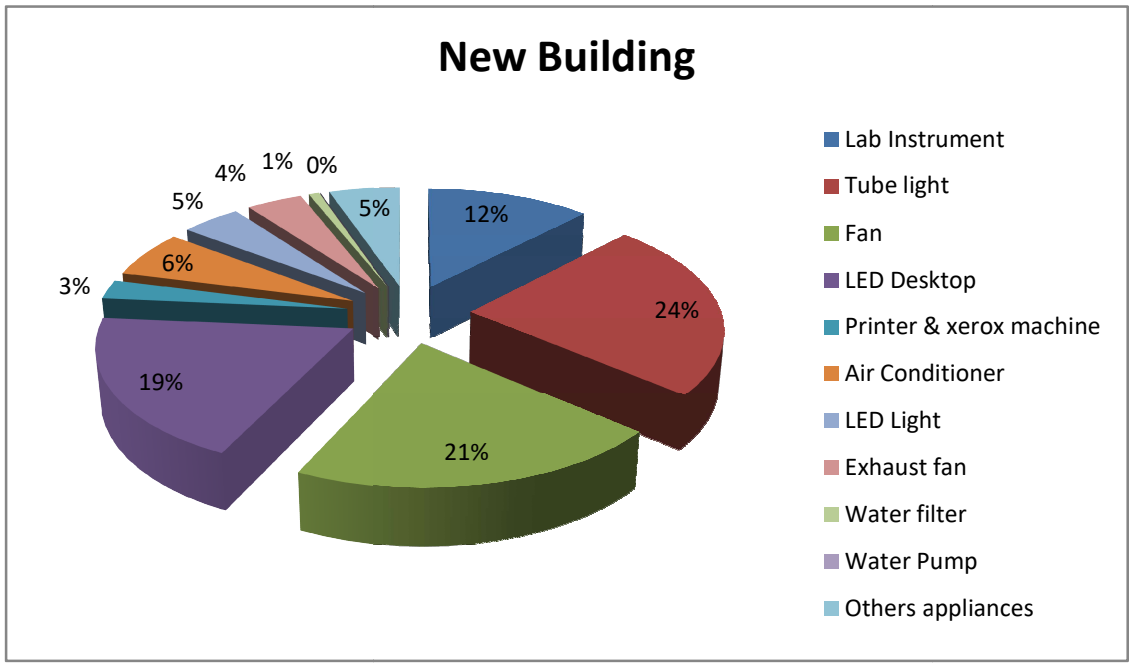

Fig 4.2.2: Daily average percentage consumption (kWh) (New Building)

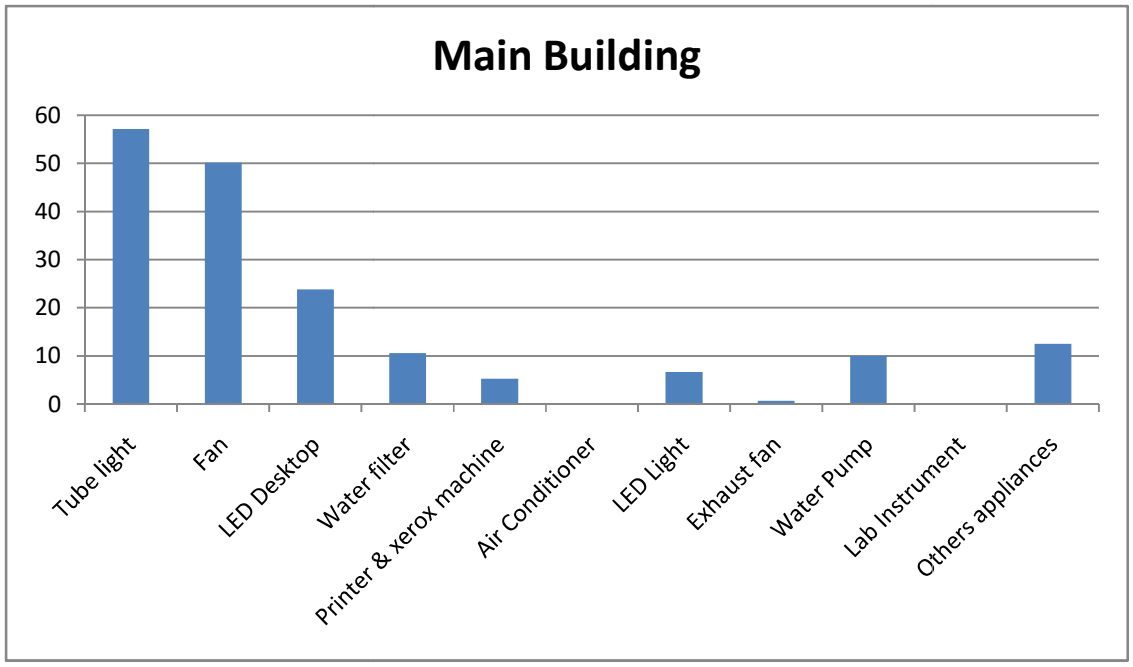

Fig 4.2.3: Daily average consumption (kWh) (Main Building)

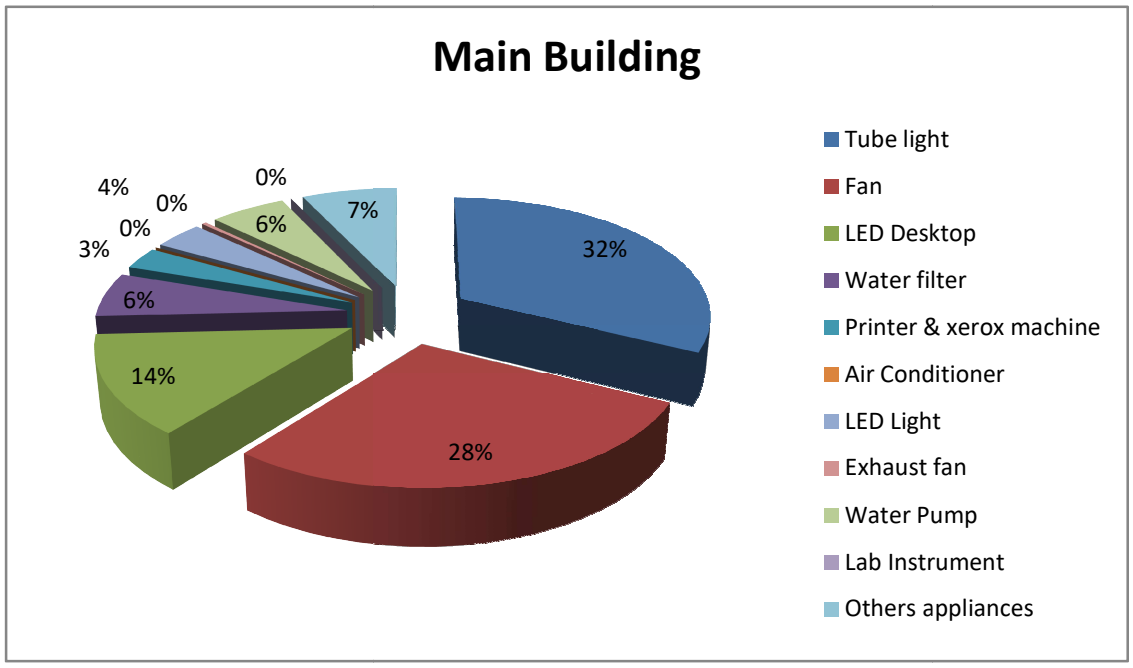

Fig 4.2.4: Daily average percentage consumption in percentage (kWh) (Main Building)

4.3 Unit Area Energy Consumption

The energy consumption per sq. ftfor theMain buildings and New building

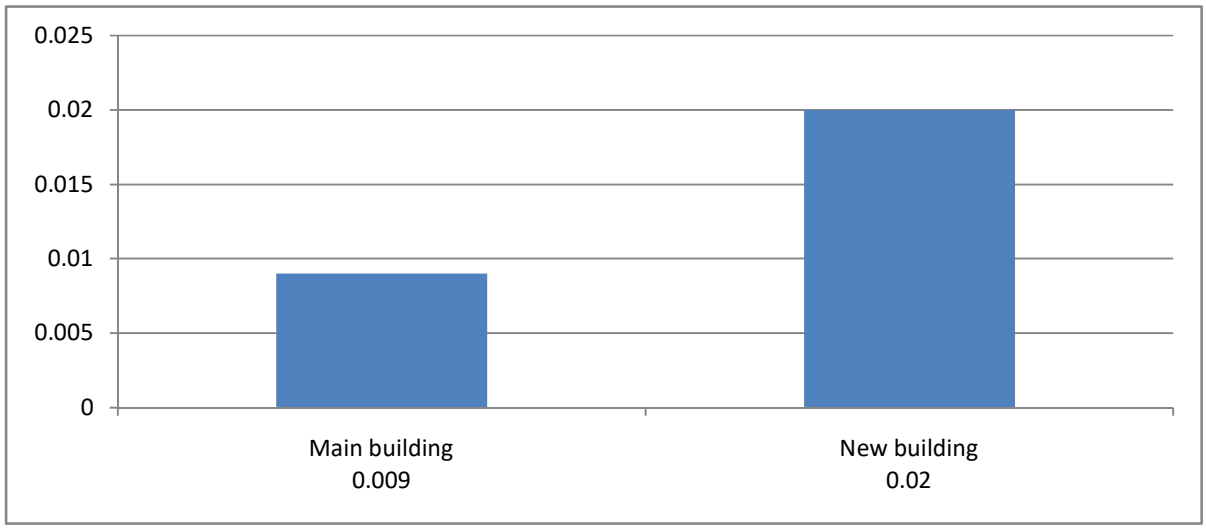

Fig. 4.3 Building area unit consumtion in sq. ft

4.4 Yearly energy consumtion

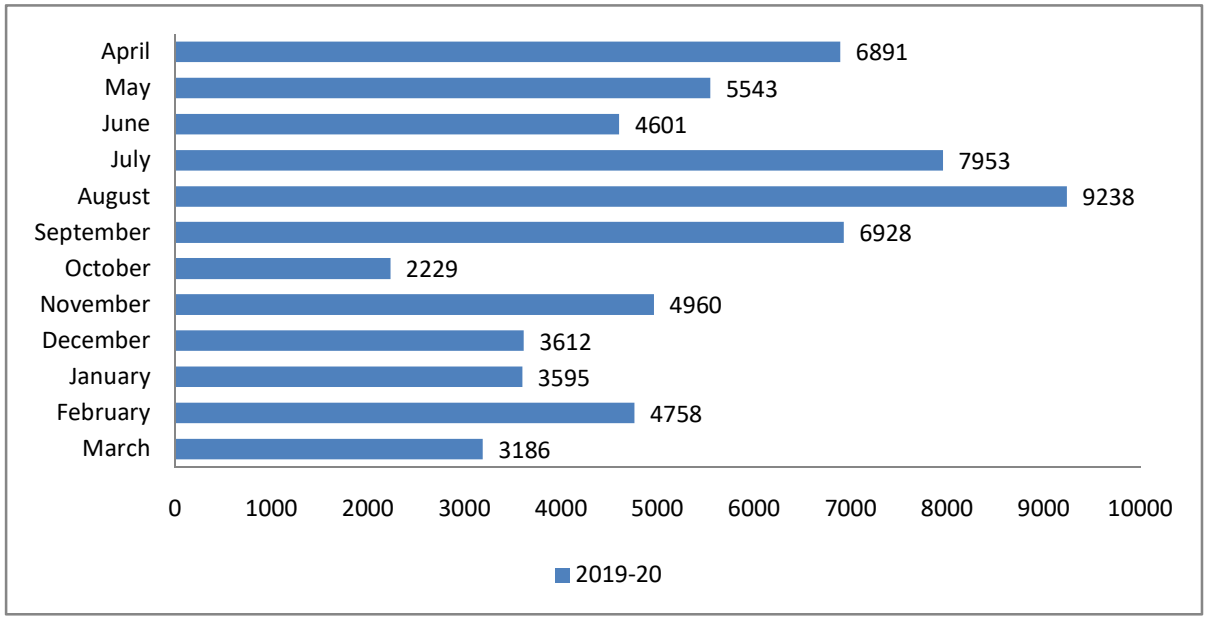

Fig 4.5.1 Yearly energy consumtion

4.5 ECBC Standards and Comparison

As per the Energy Conservation Building Code (ECBC) – 2007, published by the Bureau of Energy Efficiency (BEE), Govt. of India, recommended levels of lighting power density are as given below in Table 4.1.

Space/ application	Lighting power density in W/sq.m.
General 200	Reading Room 200
Reading tables 200	Bathrooms 50
Computer Workspace 300	Interior Parking Area 20
Music Rooms 200	Sports halls 200
Corridors, passageways &Stairs 50	Canteens ,Cafeterias ,Dining Rooms and
Mess Rooms	150
Food Preparation and Cooking 300	
General 200	Reading Room 200
Reading tables 200	Bathrooms 50
Computer Workspace 300	Interior Parking Area 20
Music Rooms 200	Sports halls 200

Table 4.5: ECBC recommended levels for lighting power density

4.6 Illumination Level

Measured Lux Level as in the Table 4.1

Place	Lux level (lx)
Class Room	160
Office	180
Laboratory	160
Common area	130

5. Recommendation

Based on the power consumption data analysis, few steps have been proposed for improving

energy efficiently in the main building and new building. Given below are few important recommendations for better energy efficiency.

5.1 Replacing Conventional Ballast FTLs with Electronic Ballast FTLs

5.1.1 Cost Analysis of Replacement (Calculation for 100 Conventional Ballast FTL is done here)

- Conventional Ballast FTL=100
- Average consumption of power of Conventional Ballast FTL=52W
- Average consumption of power of Electronic Ballast FTL=40W
- Power can be saved per FTL= (52-40)W= 12W
- Total power can be saved= 100*12W=1200W= 1.2kW
- Average FTL use per year =280*7hours=1960 hours
- Total energy can be saved per year=1.2kW * 1960 hours= 2352kWh
- Saving in Rs. Per year=2352 kWh * 8= Rs.18816
- Average cost of replacing each FTL= Rs. 150
- Total cost of the replacement of 100 Conventional Ballasts FTLs= 100 * 150= 15000
- Capital cost recovery time needed= 15000/18816 = 0.797 years.

Hence time needed for the capital cost recovery is 0.797 years for replacing 100 Conventional Ballast FTLs with Electronic Ballast FTLs of the campus.

5.2 Installing Motion Sensors in Corridors

Corridors and toilets have large potential of saving energy by use of automation tools. Motion sensors can be used there to automatically switch on the light when there is any movement and switch off the light when there is no movement. This can greatly reduce the total load in corridors and toilets.

5.2.1 Cost Analysis Motion Sensors in Corridors

- Average number of tube lights in a corridor=10
- Average power consumption of the tube lights= 40W
- Average number of motion sensor required= 10

- Average reduction in usage of tube lights per day by motion sensor=4hours
- Total energy can be saved in a corridor per year=(10*40W*4hours*280days) / 1000= 448 kWh
- Saving in Rs per year=448*10=Rs. 4480
- Average cost of installation per motion sensors= Rs. 250
- Total cost of installing motion sensors in a corridor= 10 *250= Rs. 2500
- Capital cost Recovery time= 2500/4480= 0.5 years.

Hence the time needed for the capital cost recovery is 0.5 years for installing motion sensors in corridors

5.3 Replacing Old ACs with New Star Rated ACs

5.3.1 Cost of Replacement of the ACs (Calculation for 100 Old Window ACs)

- Old Window ACs of 1.5 tons =5
- Average consumption of power of the old window ACs= 2000W
- Average consumption of power of a new 5 star rated AC with 1.5 ton capacity= 1500W
- Power can be saved per AC= (2000-1500)W=500W
- Power consumption can be saved per AC=500W
- Total power saving= 5*500=2500= 2.5 kW
- Average use of AC per year=280*4= 1120 hours
- Total Energy saved per year= 2.5kW*1120hrs=2,800kWh
- Saving in Rs per year=2,800*10= Rs.28,000
- Average cost of replacing each old window ACs with new 5 star rated split ACs both of capacity 1.5 tons= Rs. 26000
- Total cost of replacing all AC= 5*38000= Rs. 1,90,000
- Capital cost recovery time needed= 1,90,000/26,000= 7.3 years.

Therefore time needed for the capital cost recovery is 7.3 years for replacing 5 old windows ACs

of 1.5 tons with 5 new 5 star rated new split ACs of 1.5 tons of the campus. The split AC's are costlier than the window AC's but their energy efficiency in terms of consumption is higher.

5.3.2 Better Practices for ACs

Proper Insulation – Good quality insulation must be maintained in the air conditioned rooms by keeping all doors and windows closed properly so as to prevent cool air go out and hot air come in.

Curtains – Always keep curtains on windows to prevent direct sunlight inside the room to avoid heating of cooled air. This reduces AC load significantly.

Maintenance – Proper maintenance and cleaning of ACs is required at regular intervals to make it work at highest efficiency. Any dirt in filter may reduce efficiency of ACs very significantly.

Operating – The ACs should be switched on 15 minutes before actual use and should be switched off before leaving the room

5.4. Energy saving by using Super-Efficient (BLDC) Fans

A Super-Efficient (BLDC) Fan consumes 30 watts whereas a conventional fanconsumes 80 watts.

- Hence energy savings per fan per hour = 50 Wh
- Total Energy savings by Super-Efficient Fans = 50W XOperating hours
- (Per day Per fan) = 50W X 6.5Hrs = 325 Wh = 0.325 KWh (Per day Per fan)
- Cost saving per day per fan = 0.325 KWh X Rs. 10 = Rs. 3.25/-
- Cost saving per day for 200 fans =Rs. 3.25/-X 200= Rs. 650/- (Per day)
- Total annual cost saving by using Super-Efficient Fans = Rs. 650/- X Total no.
- of operating days =Rs. 650- X 180 days =Rs. 1,17,000/-
- Cost of buying 200 Super-Efficient (BLDC) Fans = Rs. 3000/- X 200= Rs.6,00,000/-

Hence the time needed for the capital cost recovery is 5.12 years for BLDC fan.

Recommended to buy super-efficient ceiling fans instead of ordinary fan whenever there is requirement for new purchase. Also note that always use proper capacitor for ordinary fan and change the capacitor a necessary.

5.5. Energy Saving By Replacing Old Tubelights With Led lights

A 40 watt old tube light can be replaced with a LED tube light which has apower rating of 20 watt.

- Energy saving per light per hour = 20 watt
- Energy saving per light per day= 20 watt X 6.5hrs = 130 Wh=0.13 kWh
- Total annual energy saving per light = 0.13kWh X 280 days= 36.4 kWh
- Total annual energy cost saving per light = 36.4 kWh X Rs. 10 = Rs. 364/-
- Total annual energy cost saving by replacing all the old tubelights = Rs. 364/- X 500 = Rs. 1,82,000/-
- Cost for buying 500 LED tube lights = Rs. 250/- X 500 = Rs. 1,20,000/-
- Payback period = (Rs. 1,20,000/-)/ (Rs. 1,82,000/-) = 8 months

Payback period is much shorter than the lifespan of LED tubelights (Lifespan ofa LED tubelight is usually 20000 hrs+; which is around 8.4 years consideringoperating hour is 6.5 hours a day). Hence it is recommended to replace all the existing tubelights with LED light.

5.6 Electric wiring:

Power loss in old electric wirings is more than current electrical wiring and also old electrical wirings are not secured. It is recommended to maintain electric wiring with licensed electricians. Some of electric wires are laid with the help of iron angle from the main building to the new building. A further consultation with the licensed electrician is required in regard to the safety of the system. It is recommended to use proper cable try to laying the cable or wire with proper earthing arrangement.

It is also recommended that installation of modern electrical distribution board (ACDB) with

proper load distribution in generator room and other floors wherever required.

5.7 Civil work.

Maintenance and check of roofs/ceilings by professionals are recommended for the main building.

5.8Mosquitors and pest control

Regularly use pest control solution to keep college campus free from any pests and harm.

5.9 Painting

Paint wall with appropropiatecolour for light refection where needed.

6. Maximum Utilization of Renewable Energy Resources

National Assessment and Accrediation Council (NAAC)'s Vision is "To make quality the defining element of higher education in India through a combination of self and external quality evaluation, promotion and sustenance initiatives." Under NAAC criteria, Criterion VII, INNOVATIONS AND BEST PRACTICES, the key aspects are as follows-

- Environment Consciousness.
- Innovations
- Best Practices.

Under Environmental Consciousness focuses are given on topics like-

- Energy Conservations
- Rain Water Harvesting
- Maximum Use of Renewable Energy sources
- Wastes Recycling

- Efforts for carbon neutrality
- Check dam constructions
- Solid wastes, Hazardous wastes, and E-wastes Managements
- Plantations and gardening
- Efforts for Carbon neutrality
- Minimum uses of paper, plastics

6.1 Renewable Resources

India has a huge potential in generating solar energy using the unutilized space on the rooftops of any buildings. Solar power generated from any individual's household, industrial building, commercial buildings and institutional buildings or in any other types of buildings can substitute a huge amount of power demand from non-renewable power sources and can be partly used to fulfil the energy demand of the inhabitants of the building and in case of surplus can be fed into the grid. Till date, 26 states have notified their regulation to provide with Net Metering/ Gross Metering facilities to support the installations of solar rooftops. In recent times it is possible to generate solar power of about Rs. 5.50/kWh from the rooftop solar system, which is much cheaper than the electricity generation from a diesel generator sets. It is also cheaper than the cost at which most DISCOMS which would avail power to the domestic, industrial and commercial consumers. The new Technologies and initiatives will help India rise as a major country using their roof space for rooftop solar energy system on a huge scale. Nearly 60 million tonnes of CO2 per year will be reduced due to 40 GW of power, with the India's commitment toward its contribution in mitigating the global effect of climate change.The National Solar Mission was launched on the 11th January, 2010 by the Prime Minister. The Mission has set the ambitious target of deploying 20,000 MW of grid connected solar power by 2022 is aimed at reducing the cost of solar power generation in the country through (i) long term policy; (ii) large scale deployment goals; (iii) aggressive R&D; and (iv) domestic production of critical raw materials, components and products, as a result to achieve grid tariff parity by 2022. Mission will create an enabling policy framework to achieve this objective and make India a global leader in solar energy.Further, Government has revised the target of Grid Connected Solar Power Projects from 20,000 MW by the year 2021-22 to 100,000 MW by the year 2021-22 under the National Solar Mission and it was approved by Cabinet on

17th June 2015.

6.2 Solar Cell

Solar cells represent the fundamental power conversion unit of a photovoltaic system. For practical operation, solar cells are usually assembled into modules. Its operation is based on the ability of semiconductors to convert sunlight directly into electricity by exploiting the photovoltaic effect. In the conversion process, the incident energy of light creates mobile charged particles in the semiconductor, which are then separated by the device structure and produce electricity.

Depending upon the type of absorbing material used, manufacturing technique / process adopted, and type of junction formed etc., the solar cell technologies can be broadly classified as following:

- Wafer based crystalline silicon solar cells
- Thin-film solar cells, which includes, Copper Indium Gallium Diselenide (CIGS), Cadmium Telluride, Amorphous silicon (a-Si) etc.
- Concentrating Photovoltaic (CPV) and
- Emerging technologies such as thin-film silicon, dye sensitized solar cells; polymer organic solar cells etc.

Material	Thick-ness	Efficiency (%)	Colour	Features
Mono-crystalline Si solar cells	0.3 mm	15 – 18	Dark blue, black with AR coating, grey without Anti Reflective(AR) coating	Lengthy production procedure, wafer sawing necessary. Best researched solar cell material – highest power/area ratio.
Poly-crystalline Si solar cells	0.3 mm	13 – 15	Blue with AR coating, silver-	Wafer sawing necessary. Most important production

Material	Thick-ness	Efficiency (%)	Colour	Features
			grey without AR coating	procedure at least for the next ten years.
Poly-crystalline transparent Si solar cells	0.3 mm	10 %	Blue with AR coating, silver-grey without AR coating	Lower efficiency than mono-crystalline solar cells. Attractive solar cells for different BIPV applications.
EFG (Edge Defined Film fed Growth)	0.28 mm	14	Blue, with AR coating	Limited use of this production procedure Very fast crystal growth, no wafer sawing necessary
Poly-crystalline ribbon Si solar cells	0.3 mm	12	Blue, with AR coating, silver-grey without AR coating	Limited use of this production procedure, no wafer sawing necessary. Decrease in production costs expected in the future.
Apex (polycrystaline Si) solar cells	0.03 to 0.1 mm + ceramic substrate	9.5	Blue, with AR coating, silver-grey without AR coating	Production procedure used only by one producer, no wafer sawing, production in form of band possible. Significant decrease in production costs expected in the future.
Mono-crystaline dendritic web Si solar cells	0.13 mm incl contacts	13	Blue, with AR coating	Limited use of this production procedure, no wafer sawing, production in form of band possible.
Amorphous silicon	0.0001 mm + 1 to 3 mm	5 – 8	Red-blue, Black	Lower efficiency, shorter life span. No sawing necessary, possible production in the

Material	Thick-ness	Efficiency (%)	Colour	Features
	substrate			form of band.
Cadmium Telluride (CdTe)	0.008 mm + 3 mm glass substrate	6 – 9 (module)	Dark green, Black	Poisonous raw materials, significant decrease in production costs expected in the future.
Copper-Indium-Selenide (CIS)	0.003 mm + 3 mm glass substrate	7.5 – 9.5 (module)	Black	Limited Indium supply in nature. Significant decrease in production costs possible in the future.
Hybrid silicon (HIT) solar cell	0.02 mm	18	Dark blue, black	Limited use of this production procedure, higher efficiency, better temperature coefficient and lower thickness.

Table 6.2: Comparison of different Solar Cell Technologies

6.3 Solar PV System

A PV system essentially consists of modules (array of solar cells generating the electricity) and a balance of system (BoS) including the cabling, battery, charge controller and DC/AC inverter and other auxiliaries/support system. Most of the systems are in flat-plate variety having fixed orientation while some of the system uses sun-tracking (single or double axis) concentrators in order to achieve high radiation on smaller areas for higher efficiency. The storage system (batteries) is not required in grid connected SPV systems.

A Solar PV module is the smallest PV unit that can be used to generate electricity. Although individual PV cells produce only small amount of electricity, PV modules are manufactured with varying electrical outputs ranging from a few watts to more than 100 watts of direct current (DC)

electricity. The modules can be connected into PV arrays for powering a wide variety of electrical equipment. A typical schematic of grid-connected PV system is given in Figure 6.

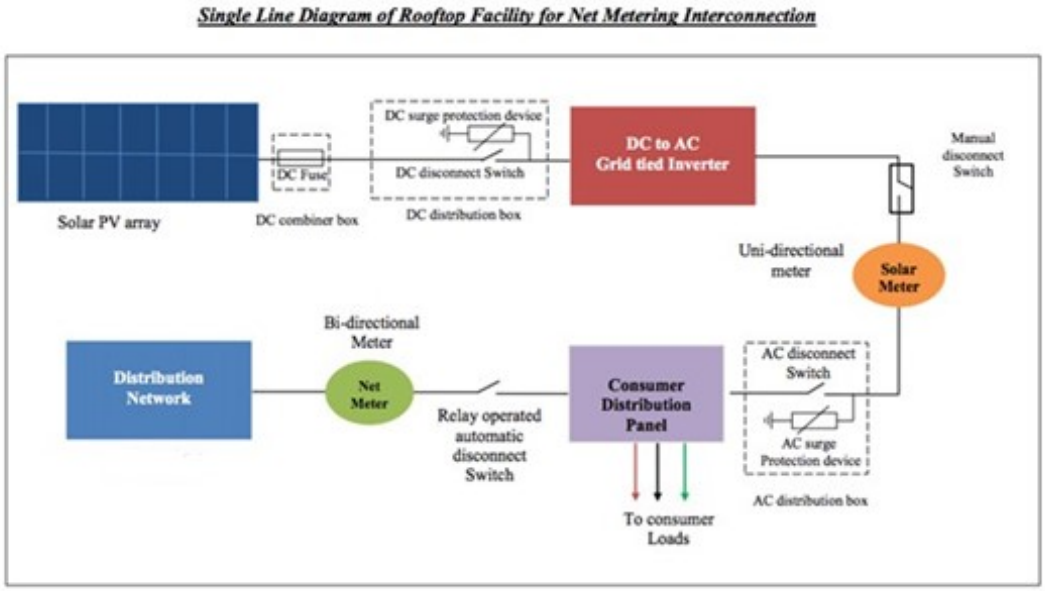

Fig 6.3: Single Line diagram with Net metering facility

6.4 Current Solar Capacity

Currently there is no solar installation in the campus. However there is a planning of rooftop solar plant but the work is pending due to COVID situation

6.5 Further scope of Solar Capacity Utilization

The college has adequate shade-free rooftop space for utilization of solar energy. A detailed available rooftop area is hereunder.

Building Name	Shade less Area	Approx Install capacity
Main building	2400 sqft	24 kWp
New building	2000 sqft	20 kWp

Therefore, harness able rooftop solar potential is approximately total 44kWp.

A 44 kW of solar PV plant will produce approximately 66,000 of electricity per year. If the current two roofs are fully utilised in regard to rooftop installation then the college will be completely energy independent.

7. Disposal and Reclying of Waste

7.1 Waste Management

The waste is segregated at source by providing separate dust bins for Biodegradable and Plastic waste. Segregation of chemical waste generated in chemistry, zoology lab and other laboratories. Solid and liquid waste from the college are also decomposed here.

Waste Category	Method of disposal
Solid waste from canteen	Organic Manure
Plastic Waste	Through Authorised recycler
Solid Waste from Lab	Composting
	Organic manure

7.2 Waste to Compost (WTC) Machine

Presently there is no waste compost machine.

7.2.1 WTC Procedure

I. The machine has Input door, Output door, Blades for Mixing, So process is noiseless and odorless.
II. Humidity sensor which sense the moisture in the wet waste, Heater, Saw dust with Micro-Organism, Air Ventilation, pipe which directly connect to the sewage system.
III. First step is to put organic waste in the Machine from waste input door then close the door.
IV. Blades start mixing all the waste in the machine at 2 RPM (Rotation per Minute) Clock wise and Anti-Clock Wise.

V. Humidity Sensor in the machine, as it is known that organic waste content 70-80% water.

VI. Once waste is sensed by the humidity sensor Heater will automatically turns On & Water gets evaporate, here we achieve 70-80% volume reduction and steam goes out through pipe which is directly connect to sewage system. e Air Ventilation is provided for Micro Organism to be in live condition.

VII. After that rest of materials are l decomposed by bacteria and hereby 80-95% volume reduction is achieved.

VIII. Per day you will get 10% compost, but no need to remove on a daily basis once in a 7-8 days when compost reaches to Maximum Indicator Line of Machine.

IX. Once byproduct came out from the machine we sent it to Laboratory to check the compost.

X. Microorganisms operate best under neutral to acidic conditions, with pH's in the range of 5.5 to 8. During the initial stages of decomposition, organic acids are formed. The acidic conditions are favourable for growth of fungi and breakdown of lignin and cellulose. As composting proceeds, the organic acids become neutralized, and mature compost generally has a pH between 6 and 8.

XI. Zero Maintenance

7.3 E-Waste Management

Over the last two decades, the amount of consumer and business electronic equipment has increased continuously. At the same time, rapid changes in information and communication technologies, the concomitant increasing versatility of most electronic devices together with the downward trend in prices have led to a drastically reduced lifespan for most electronic equipment. Almost every used electronic items are considered as e-waste such as discarded cellphones, cameras, CD players, TVs, radios, drillers, fax machines, photocopiers, printers, toners, ink cartridges, batteries, rechargeable batteries, digital calculators and clocks, CRT monitors, electric solders, computer mother boards, key board, industrial and house hold electronic machinery such as oven, fridge, sewing& washing machines, fan, air-conditioner,

grinder, iron, heater, military and laboratory electronic equipment's, etc. The rapid growth of technology, rise in per capita income of people in developing nation, up gradation of technical innovations and a high rate of obsolescence in the electronics industry have led to one of the fastest growing waste streams in the world which consist of end of life electronic waste products. Electronic waste or e-waste is one of the fastest growing waste streams around the world, growing at a rate of 3–5% per annum or approximately three times faster than normal municipal solid waste. Managing electronic waste (or e-waste) is one of the most rapidly growing pollution problems worldwide. New technologies are rapidly superseding millions of analogue appliances leading to their disposal in prescribed landfills despite potentially their adverse impacts on the environment. The consistent advent of new designs, ''smart'' functions and technology during the last 20 years is causing the rapid obsolescence of many electronic items. The lifespan of many electronic goods has been substantially shortened due to advancements in electronics, attractive consumer designs and marketing and compatibility issues. The college has following electronic equipments.

Instrument	Number (Approx)
Computer	60
Printer	20
Xerox Machine	2
CC TV Camera	40
Projector	8

In line with the institutional e-waste management best practices the college follows the policy on the e-waste. The e-waste and defective item from computer lab and other places are stored properly. The institution has decided to contact approved e- waste management and disposal facility in order to dispose e-waste in scientific manner.

8.

9.

10.

11. Water Footprint

Water footprints help individuals, businesses and countries because they reveal water use patterns, from the individual level all the way to the national level. They shine a light on the water used in all the processes involved in manufacturing and producing our goods and services. A water footprint also accounts for the amount of water contaminated during manufacturing and production because that water is made unusable and is, essentially, taken out of the system.

The water footprint gives everyone - from individuals to business managers to public officials - a solid frame of reference that helps us all be more efficient and sustainable with our water use and appreciate the role of water in our lives. A water footprint is measured in terms of the volume of water consumed, evaporated and polluted.

Blue Water Footprint : The amount of surface water and groundwater required (evaporated or used directly) to make a product.

Green Water Footprint : The amount of rainwater required (evaporated or used directly) to make a product.

Grey Water Footprint : The amount of freshwater required to mix and dilute pollutants enough to maintain water quality according to certain standards (like the ones established in the US Clean Water Act) as a result of making a product.

The college has total 6 overhead tanks and 2 (2+1 one reserved for emergency) pumps which runs almostavg 2.5hrs a day.

The water pumpes details-

Water Pump Capacity	Types	Number of pump	Instantaneous current draw	Water suction from
2HP	3 phase Centrifugal Pumps	2	2.9 A per phase per pump	Ground level water reaserver. Water supply from local govt. body (Kolkata Municipal Corporation)
2 (two) water pump use daily and 1 (one) water pump reserved for emergency purpose. It is recommended to use the emergency purpose water pump alternately.				

12. Rain Water Harvesting

Watering harvesting means capturing rain water, where it falls and capture the runoff from catchment and streams etc. Generally, water harvesting is direct rainwater collection. This collected water could be stored for later use and recharged into the ground water again. There is an advance planning for rain water harvesting in the campus.

13. Carbon Neutrality

Students and staff members are made aware of pollution caused by use of vehicles and bicycles. Most of the students in the college use bicycle for commuting and most of the staff members reside nearby. They either avail public transport, bicycle or rickshaw. Besides, residences of some of the staff are in the vicinity of the college and they commute by walking. A maximum of 2 to 3 staff members out of all, use private car for coming. In the college campus almost 70% of students are using bicycles, 20% of student using local transport and 10% of student using private conventional vehicles. The carbon consumption awareness programme improves carbon emission at individual as well as social level. It also helps the college authorities to avoid air and noise pollution in the campus due to vehicles or any activity in it.

14. Environment Awareness Programme

While maintain the environmental awareness program in the campus it is compulsory subject to all second year student which is irrespective of particular branches. Syllabus topics must consist of following:

a. Air Pollution its causes, effects & installation of various devices that reduces the air pollution.
b. Water Pollution its causes, effects & various methods to prevent the it.
c. Sound Pollution its causes, effects & installed equipments that reduces it.

d. Noise Pollution its effects on surroundings.

15. Plantation and Gardening

Activities organised in the campus to upkeep the greenery profile in the campus

12.1 Plantation of Diversified species

To create- green cover, eco-friendly atmosphere, pure oxygen at the college campus, plantation program is organized every year with involving all students, principal, and all departments faculty members. To keep the greeneries in the campus, the college regularly maintain the gardens which are looked after by paid staff under the guidance of garden committee members.

12.2. Vegetative propagation

To learn how to propagate vegetatively the garden vegetation, training program is organized for students every year by expert gardener. Students learned various propagation techniques like cutting, grafting, and gooty.

12.3 Uses of medicinal plants

There is no medicinal plants are planted in college campus. Identification of suitable place for planting medicinal plant should be look into. Educating students about scientific nomenclature and the usability of the medicinal plants will certainly help the students in the long-term.

12.4 Identification of plant species

Existing profile of the trees and plantation is given in the Table

Scientific Name	Common Name	Family	Age of tree (Yrs)
Terminaliaarjuna	Arjun tree	Combretaceae	30

Another two tree krishnachura (Delonixregia) and chatim tree (Alstoniascholaris) is near to campus wall maintain by local govt. authority.

16. Conclusion

The college campus follows a good endeavour of carbon neutrality practices. All the students use bicycle for their daily commute. Available shade free rooftop may generate solar power which may exceed the annual energy requirement of the college. However, existing rooftop solar policy of the state government / DISCOM may not support the switch to solar power completely but majority of electrical requirement can be replaced by rooftop solar system

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