



Established in 1968

**CHRISTIAN COLLEGE OF ENGINEERING & TECHNOLOGY**

Managed By St. Thomas Mission, Bhilai

Approved by AICTE and Affiliated to CSVTU, Bhilai

If You Aim High, We Provide The Means



### **QNM7.1.3**

## **QUALITY AUDITS ON ENVIRONMENT AND ENERGY REGULARLY UNDERTAKEN BY THE INSTITUTION.**

*The institutional environment and energy initiatives are confirmed through the following*

- 1. Green audit / Environment audit*
- 2. Energy audit*
- 3. Clean and green campus initiatives*
- 4. Beyond the campus environmental promotion and sustainability activities*

## **Criterion 7**

### **QnM 7.1.3 Quality Audits**



Established in 1958

# CHRISTIAN COLLEGE OF ENGINEERING & TECHNOLOGY

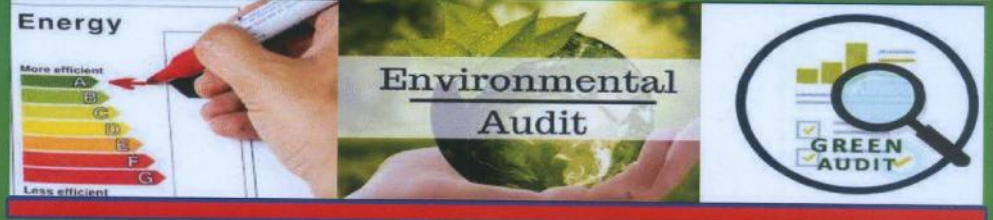
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If You Are High, We Provide The Means



## Energy Audit, Environmental Audit & Green Audit of Christian College of Engineering & Technology, Bhilai



Conducted & Prepared By :-

**RAJ ENERGY SERVICES,**

*.....dedicated in energy conservation*

62 & 81, DAYA NAGAR RISALI, BHILAI NAGAR, DIST. DURG, (C.G.)

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## Criterion 7

### QnM 7.1.3 Quality Audits



Established in 1958

# CHRISTIAN COLLEGE OF ENGINEERING & TECHNOLOGY

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If You Aim High, We Provide The Means



**RAJ ENERGY SERVICES**

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02 & 01, Daya Nagar, Risali, Bhilai Nagar, 490006 (C.G.)  
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## ENERGY AUDIT, ENVIRONMENTAL AUDIT & GREEN AUDIT CERTIFICATE

This is to certify that M/s. Raj Energy Services has conducted Energy Audit, Environmental Audit & Green Audit of Christian College of Engineering & Technology, Bhilai and submitted report under their Policy for Green Campus of the Institute.

Name and Address of the Educational Institute	Christian College of Engineering & Technology, Kailash Nagar, Industrial Estate, MP Housing Board , Bhilai, Chhattisgarh, PIN – 490 026
Contact Details	0788 228 6662 E – Mail : ccet@ccetbhilai.ac.in Website : - <a href="https://ccetbhilai.ac.in">https://ccetbhilai.ac.in</a>
Name of Principal	Dr. (Mrs.) Dipali Soren
Details of facilities Audited	Block A, Block B, Block C, Boys Hostel, Girls Hostel, Office, All departments, Laboratories, Classrooms, Auditorium, Library, Solar Power Plant, Electrical Systems, and complete Installations.
Date of Audit Conducted	16 <sup>th</sup> , 17 <sup>th</sup> & 18 <sup>th</sup> May 2023
Name of Certified Energy Auditor	Sanjay Kumar Mishra
Registration Number	EA- 8696

For, Raj Energy Services

Date: June 2, 2023

(Sanjay Kumar Mishra )

Certified Energy Auditor from Bureau of Energy Efficiency, Ministry of Power, Government of India, New Delhi  
EA- 8696

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### 3. ACKNOWLEDGEMENTS

We express our sincere thanks to Fr. Dr. P S Varghese, Executive Vice Chairman, Christian College of Engineering and Technology, Bhilai, for his kind support and giving us the assignment to contribute in their effort towards green initiatives & efficient energy management in the college.

We are highly indebted to Dr. (Mrs.) Dipali Soren Principal, for their guidance, intellectual advice and his kind support in completing the project.

Our boundless gratitude to Mr A. D. Vincent, Administrative Officer other teaching and non-teaching staff associated with this Energy Audit, Environment Audit & Green Audit study of Christian College of Engineering and Technology, Bhilai, for extending cooperation during collection of data and field study work.

We trust that the findings of this study will help the college in improving their green initiative towards creating awareness for healthy and sustainable environment.

**Raj Energy Services, Bhilai**

**Sanjay Kumar Mishra**

Certified Energy Auditor, EA- 8696

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#### 4. DISCLAIMER

##### **Warranties and Liability**

While every effort is made to ensure that the content of this report is accurate, the details provided "as is" makes no representations or warranties in relation to the accuracy or completeness of the information found on it. While the content of this report is provided in good faith, we do warrant that the information will be kept up to date, be true and not misleading, or that this report will always (or ever) be available for use.

While implementing the recommendations site inspection should be done to constitute professional approach and adequacy of the site to be established without ambiguity and we exclude all representations and warranties relating to the content and use of this report.

In no event We will be liable for any incidental, indirect, consequential, or special damages of any kind, or any damages whatsoever, including, without limitation, those resulting from loss of profit, loss of contracts, goodwill, data, information, income, anticipated savings or business relationships, whether or not advised of the possibility of such damage, arising out of or in connection with the use of this report.


##### **Exceptions**

Nothing in this disclaimer notice excludes or limits any warranty implied by law for death, fraud, personal injury through negligence, or anything else which it would not be lawful for to exclude.

We trust the data provided by the Christian College of Engineering and Technology, Bhilai, personnel is true to their best of knowledge.



## 5. CERTIFICATE



**RAJ ENERGY SERVICES**  
*dedicated in energy Conservation*  
 62 & 81, Daya Nagar, Risali, Bhilai Nagar, 490006 (C.G.)  
 Mob.: 9826179597 Email : resbhilai@gmail.com

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Name of Principal	Dr. (Mrs.) Dipali Soren
Details of facilities Audited	Block A, Block B, Block C, Boys Hostel, Girls Hostel, Office, All departments, Laboratories, Classrooms, Auditorium, Library, Solar Power Plant, Electrical Systems, and complete Installations.
Date of Audit Conducted	16 <sup>th</sup> , 17 <sup>th</sup> & 18 <sup>th</sup> May 2023
Name of Certified Energy Auditor	Sanjay Kumar Mishra
Registration Number	EA- 8696

For, Raj Energy Services

Date: June 2, 2023



(Sanjay Kumar Mishra )

Certified Energy Auditor from Bureau of Energy Efficiency, Ministry of Power, Government of India, New Delhi  
EA- 8696

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### AUDITOR'S CERTIFICATE



**BUREAU OF ENERGY EFFICIENCY**

Examination Registration No. : **E.E-8098** Serial Number **2432**

Certificate Registration No. : **4132**

### Certificate For Certified Energy Manager

This is to certify that Mr. Mrs. **Sanjay Kumar Mishra** who has passed the National Examination for certification of energy manager held in the month of **May 2008** is qualified as certified energy manager subject to the provisions of Bureau of Energy Efficiency (Certification Procedures for Energy Managers) Regulations, 2010.

This certificate shall be valid for five years with effect from the date of award of this certificate and shall be renewed subject to attending the prescribed refresher training course once in every five years.

His/her name has been entered in the Register of certified energy manager at Serial Number **3432** being maintained by the Bureau of Energy Efficiency under the aforesaid regulations.

Mr. Mrs. **Sanjay Kumar Mishra** is deemed to have fulfilled the requirement for designation as energy manager under clause (i) of Section 14 of the Energy Conservation Act, 2001 (Act No. 85 of 2001).

Given under the seal of the Bureau of Energy Efficiency, this **15** day of **February, 2013**.

Secretary  
Bureau of Energy Efficiency  
New Delhi

Digitally signed by **RAJESH KUMAR RAI**  
Serial No. 01 103141 153 2020  
Country: **INDIA**

Date of attending the refresher course	Secretary's Signature	Date of attending the refresher course	Secretary's Signature
15.02.2013			



## 7. INTRODUCTION

The Christian College of Engineering and Technology functions under the aegis of the St. Thomas Mission of the Malankara Orthodox Church, which operates More than two dozen schools and colleges in Central and Eastern India. The college is located at a beautiful lush green landscape, free from polluted environment and excellent atmosphere and ambience ideally suited for growth of the sound, soul & mind.

1.	Name of Institution	Christian College of Engineering and Technology
2.	Address of the Institution	Kailash Nagar, Industrial Estate, MP Housing Board, Bhilai, Distt.- Durg, PIN 490026
3.	University Affiliated to	Chhattisgarh Swami Vivekanand Technical University, Newai
6.	Name of the Principal	Dr. (Mrs.) Dipali Soren
7.	Contact Number	0788 228 6662
8.	E Mail ID	<a href="mailto:ccet@ccetbhilai.ac.in">ccet@ccetbhilai.ac.in</a>

Table 3: Details of Institution

The Institution offers 4 Under Graduate Programs viz. B. Tech in Computer Science, Electronics & Tele-Communication, Electrical and Mechanical Engineering. The Institution also offers three Post Graduate full time programs (2 years duration) viz. M.Tech- CAD-CAM Robotics under Mechanical Engineering Department, M.Tech-Nano Technology under Electronics & Telecommunication Engineering Department and High Voltage under Electrical Engineering Department.

CCET is affiliated to Chhattisgarh Swami Vivekanand Technical University (CSVTU), Bhilai, a State University established in 2005. Designing and curating the course content according to the market trends and demands, at the Tech Institute additional topics are taught to the students, beyond the syllabus. Spread over an area of 17.45 acres in the Industrial Belt of the Steel City, Bhilai, Chhattisgarh, CCET presents a panorama of harmony in architecture and natural beauty.

### Vision of College

CCET will be the centre of excellence by providing quality technical education inculcating high moral and social values with a human face thereby providing world class competent engineers for the progress and transformation of society.

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### Mission

To translate the vision into reality the institution is committed to –

- Run accredited Graduate and Post-Graduate programmes.
- Have state-of-the-art infrastructure facilities.
- Develop effective partnerships with industries.
- Transfer appropriate technology to society.
- Ensure placement of all students through campus interviews.
- Offer quality teaching and learning environment.
- Help in the upliftment of society by offering need based technical education facilities.
- Ensure quality services for all aspects of the campus.
- Create an ambience for the total development of staff and students.
- Become a deemed university.



The institute has a well-maintained library to facilitate academic pursuits of the students and staff members. All students, faculty members and employees of the institute are entitled to make use of the library facilities on taking library membership. The library has a large collection, approximately 54,000 text & reference books in engineering, science, humanities & other fields of knowledge. Library is subscribing more than 60 national and international journals & lending multimedia services with separate e-document section stocked 1100 CD's & Floppies. Library provides on line access to many full text journals from various publishers. The library working is fully automated. Transaction is being done through bar code scanner; all books & member's cards are bar coded.

In addition to the central library, department libraries also exist in each department which houses; books borrowed from the main library for quick reference & donated books.

Library has a separate collection of prescribed text books under book bank for the exclusive use by students belong to poor family on free of cost and for other all student's onetime payment bases.

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### Book Bank Scheme

Library operates a Book Bank Scheme for financially weaker students free of cost and for other students on a onetime payment, partially refundable for availing the facility for 4 years. Each student needs at least one textbook for each subject in all the eight semesters. This is an expensive proposition; moreover, students face a lot of problems in collecting these books. To reduce the burden CCET has the scheme of book bank for interested students. Under this scheme, students have to pay Rs 3500 for the entire course. After the completion of 8<sup>th</sup> semester student will get back Rs. 1500 from deposited book bank amount.

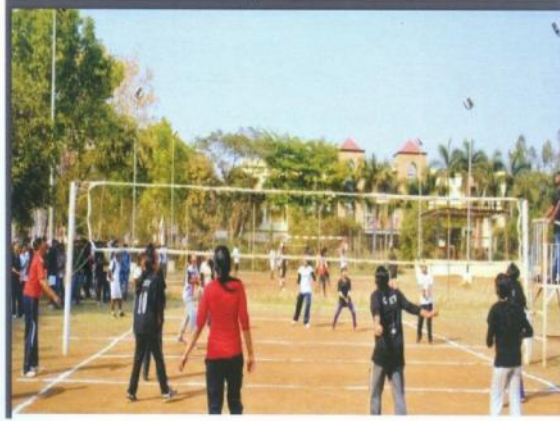
Sr. No.	Book Details	Total Numbers
1	No. of Volumes	54,391
2	No. of Titles	5,100
3	National Journal	52
4	International Journal	25
5	e – Journal	Springer Nature, Delnet & NDL (Member of National Digital Library)

The institute has facilities for Table Tennis, Basketball, Badminton, Volleyball, Handball, Foot Ball and Cricket. Indoor: Table Tennis, Carom, Chess Outdoor: Sports Complex: The college has a spacious sports complex. It has a seating capacity of 1000 spectators and has facilities for football, cricket, volleyball and basketball. It is used as a venue for hosting college level, inter collegiate and state level tournaments.



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bring laurels at university, state, national levels.

The proverb "A sound mind in a sound body" perfectly encapsulates the importance of sports in everyday life. Apart from enhancing physical fitness, it also brings in benefits of healthy socializing & builds character values. As sports play vital role in making any individual physically and mentally healthy, the college gives due importance to sports activities. The students regularly



In case of fire happening, fire extinguishers can help minimize property damage and save lives if used properly. Stationed throughout campus, portable fire extinguishers are to be used on small or the beginning stages of a fire, not on a large-scale fire. The college have fire extinguishers at designated place. Sand buckets are placed in electrical panel room. The next date of refilling of all fire extinguishers is mentioned.

#### Central Computing Facilities

CCET Computer Centre administers and manages the Campus and Hostel Network of the College. A state-of-art fiber optics backbone which provides high speed network connectivity to the Campus. More than 5 virtual network segments comprising of nearly 400 systems are connected through fiber optics cables and high-speed HP manageable switched to the Fortinet firewall to from the network environment.

College has spacious canteen facility in the college premises and is run by college management. A variety of food and snack items are provided to the students and staff of the college at highly reasonable rates

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with highest quality. The gym has all the modern equipment for workout and is made available to students during morning and evening hours.

### Faculty Development Program on Alternate Fuels

<p><b>ABOUT THE INSTITUTE</b> Christian College of Engineering and Technology (CCET) was established by Late Lamented Bishop H.G. Dr. Stephanos Mar Theodosios in 1998. It has a world-class campus with lush green and well-maintured lawns spread all around and peaceful atmosphere which provides an ideal setting for an intensive learning experience. It is approved by All India Council for Technical Education and affiliated to Chhattisgarh Swami Vivekananda Technical University, Bhilai (C.G.). It offers four years UG courses in Mechanical Engineering (Accredited by NBA), Computer Science, Electronics &amp; Telecommunication Engineering, Electrical Engineering and two years PG courses in CAD/CAM &amp; Robotics in Mechanical Engineering, Nanotechnology in Electronics &amp; Telecommunication Engineering and High Voltage in Electrical Engineering. The Institute always endeavors to be in research, training, collaborations &amp; projects and for opening more avenues for training and employments of its students.</p> <p><b>ABOUT THE DEPARTMENT</b> The Mechanical Engineering Department (Accredited by NBA) came into existence in the year 1998. The department offers B. Tech and M. Tech courses in CAD/CAM &amp; Robotics. The department is rich in its faculty as well as infrastructure. It has laboratory and workshop facilities with modern sophisticated equipment to carry out the practical and research work. The faculties are actively involved in various prestigious sponsored/consultancy project works from CGCOST, CSVTU under TEQUIP and other reputed government organizations. The department has been accredited second time for a period of 2018-19 to 2020-21.</p>	<p><b>CHIEF PATRON</b> <b>Dr. Joseph Mar Dionysius</b> Chairman, CCET</p> <p><b>PATRONS</b> <b>Fr. George C. Varughese</b> Executive Vice Chairman, CCET <b>Dr. (Mrs.) Dipali Soren</b> Principal, CCET</p> <p><b>CO-ORDINATOR</b>  <b>Dr. P. Srinivasa Rao</b> HOD, Dept. of Mech. Engg., CCET Email: srinivas.indore@gmail.com Contact no: 8259916171 <b>REGISTRATION: FREE</b> <b>EXPECTED PARTICIPANTS</b> Faculty/Research Scholars/Industrials.</p> <p><b>ORGANIZED BY</b> Mechanical Engineering Department CCET, Bhilai, CG-490026, India.</p>	 <p><b>CCET</b> CHRISTIAN COLLEGE OF ENGINEERING &amp; TECHNOLOGY</p> <p><b>AICTE TRAINING AND LEARNING (ATAL) SPONSORED FACULTY DEVELOPMENT PROGRAM ON ALTERNATE FUELS</b></p> <p><b>FDP DATES</b> SEPTEMBER, 7 - 11 - 2020</p> <p><b>ONLINE PLATFORM</b> </p> <p><b>REGISTRATION LINK</b> <a href="https://atalacademy.aicte-india.org/srgrup">https://atalacademy.aicte-india.org/srgrup</a></p>
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### Solar Power Plant

Christian College of Engineering & Technology has installed a Solar Power Plant of 85 KW capacity, however it is supposed to be commissioned in next month.



Energy Audit, Environmental Audit and Green Audit of Christian College of Engineering and Technology, Bhilai

## Criterion 7

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## Energy Management

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- Auditing for Energy Management of the Christian College of Engineering & Technology for Environmental Consciousness and Sustainability.
- Alternate Energy initiatives such as: Percentage of annual power requirement of the Institution met by the renewable energy sources.
- Percentage of annual lighting power requirements met through LED bulbs (Current year data)

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## 8. ENERGY MANAGEMENT

Energy Management is the strategy of adjusting and optimizing energy, using systems and procedures so as to reduce energy requirements per unit of output while holding constant or reducing total costs of producing the output from these systems”

### Principle of Energy Management

- Procure energy at lowest possible price
- Manage energy use at highest energy efficiency
- Reusing and recycling energy
- Select low investment technology to meet present requirement and environment condition
- Make use of wastes generated within the plant as sources of energy and reducing the component of purchased fuels and bills

### 8.1 Energy Scenario

Electrical energy is supplied by Chhattisgarh State Power Distribution Company Limited. The college has a HT connection of contract demand 240 KVA at 33 KV supply line. Electric demand of block A, block B, workshop, canteen, boys' hostel and girls hostel is catered by a single meter. There is an electrical distribution panel room near the entry gate, which receives power from transformer.

Service Number	1000281
Supply Voltage	33 KV
Meter No.	S1418559
Contract Demand	240 KVA



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For efficient use of electrical energy, an automatic power factor correction panel is also installed in the panel room of CCET Bhilai.



The APFC panel has rating of 40 KVAR and divided in 5 stages. The first two stage has the capacitor rating of 5 KVAR each and remaining three stages has the capacitor rating of 10 KVAR each. The Power factor controller is L&T make.

- Consistently high power factor under fluctuating loads.
- Prevention of leading power factor.
- Eliminate power factor penalty.
- Lower energy consumption by reducing losses.

A diesel generator set of 40 KVA is also used in case of power failure. The technical specifications of generator is as under: -

Rated capacity in KVA	40
Rated voltage in volts	415
Rated RPM	1500
Full load current in Ampere	56

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To promote and use of renewable energy, a grid connected solar power plant of 85 KWp is being installed by college. The Chhattisgarh state Power Distribution Company Limited has made a Power Purchase Agreement with Christian College of Engineering & Technology on 14<sup>th</sup> April,2023. The commissioning of grid connected Solar power plant of 85 KWp capacity is under process and it will generate power in coming months.



#### Technical Parameters of solar modules

Maximum power of solar module (Pmax)	335 Wp
Total quantity of solar modules	254 Nos.
Open circuit voltage (Voc)	45.40 V
Short Circuit current (Isc)	9.41 A
Voltage at maximum power (Vmp)	37.02 V
Current at maximum power (Imp)	9.05 A
Name of Manufacturer	Icon Solae-En-Power Technologies Pvt. Ltd, Raipur

Table 4: Technical Parameters of solar modules

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## 8.2 Electricity Bill Analysis

We have analyzed the electricity bills of CCET.

Months	Monthly Maximum Demand in KVA	KWH consumed	KVAH consumed	Power Factor	Monthly Bill in Rs.	Energy Cost in Rs. Per KWH	Energy Cost in Rs. Per KVAH
Apr-22	82.2	18430	18806	0.98	198125	10.75	10.54
May-22	55.8	16590	17001	0.97	182104	10.98	10.71
Jun-22	68.76	16335	16959	0.96	182860	11.19	10.78
Jul-22	75.36	15423	15920	0.97	174255	11.30	10.95
Aug-22	67.44	14375	14796	0.97	168534	11.72	11.39
Sep-22	71.88	15171	17135	0.88	188422	12.42	11.00
Oct-22	73.44	11955	14207	0.84	171077	14.31	12.04
Nov-22	92.76	14756	17883	0.82	208720	14.14	11.67
Dec-22	63.72	12703	16040	0.79	199141	15.68	12.42
Jan-23	63.6	13490	14630	0.92	188234	13.95	12.87
Feb-23	57.12	12544	13372	0.94	170020	13.55	12.71
Mar-23	63.36	14232	14938	0.95	184820	12.99	12.37

Table 4: Details of all service number and Contract Demand.

### Graphical Representation of maximum demand



Figure 1: Graphical Representation of maximum demand

From above graph, it is evident that the average demand in last year was 69.62 KVA, which is about 29% of contract demand of 240 KVA.

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## 8.3 Connected Load of College premises

Sr. No.	Segment	Name of item	Wattage	Quantity in Block A	Quantity in Block B	Quantity in Workshop	Quantity in Canteen	Quantity in Boys Hostel	Quantity in Girls Hostel	Total Quantity	Total Load in Wattage
1	Lighting	Conventional Tube Light	40	309	571	31	2	120	136	1169	46760
2		CFL	18	8	0	0	0	0	0	8	144
3		CFL	36	10	0	0	0	0	0	10	360
4		CFL	12	0	24	0	0	0	0	24	288
5		LED Bulb	15	5	53	2	0	0	8	68	1020
6		LED Tube Light	20	18	5	1	16	0	2	42	840
7	Heating, Ventilation & Air Conditioning	Centralised AC Unit 28 T	25200	1	0	0	0	0	0	1	25200
8		Air Conditioner 1.5 T	1700	21	15	0	0	0	0	36	61200
9	Office	Fan	70	234	432	18	21	135	132	972	68040
10		Exhaust	150	5	9	0	0	0	3	17	2550
11		Air Cooler	250	2	7	0	0	9	5	23	5750
12		Computers	100	19	23	0	0	0	0	42	4200
13		Printers	500	7	7	0	0	0	0	14	7000
14	Water Supply	Photo Copy Machine	600	0	2	0	0	0	0	2	1200
15		Water Pump	3750	0	1	0	0	0	0	1	3750
16	Campus Lighting	Water Pump	2250	0	0	0	0	1	1	2	4500
17		LED street Lights	50		30					30	1500
18	Miscellaneous	Computers ( Lab)	100	28	128	0	0	0	0	156	15600
19		Water cooler ( 2 tap)	650	1	1	0	1	1	1	5	3250
20		Water cooler ( 1 tap)	325	0	1	0	0	0	0	1	325
		Others									3000
Total Connected load in watts											256477

Table 5: Connected load of college

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The total connected load of college premises is about 257 KW.

### Segment wise connected load and their percentages

Segment	Connected Load in watts
Lighting	49,412
Heating, Ventilation & Air Conditioning	162,740
Office	12,400
Water Supply	8,250
Campus Lighting	1,500
Miscellaneous	22,175

Table 6: Segment wise connected load and their percentages

### Graphical Representation of Connected Load

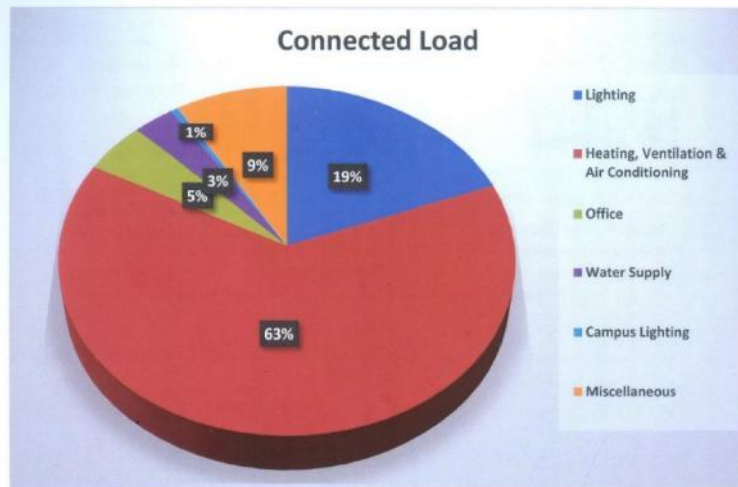


Figure 2: Total Connected Load

The maximum share of connected load is HVAC i.e. 45%

### Solar Roof Top Grid Connected Solar Power Plant

In a solar rooftop system, the solar panels are installed in the roof of any residential, institutional, social, Government, commercial, industrial buildings etc. This can be of two types

## Criterion 7

### QnM 7.1.3 Quality Audits



a) Solar Rooftop System with storage facility using battery,

b) Grid Connected Solar Rooftop System.

The Christian College of Engineering & Technology, Bhilai is commissioning grid connected solar power plant. In grid connected rooftop or small SPV system, the DC power generated from SPV panel is converted to AC power using power conditioning unit/Inverter and is fed to the grid either of 440/220 Volt three/single phase line or of 33 kV/11 kV three phase lines depending on the capacity of the system installed at residential, institution/commercial establishment and the regulatory framework specified for respective States. These systems generate power during the day time which is utilized by powering captive loads and feed excess power to the grid as long as grid is available. In case, where solar power is not sufficient due to cloud cover etc., the captive loads are served by drawing balance power from the grid.

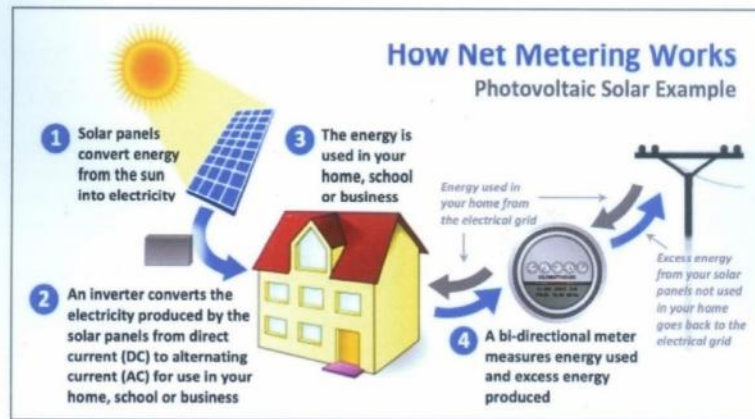


Figure 72 : How Net Metering works

#### Main components of Solar rooftop system

- Solar PV Modules/Solar Panels – The Solar PV modules/Solar Panels convert solar energy to electrical energy. They are available in different technologies such as crystalline, thin film, CIGS, CdTe, HIT, etc. Crystalline Solar PV panels are most common in use on roof tops.
- Inverter – Inverter converts DC output of Solar PV panels into AC power.
- Mounting structure – The mounting structure, is the support structure that holds the Solar PV panels
- Balance of System – These consist of cables, switchboards, junction boxes, meters, structures, tracking system (if required), earthing system, circuit breaker, fuses etc.

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### A view of installed solar PV module at CCET, Bhilai



Solar PV Modules installed at rooftop of college

#### **CAPEX Model:**

Here, the entire system is owned by the rooftop owners and he bears the cost of the solar system. Responsibility of O&M for the system lifetime (25 years) is also with the rooftop owner. Developer is responsible for installing the system and initial 2 years O&M and five years warranty.

#### **RESCO Model:**

Here, the entire system is owned by the developer. Responsibility of O&M for the system lifetime (say about 25 years) is also with the developer. Rooftop owners may consume the electricity generated, for which they have to pay a predecided tariff on a monthly basis. Excess generation may be exported to the grid, subject to availability of requisite state regulations.

For consumers that have adequate manpower/expertise for O&M, rooftop access concerns, availability of funds upfront, CAPEX model is better. Consumers in states that have net metering regulations can take benefit of the same in case they have substantial excess generation. On the other hand, consumers who prefer not to take responsibility for the system O&M, do not have rooftop security concerns and prefer to pay on a monthly basis rather than bulk upfront payment may choose to go for RESCO model.

#### **Net Metering**

The grid connected rooftop system can work on net metering basis wherein the beneficiary pays to the utility on net meter reading basis only. Alternatively, two meters can also be installed to measure the export and import of power separately. The mechanism based on gross metering at mutually agreed tariff can also be adopted.

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### 8.5 Percentage of annual power requirement of the Institution met by the renewable energy sources.

The solar power plant of 85 KWp capacity will generate electric power in coming months. The contract demand is 240 KVA.

Total Contract Demand in KW	240
Capacity of Solar Power Plant	85
Percentage of annual power requirement of the Institution met by the renewable energy sources.	35.00%

Table 7: Percentage of annual power requirement of the Institution met by the renewable energy sources.

Thus, the college will contribute about 35% of its annual power requirement of the institution by the solar energy.

### Graphical Representation of Percentage of annual power requirement of the Institution met by the renewable energy sources.

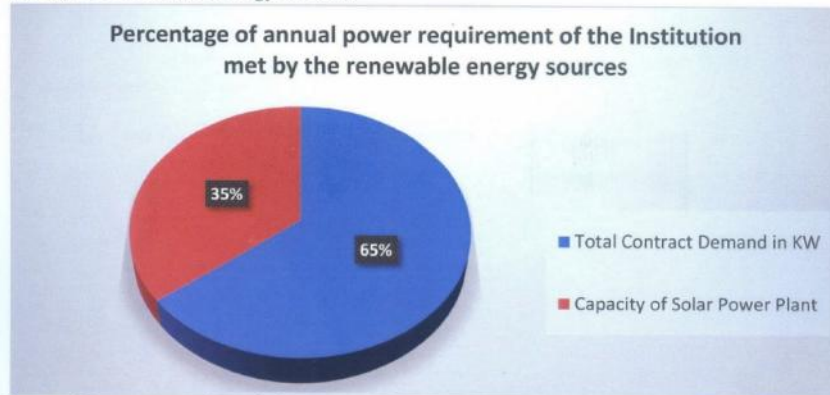


Figure 3: Percentage of annual power requirement of the Institution met by the renewable energy sources.

### 8.6 Percentage of annual lighting power requirements met through LED bulbs.

Total Load of Conventional light	47,552 Watts
Total Load of Energy Efficient LED lights	3360 Watts
Total Load	50,912 Watts

Table 8 : Percentage of annual lighting power requirements met through LED bulbs



### Graphical Representation of Percentage of annual lighting power requirements met through LED bulbs

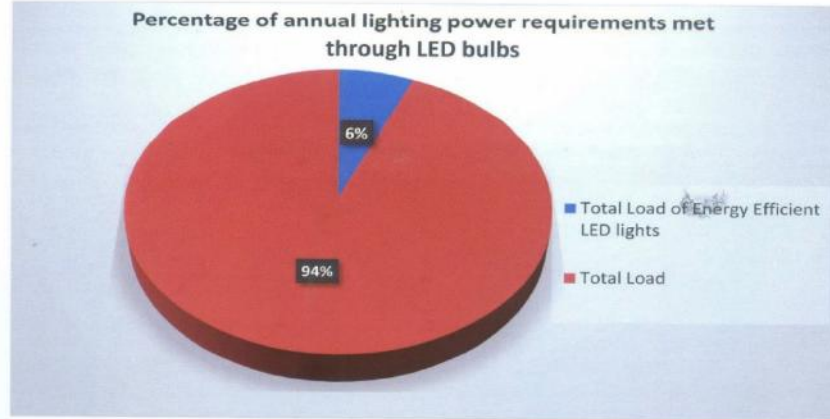


Figure 4 : Graphical Representation of Percentage of annual lighting power requirements met through LED bulbs

Thus, LED lighting covers 6% of total lighting power requirement.

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## 8.7 College Activities in Energy Management

Christian College of Engineering and Technology (CCET), Bhilai in collaboration with Chhattisgarh Swami Vivekananda Technological Institute College and CREDA Raipur celebrated the National Energy Conservation Day on 14<sup>th</sup> Dec 2022.

National Energy Conservation Day program at CCET

The poster features logos of CCET, Chhattisgarh Swami Vivekananda Technological Institute, and CREDA. The main text reads: "National Energy Conservation Day 14th December 2022 Organized By Chhattisgarh Swami Vivekanand Technical University, Bhilai & CREDA, Raipur". It lists events: Expert Lecture, Poster Making Competition, and Essay Competition. It is conducted by CCET, Christian College of Engineering And Technology, Bhilai. A small slogan "Think. Act. Save." is also present.

A collage of four photographs showing the event: a vertical banner, a speaker at a podium, a presentation slide on a screen, and an audience seated at tables in a hall.





Events conducted include Expert Lecture, Poster Making Competition and Essay competition. Theme for the event was Energy Conservation and sustainable development. This event helped to understand and educate students on the value of renewable energy and environmental protection and to give them useful advice and solutions for the conservation of energy sources and to preserve for future.

The program started with lamp lighting and welcome of the guest for the session by Dr Archana Choudhary, Vice Principal CCET. She emphasised that In today's world energy is not only in the future but it drives everything in the present. Expert Lecture on Energy Conservation and sustainable development was delivered by Dr. R.P. Dewangan, Ex.DGM, (Retd), Town Services, BSP, Chairman Water Cell, CSVTU Bhilai. Speaker elaborated the importance of Sustainable development, how the development should meet the needs of the present without compromising the future generation's needs.



and students attended the session.

The way to conserve energy was given thrust in his lecture. The useful ways such as to turn off light when not in use, Use LED lights switch off the electrical appliances, reduce water consumption, use solar powered devices, to unplug the devices when not in use was explained in detail. Water conservation technique was also discussed with focus on Rain water harvesting was discussed.

Poster Making Competition and Essay competition was also conducted to mark the celebration of the National Energy Conservation Day.



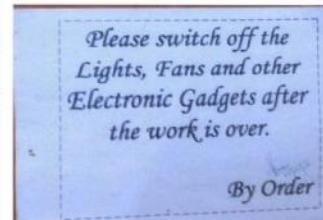
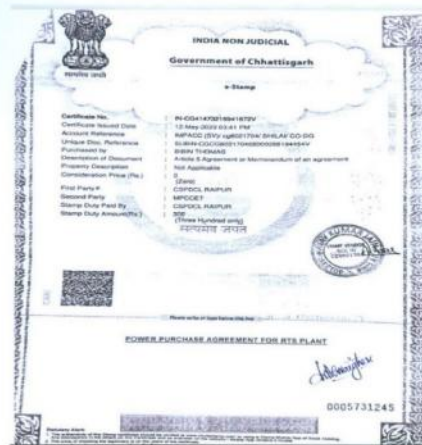
Prizes in the form of solar related items and certificates for the winners of both the event were distributed in the valedictory program. Program coordinator Dr. Preeti Nand Kumar presented the mementoes to Judges for the event and proposed vote of thanks to the faculties and Students. Students of all semester have actively participated in the events and they were delighted to receive the gifts along with certificates.



## 2) Commissioning of Grid Connected Solar Power Plant

Christian College of Engineering & Technology is commissioning a grid connected solar power plant of 85 KW capacity. The electricity generation of solar power plant will be purchased by

Chhattisgarh State Power Distribution Corporation Limited. is principally agreed for installation of solar power plant. A memorandum of Power Purchase Agreement is signed with Chhattisgarh State Power Distribution Corporation Limited.







## 8.8 Recommendations

### 1. Replacement of conventional 40-watt tube light with 20-watt LED tube light

We suggest to replace all the conventional tube light with energy efficient tube light. The LED lights have better luminous efficacy and consume less watts as compared to conventional tube light.

Wattage of Conventional Tube light including choke [a]	50
Wattage of LED tube light [b]	20
Saving in wattage [c] = [b] - [a]	30
Quantity of Conventional tube light [d]	1169
Total Operating hours [e]	905
Diversity Factor [f]	0.4
Annual saving in unit consumption [g] = [c]x[d]x[e]x[f]	12,695
Energy Cost in Rs. Per unit [i]	12.75
Total annual monetary saving in Rs. [j] = [h]*[i]	1,61,861
Price of one LED 20-Watt tube light [k]	220
Total Investment in Rs. [l]=[d]x[k]	2,57,180
Simple Payback period [m]=[l]x12/[j]	19

The total investment is about Rs. 2,57,180 and simple payback period is 19 months.

### 2. Formation of ENCON Club:

We recommend to formation of the ENCON Club in Christian College of Engineering & Technology, Bhilai for spreading awareness on the importance of energy conservation. ENCON Club will participate in all energy conservation activities and organize program with the support of Chhattisgarh State Renewable Energy Development Agency, (CREDA) Raipur and Bureau of Energy Efficiency,(BEE) New Delhi.

Every year, India observes National Energy Conservation on December 14. The day is organized by the Bureau of Energy Efficiency (BEE) – which operates under the Ministry of Power, aiming to present India's stellar achievements in cost-efficient energy





production and resource conservation. ENCON Club will celebrate "Energy Conservation Day" on 14th December, each year. Further plans may be discussed on this day, targeting holistic development as the main goal towards mitigation of climate change. It would not only help in imparting knowledge on energy efficiency but also in its implementation in households and institutions.

**Objective of ENCON Club**

The objective of the club is to create awareness among the students, staff and teachers and equip them for efficient management of all forms of energy, to promote energy efficiency and energy conservation. The club will keen to spread "Energy Conservation Messages" in the society by conducting awareness programmes to students and public.

**3. Reduction of contract demand from 220 KVA to 100 KVA.**

We have analyzed the electricity bill of last one year, and noted that the average maximum demand of CCET is 70 KVA and maximum of monthly demand was 93 KVA in the month of November 2022.

If similar type of load pattern will be followed in coming years and, then it is recommended to reduce the contract load up to 100 KVA.

Present Contract Demand in KVA	240
Minimum Chargeable demand (80%) of present contract demand in KVA	192
Recommended maximum demand in KVA	100
Minimum Chargeable demand (80%) of suggested contract demand in KVA	90
Saving in demand in KVA	102
Demand Charge in Rs. Per KVA	190
Annual Saving in Rs.	2,32,560

The total saving of this recommendation is Rs. 2,32,560

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If You Are High, We Provide The Means

# Water Management

- Auditing for Water Management of the institute for Environmental Consciousness and Sustainability
- Rain water harvesting structures and utilization in the campus

## Criterion 7

### QnM 7.1.3 Quality Audits



## 9. WATER MANAGEMENT

This indicator addresses water consumption, water sources, irrigation, storm water, appliances, and fixtures. Aquifer depletion and water contamination are taking place at unprecedented rates. It is therefore essential that any environmentally responsible institution should examine its water use practices.

Forty per cent shortfall in freshwater resources by 2030 coupled with a burgeoning world population—according to current estimates—has the world careening towards a global water crisis. Recognizing the growing challenge, the UN General Assembly launched the Water Action Decade—officially the International Decade for Action “Water for Sustainable Development”—on 22 March 2018, to mobilize action that will help transform how we manage water.

The new Decade will focus on the sustainable development and integrated management of water resources for the achievement of social, economic, and environmental objectives and on the implementation and promotion of related programmes and projects, as well as on the furtherance of cooperation and partnership at all levels in order to help to achieve internationally agreed water-related goals and targets, including those contained in the 2030 Agenda for Sustainable Development.

Christian College of Engineering & Technology, Durg gets water from three ground water bore wells sources. Three submersible pumps, in which two pumps having rating of 3 HP & one pump having 5 HP capacity are operated to lift water from bore well to overhead water tanks. Thus, college have total 36000 liter of water storage capacity.

Capacity of Water tank (Block B) in liter	30,000
Capacity of Water tank (Girls Hostel) in liter	4,000
Capacity of Water tank for boys hostel in liter	4,000
Total water storage capacity in liter	38,000

Table 9: water storage capacity of water tanks

### Quantities of water taps

Particulars	Block A	Block B	Workshop	Canteen	Boys hostel	Girl's hostel	Total
Wash Basin tap	14	34	1	1	28	36	114
Toilets	17	27	2	1	24	24	95
Urinals	11	60	1	0	1	0	73
Bathrooms	0	0	0	1	18	43	62

Table 10: Quantities of water taps



**9.1 Water Consumption**

Water Audit at Christian College of Engineering & Technology, Bhilai					
1	2	3	4	5	6
Activity	Average litres of water used per activity in litres	Number of times activity done each day	Total water used by a person each day (litres)	Number of people in the College using water	Water Consumption per day (litres)
<b>College Use</b>					
Wash hands and face	1.5 litre	Once	1.5	200	300
Toilet flush	6 To 21	once	9	160	1440
Drinking (cup)	0.25	Twice	0.5	250	125
Gardening	10000	once			10000
Overflow of water& leakage	150	Twice	300	1	300
Canteen ( Av. For 5 people breakfast/ meal)	2		2	120	240
<b>Total Consumption of water in litre (A)</b>					<b>12,405</b>
<b>Hostel Use</b>					
Overflow of water& leakage	50	Two times	100	1	100
Hostel (Wash hands and face)	1.25 litres	Two times	2	43	86
Hostel (Bath)	60-120	once	90	43	3870
Hostel (Toilet flush)	6 To 21	once	14	43	602
Hostel (Clothes)	15-20	once	16	22	352
Hostel Washing dishes (hand)	1	Two times	2	43	86
Hostel Drinking (cup)	0.25	8 Times	2	43	86
<b>Total Consumption of water in litre (B)</b>					<b>5,182</b>
<b>Average consumption for agriculture &amp; gardening use ( C)</b>					<b>10,000</b>
<b>Total Consumption in college premises (A+ B + C)</b>					<b>27,587</b>

Table 11: Total water consumption in college

**9.2 Rain Water Harvesting System**

Rainwater harvesting is a technology used to collect, convey and store rain water for later use from relatively clean surfaces such as a roof, land surface or rock catchment. RWH is the technique of collecting water from roof, Filtering and storing for further uses. Rainwater Harvesting is a simple

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technique of catching and holding rainwater where it falls. Either, we can store it in tanks for further use or we can use it to recharge groundwater depending upon the situation. RWH system provides sources of soft, high water reduces dependence on well and other sources and in many contexts are cost effective.

### 9.3 Rain Water Harvesting System at Christian College of Engineering & Technology

The college has two rain water harvesting systems. One is for block A and another is for block B.

Details	Dimension in ft.	Capacity in litre
Rain Water Harvesting pit for block B	25' x 12' x 10'	84,950
Rain Water Harvesting pit for block A	20' x 10' x 10'	56,634
Total capacity of rain water harvesting system in litre		1,41,584

Table 12: Capacity of rain water harvesting systems.

Available roof area for rain water harvesting system

Sr. No.	Name of Building	Roof Area in sq. m.
1	Block A	1922
2	Block B	2709
3	Boys Hostel	918
4	Girls Hostel	918
5	Total roof area	6467

Table 13: Area of roof for rain water harvesting system.

### 9.4 Amount of water received through rain

Open roof area (A)	6,467 Sq. Meter
Average rainfall per square meter in Bhilai (B)	1200 mm or 1.20 Meter
Amount of water received through rain (C = A x B)	7,760 Cu. Meter
Run off Coefficient factor through rain (D)	0.80
Total water received (E = C x D)	6,208 Cu. Meter
Total water received in liter	62,08,000 liters

Table 14: Amount of water received through rain

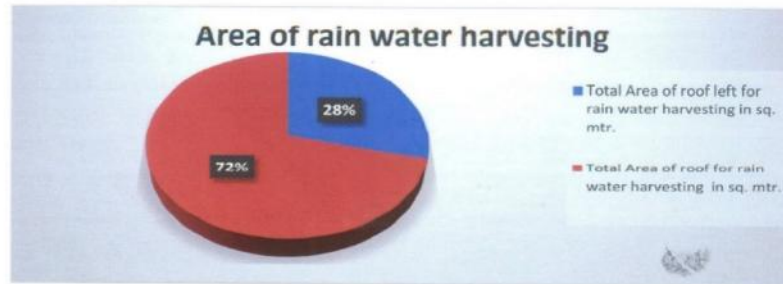


Figure 5: Percentage area of rain water harvesting

## 9.5 Other Activities of College in Water Management

### Waste water Management



Six water purifiers are installed at various sites throughout the college campus. Waste water from these purifier outlets is used to water various indoor and outdoor plants to ensure least water wastage and beautification of the campus.





## 9.6 Recommendations

- 1) Potted plants should be placed below the outlets of Air Conditioners so that the water discharge from these outlets can be utilized properly.
- 2) We have observed that there is no control on overflow of water from the water tank. It is suggested to install an overflow controller for the water tank.



- 3) Rain water harvesting system should be adopted also for boys hostel and girls hostel .



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If You Are High, We Provide The Means

## Waste Management

- Auditing for Waste Management of the institute for Environmental Consciousness and Sustainability.
  
- Waste Management steps including: • Solid waste management • Liquid waste management • E-waste management

### Criterion 7

#### QnM 7.1.3 Quality Audits



## 10. WASTE MANAGEMENT

This indicator addresses waste production and disposal, plastic waste, paper waste, food waste, and recycling. Municipal solid waste has a number of adverse environmental impacts, most of which are well known and not in need of elaboration. To reduce waste at institute, students and staff are educated on proper waste management practices through lectures, advertisement on noticeboards, displaying slogan boards in the campus.

Waste is collected on a daily basis from various sources and is separated as dry and wet waste. Colour coded dustbins should be used for different types of wastes. Green for wet and blue for solid waste.

Daily garbage is collected by housekeeping personnel and handed over to authorized personnel of Municipal Corporation, Durg for further processing.

### 10.1 Solid Waste management

Solid waste can be divided into two categories: general waste and hazardous waste. General waste includes what is usually thrown away in homes and schools such as paper, plastics tins and glass bottles. Hazardous waste is waste, that is likely to be a threat to one's health or the environment like cleaning chemicals and petrol. Small bucket and big buckets are used for solid waste.

Small Plastic bucket = 32 Nos.

Big Plastic Bucket = 10 Nos.

Total Production of Solid Waste (Bio degradable) : 2-4 Kg

Total Production of Solid Waste (Non Bio degradable): Less than 1 Kg.

#### 10.1.1 Non Bio degradable Waste – Plastic Bottles / Waste Paper etc.

- Non- biodegradable are those waste, which cannot be decomposed by biological processes. 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, thermocol, 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.





It is informed by college that waste material like plastic, papers etc. are collected and sold out to scrap vendor from time to time.

#### 10.1.2 Compost Pit

Various waste such as wet waste generated from hostel mess, canteen & Tiffin of students and teachers are used for composting (in composting pit) to form manure and bio fertilizers and further used for organic farming in college campus.



College has a compost pit, but it has to be maintained properly so that it can produce compost manure from the canteen/ mess solid waste and waste from other sources. Manure may be used for the purpose of different gardens and trees.

#### 10.2 Liquid waste management:

The waste chemicals mixed water from laboratory should not be mixed with groundwater. Labs are bringing to adopt fully or to minimize hazardous chemical.

##### **Re-use waste water from purifier**

Impure drinking water is one of the main sources of infection, even mild poisoning, in many cases. Hence, it is important to use water purifiers in college campus. Waste water from these purifier outlets is used to water various indoor and outdoor plants to ensure least water wastage and beautification of the campus.



### 10.3 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 solidwaste 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. Presently, a very small amount of Ewaste from offices and glass waste from labs is generated in College.

The E-waste collected is stored in store room and disposed every year by selling it to vendors., but CCET reuses the old non-working computer by changing some hardware like motherboards, hard disk, processor, SMPS etc. with installing updated software. The total e-waste kept in college is about 70 Kg.

### 10.4 Recommendations

#### 1) Re-use of waste water from Air Conditioners

Potted plants have been placed below the outlets of Air Conditioners so that the water discharge from these outlets can be utilized properly.

#### 2) Proper maintenance of Compost pit

The compost pit should be properly maintained. To maintain it, standard of procedures should be adopted. It must be protected from rain. Efforts should be taken to produce compost manure from the canteen/mess solid waste and waste from other sources .The manure may be used for the purpose of garden as well or for planted tree.

## Criterion 7

### QnM 7.1.3 Quality Audits



# Green Audit

- Green Campus Management and Carbon Footprint of the institute for Environmental Consciousness and Sustainability.
- Green Practices
  - Students, staff using a) Bicycles b) Public Transport
  - c) Pedestrian friendly roads
- Plastic-free campus
- Paperless office
- Green landscaping with trees and plants

## Criterion 7

### QnM 7.1.3 Quality Audits





## 11. GREEN CAMPUS MANAGEMENT

All plant and animal species - including humans - are linked together in a complex web of life; we depend upon biodiversity for our survival. Biodiversity is the key to healthy ecosystems and ultimately a healthy planet. It keeps the air and water clean, regulates our climate and provides us food, shelter, clothing, medicine and other useful products. Each part within this complex web diminishes a little when one part weakens or disappears.



The trees work hard to keep the air we breathe clean and healthy. They are like sponges. Their leaves take in much of the poisonous unwanted carbon dioxide in the air, and replace it with the oxygen we need for healthy living. This system of absorbing gases on which all plants rely for their food is called photosynthesis. In this process, the plants with the help of sunlight, water, minerals, and the green material called Chlorophyll within the leaves change the carbon-dioxide into food for themselves. When doing this they release oxygen into the air which is vital for all life on earth. At night when there is no sunlight the plant no longer makes food, so it does not release the same amount of oxygen.





One is often told not to sleep with plants in one's room, as they will use up all the oxygen. However, at night although photosynthesis does take place the plants also rest, so that little oxygen is absorbed from the air and very little harm can be done to the ones sleeping in the room.



The roots of trees dig deep into the earth and hold it together so that the rain and wind cannot wash or blow it away. This is very important as the earth has only a very thin layer (seldom more than one foot) of fertile soil covering it. If this is washed, blown, or worn away leaving rock or sand on which no plants can grow then the earth would become a desert. The removal of this top-soil is called soil erosion. Scientists, all over the world are trying to find ways to prevent soil erosion. One of the most important ways is creating by planting more trees.



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Trees send up water vapour into the atmosphere through their leaves. When this vapour meets the cool air above it turns into drops of water which then fall as rain. They give us beauty, colour and greenery. This is something which we often forget and fail to appreciate. They are the homes of many birds, animals and insects. Each of these is important in maintaining the balance of nature.

#### 11.1 Green Audit

Green Audit defined as documented, verification process of specified environmental activities, events, conditions, management system. Green Audit can create awareness in college staff as well as students which are our responsibility too, to save our environment and also can find the ways to improve environmental issues which are increasing day by day. Environmental problems such as recycling of waste, water conservation and recycling, pollution control, plantation, biodiversity conservation etc. can solve through Green Auditing. Good growth come from good education as well as good mental and physical health if we protect our environment, we can also protect our health.

Green Audit means of assessing environmental performance. It is a systematic documented periodic, and objective review by regulated entities of facility operations and practices related to meeting environmental requirement. It is otherwise the systematic examination of the interactions between any operation and its surroundings. This includes all emissions to air, land and water, legal constraints, the effects on the neighbouring community, landscape and ecology, the public's perception of the operating company in the local area. Green audit does not stop all compliance with legislation. Nor is it a 'green washing' public relations exercise. Rather it is a total strategic approach to the organization's activities.

#### VISION

To empower the youth, especially belonging to the underprivileged sections of society, through quality education by inculcating philanthropic values and enabling them to meet the challenges of the contemporary knowledge society.

#### MISSION

To translate the vision into reality the institution is committed to -

- Embrace in its fold students from all sections and categories especially addressing to the needs of the first generations learner.
- Expose the students (especially the under-privileged ones) to variety of activities, academic and extra-academic, aiming at their overall development.

## Criterion 7

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- Inculcate humanistic and social values in the students to motivate them towards community services.
- Kindle the entrepreneurial spirit in students.
- Inspire the young minds to develop the habits of critical thinking to achieve Creative Excellence.
- Promote quality research among the teachers and students.
- Sensitize the students on issues relating to ecology, environment, human rights and gender equality.
- Foster global competencies.

### 11.2 Green Campus Policy of College

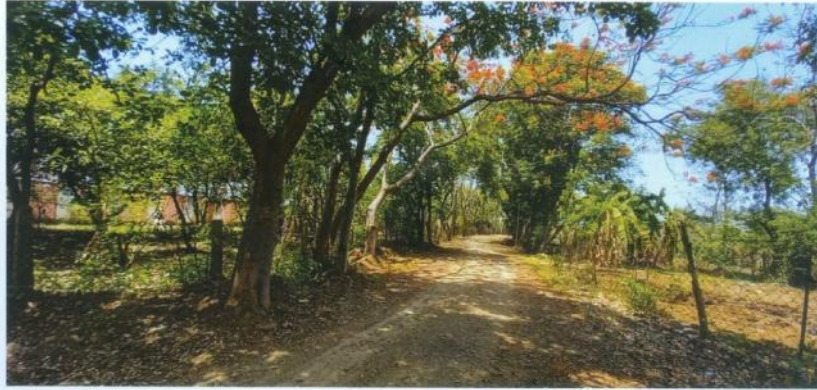
CCET, Bhilai is committed to develop its campuses as places where education is combined with environmental friendly practices to promote Sustainable Development by a restricted entry of automobiles, promoting the use of Bicycles and provision of Pedestrian Friendly pathways a ban on use of disposable Plastics in line with the State Government Guidelines. creating awareness with stakeholders on the need for maintaining greenery in the campus for sustainable ambience.



encouraging all stakeholders to support and participate in ensuring green cover in the campus. a preserving age old trees and protect them to have prolonged life. enhancement of green cover by landscaping with trees and plants. conduct of green audit at regular intervals and implement the suggestions towards creating green campus. The faculty, staff and students are encouraged to contribute collectively to develop an eco-friendly sustainable campus and disseminate the concept of eco-friendly culture to the nearby community and wherever possible.

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Christian College of Engineering & Technology, Bhilai envisions a clean and green college campus where ecological friendly practices and education combine to encourage sustainable and eco- friendly systems in the campus and beyond the campus. The green campus offers the organization a prospect to take the lead in redefining its green culture through promoting environmental ethics among students and staff. The Institute also promotes clean and green campus through adopting, practicing and promoting environmentally friendly practices among students and staff to generate Eco consciousness among them and in the world around them.



**Objectives of the policy:** To compose students by understanding the importance of environment and its problem areas important function of the policy .

- To train students to create responsiveness amongst public.
- To encourage students to keep environment safe and clean.

## Criterion 7

### QnM 7.1.3 Quality Audits





- To encourage students to adopt environment friendly practices which include paper bags, save .
- To help the students to minimize the use of polluting product.

Particulars of Flora	Numbers
Full grown Tree	675
Semi Grown Tree	250
Quarter grown plants	128

Table 15: Type and quantity of flora

### 11.3 Carbon Footprint

A carbon footprint is the amount of greenhouse gases—primarily carbon dioxide—released into the atmosphere by an individual, event, organization, service, or product, expressed as carbon dioxide equivalent. In addition to the water, waste, energy and biodiversity audits we can also determine what our carbon footprint is, based on the amount of carbon emissions created. The release of carbon dioxide gas into the Earth's atmosphere through human activities is commonly known as carbon emissions.

An important aspect of doing an audit is to be able to measure our impact so that we can determine better ways to manage the impact. In addition to the water, waste, energy and biodiversity audits we can also determine what our carbon footprint is, based on the amount of carbon emissions created.

A) The following activities are responsible for carbon emission: -

- Transportation
- Electricity purchased from Distribution companies.
- Firewood

## Criterion 7

### QnM 7.1.3 Quality Audits



**11.3.1 Carbon Emission by Transportation**

Principal, Administrator, teaching & non-teaching staff and students comes to college either by two wheelers & fourwheelers. The two major fuels used by the transport sector are petrol and diesel. These fuels are carbon intensive as they contain 80-85% of carbon by weight.

Particulars	Mode of conveyance	Average Number	A Nos. of vehicles used	B Total mileage	C Average distance in KM	D=C/B Fuel Consumed per Day per Vehicle in ltr	E Total working days	F=E x D Fuel Consumption Per Vehicle in a year	G Emission factor	H=G x F x A Total emission by college students/faculty
Students	On foot	40			2	0				
	Bicycle	15			10	0				
Students	Two-Wheeler	130	100	40	10	0.25	180	45	2.67	12015
	Two-Wheeler	40	30	40	16	0.4	180	72	2.67	5767
Supporting Staff	On foot	5								
	Bicycle	1								
Supporting Staff	Car	3	3	20	30	1.5	180	270	2.67	2163
	Two Wheeler	10	10	40	6	0.15	180	27	2.67	721
Teaching Staff	Two Wheeler	5	5	40	14	0.35	180	63	2.67	841
	Two Wheeler	14	14	40	30	0.75	180	135	2.67	5046
Non-teaching staff	Two Wheeler	9	9	40	20	0.5	180	90	2.67	2163
										28716

Total Co2 emission in KgCo2 eq per Year

Table 16: Carbon emission by transport



Thus, total emission by the transport is 28,716 KgCO<sub>2</sub> eq. Per year

### 11.3.2 Carbon Emission by Electricity

Electricity is taken by grid which uses coal for generating electricity or DG set which uses diesel for electricity generation.

Parameter	Emission Factor (A)	Unit in KWH (B)	Total emission (C=A x B)
Grid Electricity	0.82	1,76,004	144,323
<b>Total KgCO<sub>2</sub>Eq. Emission by Electricity</b>			<b>144,323</b>

Table 17: Carbon Emission by Electricity

Thus, total carbon emission by purchased electricity is 1,44,323 KgCO<sub>2</sub>Eq.

### 11.3.3 Carbon emission by firewood & LPG

It is estimated that about 1200 Kg of firewood is required in the hostel mess. Burning of 1 Kg wood produces 1.70 Kg of CO<sub>2</sub>. Hence, total 2,040 Kg CO<sub>2</sub>eq. is produced.

Parameter	Emission Factor (A)	Total LPG consumed in KG (B)	Total emission (C= A x B)
LPG 19 Kg Cylinder- 24 Nos	0.2983	456	136
<b>Total CO<sub>2</sub> Emission by cooking</b>			<b>136</b>

Table 18: Carbon emission by burning of wood & LPG in hostel mess

Thus, total carbon emission in cooking is about 2,176 Kg CO<sub>2</sub>eq.

**Total Carbon dioxide emission at Christian College of Engineering & Technology , Durg**

Area	CO <sub>2</sub> eq. emission in KG
Transport	28,716
Electricity	144,323
Cooking	2,176
<b>Total</b>	<b>1,75,215</b>

Table 19: Total Carbon dioxide emission at Christian College of Engineering & Technology

### 11.4 Reduction of Carbon Emission

The following installation /activity is responsible for reduction in carbon emission

- Grid connected Solar Power Plant of 85 KW Capacity
- Composting
- Tree plantation



#### 11.4.1 Reduction of Carbon Emission by Solar Power Plant

The commissioning of solar power plant is under process. After generating power by solar, there will be reduction in purchasing from electricity distribution companies. Thus, there will be reduction of coal consumption, which causes carbon dioxide emission.

#### 11.4.2 Reduction of Carbon Emission due to absorption of CO<sub>2</sub> by Tree Plantation

Planting is a great way to help sequester carbon emissions. Through photosynthesis trees absorb carbon dioxide to produce oxygen, food and wood.

Particulars of Flora	Numbers (A)	Carbon absorption in Kg by one tree Per year (B)	Total Carbon Di Oxide in Kg (AxB)	Oxygen Production by one tree Per year (D)	Total Oxygen produced in Kg (AxD)
Full grown Tree	670	21	14070	117.6	78792
Semi Grown Tree	560	9	5040	58.8	8467
Quarter grown plants	1600	3	4800	29.4	6527
Total			23,910		93,786

Table 20: Carbon absorption by tree plantation.





## 11.5 Activity of College



“TREE PLANTATION” campaign was organized on 17th August 2022 commemorating the “AAZADI KA AMRIT MAHOTSAV”. The program was conducted under the guidance of Administrative Coordinator Rev. Fr. Phillip Kuruvilla and Principal Dr. Dipali Soren. All the staff members including technical, non-technical, admin and library staff along with the students have contributed their best in the campaign to make it a successful one. The program was organized by NSS, CCET and coordinated by Prashant Bawaney and Richa Sahu.



## Criterion 7

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## 12 General Recommendation for Energy Saving in Office Equipment

Equipment	Wattage	Comments
CRT Monitor	100 120W (During operating condition)	CRT monitors consume a lot of power, much of which is wasted as heat, and represent the largest power consumption component in a typical desktop computer. Emit potentially harmful radiation. Fortunately, most CRT monitors these days are legacy equipment as new computers are generally supplied with LCD monitors. Unfortunately, most CRT monitors end up in landfill.
Desktop Computer	150W (During operating condition)	Power consumption will differ significantly depending on whether a CRT or LCD monitor is used. In home and office situations where it is necessary to run multiple desktop computers, it may be possible to make significant power savings by running a single terminal server computer with several LCD monitors and keyboards attached. Terminal server computers can also greatly simplify network management, software upgrades, etc
Photocopier	7-30W (Sl. Mode) 40-300W (Standby) 200-1300W (op. Condition)	Most of the energy used in a photocopier is consumed by the hot rollers, which are usually kept hot on stand-by, consuming from 40-300W. Significant energy savings (40% to 60%) can be made by ensuring that photocopiers are switched off at night and on weekends. Some photocopiers consume up to 30 watts even when switched off, so photocopiers should be switched off at the power outlet to ensure they are really "off".
LCD Monitor	30-50W (During operating condition)	LCD monitors typically require about 30% of the power required for a CRT monitor with the same screen area. In addition, the amount of heat generated by an LCD monitor is considerably less than a CRT monitor, resulting in a lower load on ACs. Building cooling needs may be decreased by up to 20%.

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Inkjet Printer	120W (During operating condition)	Inkjet printers use relatively little power in comparison to laser printers. From an energy consumption point of view, inkjets are preferable to lasers. Unfortunately, they typically cost more to un on a cost -Per -print basis and sometimes produce less than optimum results.
Laser Printer	25-80W (Standby) 150-1100W (During operating condition)	Laser printers consume significant amounts of power even when in standby mode. Over the course of an 8-10 hr working day, a laser printer could consume around 1kWh of energy. On the other hand, laser printers are cheaper to run on a cost -per page basis and generally produce better results. Both the number of laser printers used, and the number of hours the are operated for, should be minimized. As with printing of any kind, office procedures should be developed which minimize the need for printing to paper.
Laptop Computer	15-40 W (During operating condition)	Laptop computer power consumption is typically 10% to 25% of that of a desktop computer. In situations such as an office or home office, where computers may operate for 8 to 10 hours a day, this difference is significant and could represent an energy saving of up to 1kWh per day.

Table 37: General Recommendation for Energy Saving in Office Equipment

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# INSTITUTE POLICIES

**Criterion 7**

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## ENERGY POLICY

### PREAMBLE

Energy is now a vital part of everyday life. With a population of 1.4 billion and one of the world's fastest-growing major economies, India will be a bulk consumer the global energy markets. Based on current policies, India's energy demand could double by 2040, with electricity demand potentially tripling as a result of increased appliance ownership and cooling needs. (*India 2020 – IEA Analysis-Energy Policy Review*). As per the Environment Policy 2020 of AICTE, that sets long term goals for educational institutes to conserve natural environment, develop sustainable solutions and control energy consumption, an educational institution has to evolve programs and policies that turns the institute into a carbon-negative institute and promote in educating students and employees on environmental concerns and sustainability, be responsive to the emerging challenges in the Energy sector and Sustainable development of the State and Country. So, it is essential for the educational community to practice sustainable energy that will provide favorable effect on the eco-system.

The Energy Policy of the Institution will thus be effective in organizing structured programs to promote awareness on the proper management and conservation of energy those models resource- efficient and low-carbon campuses that demonstrate practice for sustainability.

### FEATURES IN THE CAMPUS:

1. KSEB fed 11 KV Substation.
2. Grid connected Solar Plant
3. PF Improvement Equipment
4. 100% Power Backup – DG Set and Solar Plant
5. LED Light fixtures.
6. Effective peak load management
7. Repair, Re-use and frequent maintenance of equipment to ensure sustainable longevity.
8. Effective maintenances through annual maintenance. Contracts to increase reliability.

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## ENERGY POLICY STATEMENT

Continuation Sheet

The CCET energy policy articulates commitment of the Institution to the conservation of energy by defining energy management protocol for thermal and electrical energy systems of the institution, focusing on sustainable practices in reducing carbon footprint and other environmental impacts as per the norms of Energy Conservation and Management, for maintaining an eco- friendly green campus.

### 2. OBJECTIVES

- Utilize energy resources efficiently by introducing innovative technologies
- Use of renewable energy.
- Optimize the Energy consumption and cost.
- Reduce, Reuse and Recycle.
- Carry out regular internal energy audits to identify energy conservation opportunities.
- Regular monitoring and follow up procedures managed by the Institution Energy Audit/Management Cell for effective implementation at department levels.
- Train faculty, non-teaching staff, students and housekeeping staff to make the Institute a role model in the area of Energy conservation.
- Encourage faculty members to obtain certification as Certified Energy Auditors and Managers.
- Establish ties with Industries and conduct a complete Energy Audit.
- Promote awareness related with Energy conservation among various sections of society.
- Review the Policy on a regular basis.

### 3. RESPONSIBILITIES AND ROLES

Sn	Name of Committee member	Designation
01	Dr Dipali Soren	Principal
02	Dr Dillip Dash	Professor
03	Dr S S Bishoyi	IQAC Coordinator
04	Mr R Bobby	Technical Staff
05	Mr Ajay	Housekeeping Staff

The team should carry out the action plan and ensure the energy resources are made available and utilized optimally.

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## ACTION PLAN

**Energy Optimization Plan**

1. Restructuring the Energy Management Cell with representatives from all Departments, for effective implementation of Energy management program.
2. Regular Monitoring and benchmarking resource use and waste generation.
3. Monitor and evaluate the energy performance levels
4. Setting short term and long term targets and conservation strategies, to achieve and surpass goals for zero-carbon Campus.
5. Use of energy efficient, star labeled equipment.
6. Periodic maintenance and replacement of other lights/lighting fixtures to LED.
7. Maintaining a sustainable approach by use of existing equipment efficiently till its life cycle ends, and replacing with more efficient equipment when necessary.
8. Reduce e-waste to maximum with proper maintenance, before moving on to Replace & Recycle stage.
9. Maximum use of Daylight for Indoor illumination and natural ventilation.
10. Use of occupancy sensors for classrooms, halls, administrative offices, restrooms and sensor-based switches for streetlights, corridor lighting to optimize energy use.
11. Fine tuning of optimum temperature setting of Air Conditioners and Water coolers.
12. Maximize use of Renewable Energy – Grid Interactive Solar PV System installed in the Campus.
13. Maximum demand optimization by adequate reactive power management
14. Encourage students to undertake UG and PG projects on Energy Management, Energy optimization techniques, Renewable Energy Harvesting thereby promoting a sense of awareness towards Energy use and its cost.
15. Provide training for faculty and students about Energy Management, Energy Auditing.
16. Include Project learning strategies for Energy Conservation and Energy management courses in the curriculum in tie up with Industries.

## 5. MECHANISM OF ACTION PLAN

The Energy Management Cell should lay down well-defined procedures as mentioned below, that follows the indicated stages.

- i. Create Energy Baseline Assessment
- ii. Define the Energy Agenda of the Academic year
- iii. Create Implementation guidelines
- iv. Review: Monitoring and follow-up

Continuation Sheet

  
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## ENVIRONMENT POLICY DOCUMENT

### Preamble

Environment being the basis of life its conservation is an indispensable aspect of education. Future Technologies should emphasize the dependence between technology and nature. Proper Environment Management is essential for sustainable development and the Environment Policy is designed in tune with the United Nation's Sustainable Development Goals 2030, realizing that protection of Environment is part of the Institution at social Responsibility for the survival of humanity. This document through the policy Statement makes clear the Institution's approach to Environment protection which will be ensured through the Environment Audit which is defined as a tool comprising a systematic, documented, periodic and objective evaluation of how well environmental organization, management and equipment are performing with the aim of safeguarding the environment and natural resources" in the functioning of the Institution and dissemination of Knowledge

Besides initiatives for Environment Protection, the Environment Policy includes Energy Management, Waste Management and Water Management which are dealt with separately taking into account the importance of each, and policies and procedures have been formulated for these topics.

### POLICY STATEMENT

CCET avows to protect the Environment by maintaining a Green, Eco-friendly campus, and by creating an awareness among it's stakeholders both as individuals and members of the society.

### OBJECTIVES

- Promoting & Benchmarking for environmental protection initiatives
- To encourage projects on environmental assessment
- To impart awareness about green clean campus
- To initiate sustainability practices in the campus and among stakeholders
- Friendly initiatives (clean fuel, renewable resource etc.)

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## Criterion 7

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Continuation Sheet

Reduction in resource use

- Curriculum enrichment through practical experience
- Development of ownership, personal and social responsibility for the CCET campus and its environment
- Enhancement/updating of Institution profile
- Developing an environmental ethic and value systems in young people
- Conduct audits for recommendations and continuous improvement
- Teach sustainable development across all disciplines of study.
- Encourage research and dissemination of sustainable development knowledge.
- Green campuses and support local sustainability efforts
- Engage and share information with international networks.
- Introduce carbon neutrality measures

## PROCEDURE / ORGANIZATION STRUCTURE

Sn	Name of Committee member	Designation
01	Dr Dipali Soren	Principal
02	Dr Dillip Dash	Professor
03	Dr S S Bishoyi	IQAC Coordinator
04	Mr R Bobby	Technical Staff
05	Mr Ajay	Housekeeping Staff

Suggested mode of Implementation: Each floor in every block will be assigned to a lab staff so that quantification of reusable resources (plastic wastes pen/pencils etc., papers/assignment books...) can be done. Bi-weekly reporting of lab staff to the concerned department faculty will ensure smooth execution of resource management within the campus.

- Environment Protection and awareness
- Environment Policy to be implemented in the Campus.
- Water Meter should be installed and maintain the inventory of water resource
- Storage of chemicals like; paints, gums resins, oils, lubricants, acids etc. in designated place and display of safety/warning signs.
- Internal inspection system should be developed for various equipments available in campus.
- Waste Management plan should be prepared for the campus.
- Environmental drills for response against spillage and leakage of chemicals in the campus
- Plastic usage can be reduced in college campus.

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The monthly inventory of e-waste is required to be maintained in formats on regular basis.

Implement measures for carbon neutrality.

- Communicate the Environment Policy to all faculties members and staff.
- Form of interest group of students and faculty to follow on nature friendly pursue its and sustainable awareness.
- Environmental Monitoring i.e. (Ambient Air Quality monitoring, Stack Monitoring of DG sets, Water and waste water monitoring need to be conducted by CG State Pollution Control Board.
- E-waste monthly inventory be maintained in the campus as per E waste rules 2016.
- Water Meter should be installed at the institute for monitoring of water consumption per capita.
- Increase in Environmental promotional activities for spreading awareness in the campus.
- Environment/Green committee formation for regulating eco-friendly initiatives in the campus premises and periphery.

#### ACTION PLAN

1. Observation of various days of importance ozone day, environment day, earth day etc
2. Conduct awareness campaign on pollution and preventive measures
3. Conduct regular green/environment audit and follow up corrective measures
4. Ensure regular follow up and updates for clean campus practices like proper waste disposal, e-waste campaigning among stakeholders, rain water harvesting and monitoring judicious water usage
5. Activities encouraging recycling, reuse, repair and refurbishing etc
6. Conduct invited talk (dept/college level on various updates policies and various dimensions of environment studies)
7. Formation/revival of Energy Management Cell (instead of energy audit cell)
8. Monitor Green/renewable Energy initiatives and audits on its maintenance records once a year.

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## WASTE MANAGEMENT POLICY

### Preamble

The educational institutions represent the main components of sustainability promotion in our society. Waste Management is one of the challenges that educational institutions have to face in accomplishing the sustainability goals. In 2016, the Union Ministry of Environment, Forests and Climate Change released the updated Solid Waste Management (SWM) Rules which applies to every Solid Waste generator contributing to Waste generation in the premises.

In recent years, technologies have been developed that not only help in generating substantial quantities of decentralized energy but also in reducing the quantity of Waste for its safe disposal.

### 1 FEATURES IN THE CAMPUS:

1. Biogas plant.
2. Material recovery facility and Incinerator.
3. Paper recycling and reuse by converting to Notepads.
4. Repair, Re-use and frequent maintenance of equipment to ensure sustainable longevity.
5. Waste Segregation using Colour Bins
6. Cast iron Recycling for the scrapiron.
7. E Waste Recycling and management.
8. Sanitary Waste Incinerator.
9. Student Projects on Waste management
10. Awareness programs for Waste management in the campus.

### 2. WASTE MANAGEMENT POLICY STATEMENT

The CCET Waste Management Policy articulates commitment to reducing its environmental impacts through effective Waste Management and sustainable practices in converting Waste to resource. The Campus works to achieve a Zero Waste strategy in

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to achieve its Eco-friendly status through the "reduce, reuse, and recycle" policy.

Continuation Sheet

**3 OBJECTIVES**

- Avoiding and minimising the generation of Waste.
- Reducing, re-using, recycling and recovering Waste.
- Ensure segregation of Waste at the source
- Treating and safely disposing of Waste to reduce the pollution.
- Promoting and ensuring the effective delivery of Waste services.
- Achieving integrated Waste Management reporting and planning.
- Ensure that the stakeholders are aware of the impact of Waste on their health, wellbeing and the environment through Awareness programs
- Increase consumer awareness of Waste minimization issues
- Ensure the protection of the environment through effective Waste Management measures.
- Monitoring and assessments of various Waste management systems in the college.
- Regular monitoring and follow up procedures managed by the Institution Waste Management Cell for effective implementation at department levels.
- Train faculty, non-teaching staff, students and housekeeping staff to make the Institute a role model in the area of Energy conservation.
- Review the Policy on a regular basis.
- Bench mark the Campus using the green norms.

**4 RESPONSIBILITIES AND ROLES**

Sn	Name of Committee member	Designation
01	Dr Dipali Soren	Principal
02	Dr Dilip Dash	Professor
03	Dr S S Bishoyi	IQAC Coordinator
04	Mr R Bobby	Technical Staff
05	Me Ajay	Housekeeping Staff
06		External member





Continuation Sheet

The team should carry out the action plan and ensure the Waste Management strategy is organized and implemented optimally.

#### 5 ACTION PLAN

##### **Waste Management Plan**

1. Constitute the Waste Management Cell with representatives from all Departments, for effective implementation.
2. Regular Monitoring and benchmarking resource use and Waste generation.
3. Quantify, Monitor and Evaluate the Waste generation, disposal and collection system in the Campus, regularly.
4. Setting short term and long term targets and conservation strategies pertaining to the UN Sustainable Goals.
5. Initiate sustainable practices like Composting for Waste, generated from the Canteen.
6. Continue to introduce innovative strategies to reduce paper Waste and plastic Waste in the Campus.
7. Ensure effective disposal methods for Laboratory and Hazardous Wastes generated in the campus.
8. Provide training for faculty, students and staff about Waste Management and practicing Sustainable habits.
9. Include Sustainable Project learning strategies for Waste Management in the curriculum with Industry tieup.
10. Conduct awareness programs on Fire Safety, Occupational Safety and Work Ethics.

#### 6 MECHANISM OF ACTION PLAN

The Waste Management Cell should lay down well-defined procedures as mentioned below, that follows the indicated stages.

- a. Define the Sustainable Goal Agenda of the Academic year pertaining to Waste Management
- b. Create Implementation guidelines
- c. Review: Monitoring and follow-up

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## WATER MANAGEMENT POLICY

### STATEMENT

Water is the fundamental requirement of life. It touches all life activities such as agriculture, domestic and all socio economic activities. The water management policy of CCET includes all the water related field activities. There are more than seven water conservation systems available in the campus which supplies drinking water to a large academic community of the entire Institutions at CCET. A water management policy is required to assure the quality of water distributed from the unique sources of water conservation system at CCET.

### OBJECTIVES

- To provide adequate water supplies to meet demands of the campus.
- To provide clean, safe, reliable drinking water at all times.
- To increase water availability through cycling.
- To provide for ground water recharge while protecting groundwater resources from overdraft
- To protect the groundwater resources from contamination
- To control excessive erosion and manage sedimentation/situation
- To minimize point-source and non-point-source pollution including Chemical effluent.
- To maintain health of watershed vegetation; land cover, natural stream buffers and floodplains, to improve filtration of point and non-point-source pollutants
- To protect, restore, and rehabilitate watershed and bay processes
- To work with local land, water, wastewater and storm water agencies, project proponents and other stakeholders to develop policies, ordinances and programs that promote water management goals and to determine areas of integration

  
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### PROCEDURE

To undertake activities to sensitize people about Climate change.  
Increase water resources related recreational opportunities

Continuation Sheet

1. A team is formed to create and implement the water management policy in the CCET campus. The team should visually inspect all the water conservation system in the campus periodically. This team ensures primarily on the regular monitoring of quality of drinking water, maintenance of water distribution system and effective utilization of the waste water.
2. The water demand, wastage of water and the quantity of the water in the reservoirs should be quantified periodically
3. The layout of water distribution system should be developed. This map will help the team to identify potential hazard condition of the water distribution system. The up-to-date plumbing drawings should be available to assess the performance of plumbing components.
4. New technologies should be developed to protect and restore the water in the reservoirs and to improve the facilities for ground water recharging and waste water recycling.
5. Productive and efficient methods should be implemented to improve the reservoir capacity and drinking water quality and these methods should be monitored and the efficiency should be evaluated.
6. The standard operating procedures should be developed and documented

### ROLES

The Water Management Team comprises of

Sn	Name of Committee member	Designation
01	Dr Dipali Soren	Principal
02	Dr Dilip Dash	Professor
03	Dr S S Bishoyi	IQAC Coordinator
04	Mr R Bobby	Technical Staff
05	Me Ajay	Housekeeping Staff
06		External member

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## Criterion 7

### QnM 7.1.3 Quality Audits





Continuation Sheet

1. Conduct meeting regularly and review the policy
2. Update the maintenance register
3. Conduct the water audit
4. Monitor the water levels of all conservation system
5. Verify the water quality periodically
6. Measures to be taken to improve the water quality
7. Quantify the water demand and wastage of water of all the institutions and hostels.
8. Review of project proposals in the area of water conservation system or waste water recycling which would be beneficial for preserving the water management in the CCET campus.
9. Conduct workshops and seminars for providing the awareness for saving the natural resource and reduce the wastage of water to students and public.

  
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