

**Shri Ramdeobaba College of Engineering and Management  
(RCOEM), Nagpur**

**Energy Audit Report (2022-23)**



**CONDUCTED BY :**

**SHREYAS QUALITY MANAGEMENT SYSTEM,**

**11, Tulsivihar, Abhyankarnagar, Nagpur-440010 (MS)**

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# CERTIFICATE



## Shreyas Quality Management System

(QCI, GOI Approved LQMS, Business Improvement, & Lean Consultancy and ISO 9001 QMS,  
ISO 14001 EMS, ISO 45001 OHSMS & ISO 50001 EnMS Certified Organization)

### ENERGY AUDIT CERTIFICATE

This Certificate has been awarded to

## Shri Ramdeobaba College of Engineering and Management

Ramdeo Tekdi, Katol Road, Gittikhadan,  
Nagpur-4410013. Maharashtra

in recognition of the organization efforts towards environment &  
energy conservation and sustainable development.

SQMS/CERT/ENA/22-23/II/03  
SQMS Certificate No.

10.03.2023  
Expiry Date



11.03.2022  
Date of Issue

-  
Date of Re-Issue

**Dr. R. R. Lakhe(Director)**  
Shreyas Quality Management System

Note: Certificate validity is based on organization compliance on green audit recommendation and continual maintenance of the system and conduction of regular audit.

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## AKNOWLEDMENT

Energy Audit Assessment Team thanks **Shri Ramdeobaba College of Engineering and Management (RCOEM), Nagpur** for assigning this important work of Energy Audit. We appreciate the cooperation extended to our team during the entire process.

Our special thanks are due to Principal – Dr. Rajesh Pande & Team members for giving us necessary inputs to carry out this very vital exercise of Energy Audit.

We are also thankful to Department Heads and other staff members who were actively involved while collecting the data and conducting field measurements.



Dr. R. R. Lakhe Director

Shreyas Quality Management System, Nagpur.



## DISCLAIMER

Energy Audit Team has prepared this report for **Shri Ramdeobaba College of Engineering and Management (RCOEM), Nagpur** based on input data submitted by the representatives of College complemented with the best judgment capacity of the expert team. The audit was conducted on the sample basis by visiting the college and interacting with the various stakeholders. Audit was conducted by interviewing the concerned persons, observing on-site implementation and verifying the documents and records.

While all reasonable care has been taken in its preparation, details contained in this report have been compiled in good faith based on information gathered.

It is further informed that the recommendations are arrived following best judgments and no representation, warranty or undertaking, express or implied is made and no responsibility is accepted by Audit Team in this report or for any direct or consequential loss arising from any use of the information, statements or forecasts in the report.

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## **Executive Summary**

The rapid urbanization and economic development at local, regional and global level has led to depletion of natural energy sources. On this background it becomes essential to adopt the system of the Energy conservation practices on the Campus of the institute which will lead for sustainable development.

Shri Ramdeobaba College of Engineering and Management is deeply concerned and unconditionally believes that there is an urgent need to address these fundamental problems and reverse the trends of pollution. Being a premier institution of higher learning, the college has initiated 'The Green Campus' program two years back and has actively promoted the various projects for the environment protection and sustainability.

The purpose of the audit was to ensure that the practices followed in the campus are in accordance with the Energy Policy adopted by the institution and also following the practices of ISO 50001 EnMS. It works on the several facets of 'Energy Friendly Campus' including adoption of alternative Energy sources. With this in mind, the specific objectives of the audit are to evaluate the adequacy of the management control framework of energy sources sustainability as well as the degree to which the Departments are in compliance with the Energy Policy. It can make a tremendous impact on student health, reducing college operational costs and improvement in the energy performance. The criteria, methods and recommendations used in the audit were based on the identified risks.

### Vision

Shri Ramdeobaba College of Engineering and Management envisage the institute par excellence, providing world class technical and management education.

### Mission

To impart quality education in the field of Engineering and Management and to foster mutually beneficial relationship with industries to create an intellectually stimulating environment for learning, research and for promoting professional and ethical values.

### Quality Policy

Shri Ramdeobaba College of Engineering and Management is committed to achieve exemplary standards in Engineering and Management Education.

We aim at continuous improvement of all our processes and will strive to provide an environment conducive to the pursuit of knowledge and overall personality development.

We encourage all to adhere to the highest ethical standards and professional integrity and aim to enhance the satisfaction level of all stakeholders.





## INTRODUCTION

Energy Audit is a process of systematic identification, quantification, recording, reporting and analysis of components of energy consumption and conservation of various establishments. It aims to analyze energy conservation practices within and outside of the concerned sites, which will have an impact on the eco-friendly ambience. Energy audit can be a useful tool for a college to determine how and where they are using the most energy or water or resources; the college can then consider how to implement changes and make savings. It can also be used to determine the type and volume of waste, which can be used for a recycling project or to improve waste minimization plan. It can create health consciousness and promote environmental awareness, values and ethics. It provides staff and students better understanding of Energy impact on campus. If self-enquiry is a natural and necessary outgrowth of a quality education, it could also be stated that institutional self-enquiry is a natural and necessary outgrowth of a quality educational institution. Thus it is imperative that the college evaluate its own contributions toward a sustainable future. As energy conservation is becoming an increasingly important issue for the nation, the role of higher educational institutions is more prevalent.

A Nation's growth starts from its educational institutions, where the ecology is thought as a prime factor of development associated with environment. Educational institutions now a days are becoming more sensitive to environmental and energy factors and more concepts are being introduced to make them eco-friendly. To preserve the environment within the campus, various viewpoints are applied by the several educational institutes to solve their environmental problems such as promotion of the energy savings, etc.. The activities pursued by colleges can also create a variety of adverse environmental impacts. Energy auditing is a process whereby an organization's energy performance is tested against its environmental policies and objectives. Energy audit is defined as an official examination of the effects a college has on the energy conservation. As a part of such practice, internal



audit is conducted to evaluate the actual scenario at the campus. Energy audit can be a useful tool for a college to determine how and where they are using the most energy or water or resources; the college can then consider how to implement changes and make savings. It can also be used to determine the type and volume of waste, which can be used for a recycling project or to improve waste minimization plan. Energy auditing and the implementation of mitigation measures is a win-win situation for all the college, the learners and the planet. It can also create health consciousness and promote energy conservation awareness, values and ethics. It provides staff and students better understanding impact on campus. Energy auditing promote financial savings through reduction of energy resource use. It gives an opportunity for the development of ownership, personal and social responsibility for the students and teachers. Thus it is imperative that the college evaluate its own contributions toward a sustainable future. As Energy conservation is becoming an increasingly important issue for the nation, the role of higher educational institutions in relation to Energy conservation is more prevalent. Energy conservation effective learning and provides a conducive learning environment. There are various efforts around the world to address energy consumption and conservation related issues. ISO 50001:2018 Energy Management Systems (EnMS) is very popular in the industrial sector, but the general belief is that EnMS is something pertaining to industries only. Other parts of the world have started adopting compatible energy management systems either voluntarily or for promoting standards by external certification.

#### **Goals of Energy audit:**

College has conducted a Energy audit with specific goals as:

1. Identification and documentation of energy saving practices followed by college.
2. Identify strength and weakness in energy saving practices.
3. Conduct a survey to know the ground reality about energy saving practices.
4. Analyze and suggest solution for problems identified from audit.
5. Increase energy saving awareness throughout campus.
6. Identify and assess environmental risk.
7. Motivates staff for optimized sustainable use of available resources.

8. The long term goal of the energy audit program is to collect baseline data of energy parameters and resolve environmental issue before they become problem.

#### **Objectives of the Audit:**

The main objective of the Energy audit is to promote the Energy Management and Conservation in the College Campus. The purpose of the audit is to identify, quantify, describe and prioritize framework of energy conservation in compliance with the applicable regulations, policies and standards. The main objectives of carrying out Energy Audit are:

- To examine the current practices which can impact on energy such as of resource utilization, energy management etc.
- To identify and analyze significant energy issues.
- Setup goal, vision and mission for energy saving practices in campus.
- Establish and implement energy Management in various departments.
- Continuous assessment for betterment in performance in energy saving practices and its evaluation.

To prepare Report on energy saving practices followed by different departments, support services and administration building.

In order to perform Energy audit, the methodology included different tools such as preparation of questionnaire, physical inspection of the campus, observation and review of the documentation, interviewing key persons and data analysis, measurements and recommendations. The study covered the following areas to summarize the present status of energy management in the campus:

#### **• Water management**

- Raw Water
- Drinking Water
- Laboratory Waste Water
- Sewage Water
- Rain Storm Drain Water
- Washroom water
- Water used in Canteen/Mess
- ETP/STP
- Waste water

#### **• Energy Conservation**

- Petrol

- Diesel
- LPG
- Electricity
- Batteries
- Solar Energy

**Review of the Documentation:**

Energy Policy & ISO50001 Energy Management System requirements.

**Interviews:**

Baseline data for Energy Audit report preparation was collected by questioning and visiting the places identified (sample basis). Checklist prepared to conduct the Energy audit in the university campus is based on the guidelines, rules, acts and formats prepared by Ministry of Environment, Forest and Climate Change Energy Management System requirements, Central Pollution Control Board and other statutory organizations. Most of the guidelines and formats are based on broad aspects and some of the issues or formats were not applicable for college campus. Interviews were conducted with the Principal, and also faculties and students.

**Physical Inspection:**

The audit team visited the college to inspect the campus and review energy saving initiatives.

**Auditors for Energy Audit:**



Sr.No.	Name of Auditor	Designation
1	Mr. Jayant Deshpande	Lead Auditor for ISO 14001 EMS , ISO 45001, ISO 9001 & ISO 50001

2	Sayyad Nasir	ISO 14001 EMS/ISO 50001 auditor, Sr. Consultant, SQMS, Certified Energy Auditor from Bureau of Energy Efficiency (BEE)
3	Mr. M. M. Naveed	ISO 14001 EMS ISO 50001 auditor , Sr. Consultant, SQMS Nagpur



### About College:

Shri Ramdeobaba College of Engineering and Management (RCOEM) was established in 1984 by Shri Ramdeobaba Sarvajanik Samiti (SRSS), a trust which has been involved in community service for over four decades. More than 30 years of existence has helped RCOEM grow deep roots and establish a strong foundation in technical education. Journey of a student in this institute has always involved comprehensive knowledge building from practical skills, theoretical knowledge to personality development, which has given them a head-start in their career.

We encourage all to adhere to the highest ethical standards and professional integrity and aim to enhance the satisfaction level of all stakeholders. Autonomy RCOEM was granted progressive academic autonomy from the session 2011-12. Various statutory bodies such as Board of Management, Academic Council, Board of Studies, and Finance Committee have been constituted and an industry need-based syllabus has been introduced.

### No of Branches (18)

Departments • First Year Engineering

- **Applied Sciences & Humanities**

- Chemistry o Humanities
- Mathematics o Physics
- Physical Education

- **Computer Application**

- **Engineering**

- Civil
- Computer Science
- Electrical
- Electronics
- Electronics and Communication
- Electronics Design Technology
- Industrial o Information Technology
- Mechanical

- **Management Technology**

**No of Buildings & its details**

1. Admin Block
2. Mgmt Tech Building
3. Civil Engg
4. IT Block
5. Electrical Block
6. Workshop
7. EN Block
8. First Yr. Block
9. MCA Building
10. Boys Hostel
11. Boys Mess & Gym Area
12. Girls Hostel



Name of the Institute: Shri Ramdeobaba College of Engineering and Management.



- No. of Branches:UG-09, PG: MTech-07, MBA, MCA, MBA (Integrated)
- No. of Students: Intake UG-810, PG-441, Total: 4685
- No. of Faculty Members:279
- No. of Non-Teaching Members:159
- No. of Buildings:12+ 1 Temple+1SubStation
- Total campus area: 44596.35 m<sup>2</sup>
- College building Spread Area: 34011.08 m<sup>2</sup>
- Girls common room: 12

	No. of Student	No. of Teachers	Non-teaching staff
<b>Gents</b>	2872	167	124
<b>Ladies</b>	1813	112	35

**Garbage collection bins:198**

- **Lab:76**
- **Class room:66**
- **Boys class room:3**
- **First aid/Sick room:1**

**Good Points:**

1. College has formed the team of faculty and student as REEF which works to maintain biodiversity on the campus and also participates in preventing pollution in society through various drives.
2. College has installed solar panels and increasing upto its maximum capacity.
3. Energy conservation subject is included in teaching plan.
4. College has developed an Energy Policy.
5. Arranged training program for the staff of the college on Energy.

As a part of the Initiatives the practices followed are:

- 460 kW Roof top PV Solar power plant
- Overall lighting through LED Bulbs in campus
- Student participation in activities announced by AICTE
- Eco –Club , REEF
- Total No. of plant in Campus= 1200

### A. Water Management:



Water which is precious natural national resource available with fixed quantum. The availability of water is decreasing due to increasing population of nation, as per capita availability of utilizable water is going down. Due to ever rising standard of living of people, industrialization, urbanization, demand of fresh water is increasing day by day. The unabated discharge of industrial effluent in the available water bodies is reducing the quality of these ample sources of water continuously. Hence, the national mission on water conservation was declared by **the Hon. Prime Minister Narendra Modi as 'Jal Shakti Abhiyan'** and **appealed to all citizens to collectively** address the problem of water shortage, by conserving every drop of water and suggested for conducting water audit for all sectors of water use. Water audit can be defined as a qualitative and quantitative analysis of water consumption to identify means of reducing, reusing and recycling of water. Water Audit is nothing but an effective measure for minimizing losses, optimizing various uses and thus, enabling considerable conservation of water in irrigation sector, domestic, power and industrial as well. A water audit is a technique or method which makes possible to identify ways of conserving water by determining any inefficiencies in the system of water distribution. The measurement of water losses due to different uses in the system or any utility is essential to implement water conservation measures in such an establishment. This indicator addresses water consumption, water sources, irrigation, storm water, appliances and fixtures. A water audit is an on-site survey and assessment to determine the water use and hence improving the efficiency of

its use.

Water conservation is a key activity as water availability effects on the development of the campus as well as on all area of development such as farming, industries, etc. Keeping this in view water conservation activity is carried out by the college.

Bore 1	Nr. Gyan	150				Depth in Feet From Gr. to Water top Dist.
Month	Year 2018	Year 2019	Year 2020	Year 2021		
Jan.	86	84	83	81	5	
Feb.	91	90	89	88	3	
Mar.	93	91	90	89	4	
Apr.	105	104	103	100	5	
May.	107	105	104	102.5	4.5	
Jun.	91	89	87	85	6	
July.	64	62	61	59	5	
Aug.	60	59	58	55	5	
Sep.	55	53	52	51	4	
Oct.	60	59	58	57	3	
Nov.	70	68	67	66	4	
Dec.	75	74	73	72	3	
Total =					51.5	
Average					6.44 Feet	
Increase of water lvl					1.96 Meter	

Bore 2	Nr. Pitch	150				Depth in Feet From Gr. to Water top Dist.
Month	Year 2018	Year 2019	Year 2020	Year 2021		
Jan.	79	76	74	72	7	
Feb.	81	80	79	78	3	
Mar.	86	85	83	82	4	
Apr.	101	100	99	96	5	
May.	99	97	94	92	7	
Jun.	73	71	69	67	6	
July.	59	57	56	54	5	
Aug.	54	53	52	49	5	
Sep.	49	47	46	45	4	
Oct.	54	51	50	48	6	
Nov.	64	63	62	60	4	
Dec.	69	68	67	66	3	
Total =					59	
Average					7.375 Feet	
Increase of water lvl					2.25 Meter	

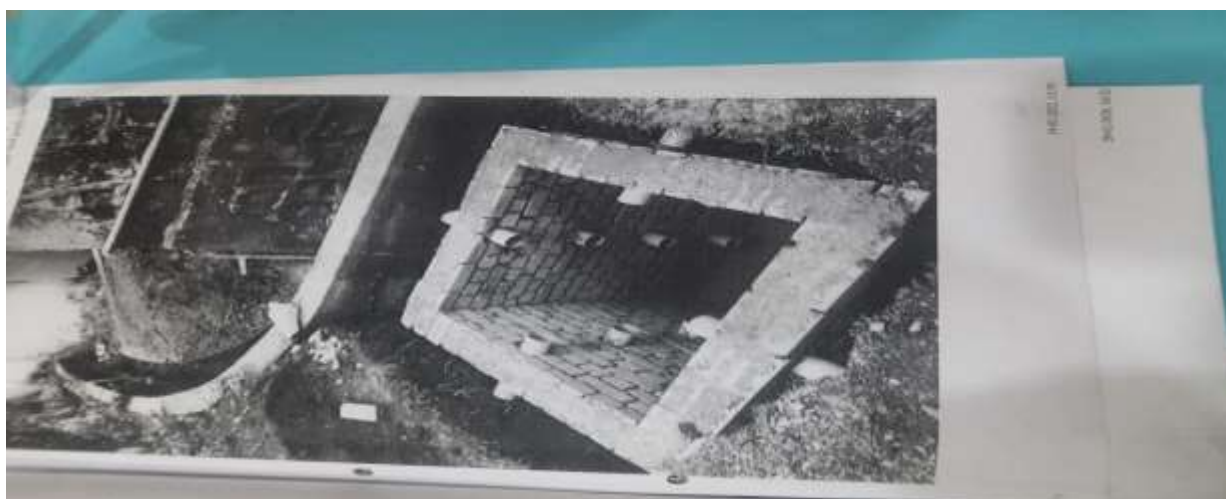
Well	45				Depth in Feet From Gr. to Water top Dist.
Month	Year 2018	Year 2019	Year 2020	Year 2021	
Jan.	30	26	24	22	8
Feb.	32	30	29	28	4
Mar.	35	34	31	30	5
Apr.	37	36	34	31	6
May.	42	40	38	36	6
Jun.	30	29	27	25	5
July.	17	14	12	10	7
Aug.	10	9	8	5	5
Sep.	8	5	4	4	4
Oct.	10	7	5	5	5
Nov.	15	14	13	13	2
Dec.	20	18	17	18	2
Total =					59
Average					7.375 Feet
Increase of water lvl					2.25 Meter
Avg. Increase of water lvl					2.15 Meter

Fig: Report for enhancement of Water level in Well No.1 due to rain water harvesting.

The college uses approximate 1500 Taps. It has 4 wells with 1 dug well and 3 bore wells. Main source of water is Municipal water. The present depth of water is 30

feet in well. The college stores the water in overhead tank and sump. There are two sumps storing 2 Lakh & 1.5 Lakh liters of water and overhead tank with 1 L capacity. Every day about 1 Lakh liter of NMC water is pumped. Wastage of water is prevented by closing the valves manually. No leakage of water is detected during the audit. The waste water mainly comes from labs, washrooms & kitchen & waste water is released to soap pit. Construction of STP is in progress. At present waste water is not used for any other purposes. At present lab water is released in common drainage of qty. 5000 Ltr/week. Treatment of lab water is carried out at present. In order to reduce the amount of water used in college, push taps or timers in urinal is proposed. The details of the pump used for pumping the water in overhead tanks are as follows-

Sr.No/	No. of Pumps	Power	Location
1	4	5HP	Main water tank
2	3	3	MBA, IT &Electrical Dept
3	1	1	Admin. Building



**Fig: Pit for rain water harvesting:**

- Dug well gets dry and has pump of 3HP and is operated 3 days for 2 Hrs. while bore well has 2 pumps of 3 HP and one pump of 1Hp and operated daily for 3 Hrs.
- Rainwater harvesting is done by the college.
- There are no technical data at present to analyse the amount of water lost.
- There are no water fountains.
- Drip irrigation is used to water the plants.



- Garden is watered twice in a day for 2 Hrs. each.
- College can prepare water management plan with new water saving techniques.
- Slogan for water saving are displayed at various places in the college and in hostels buildings.
- Water management is part of the civil engineering curriculum.

#### Sources of Water

-Municipal corporation Water

-Well water

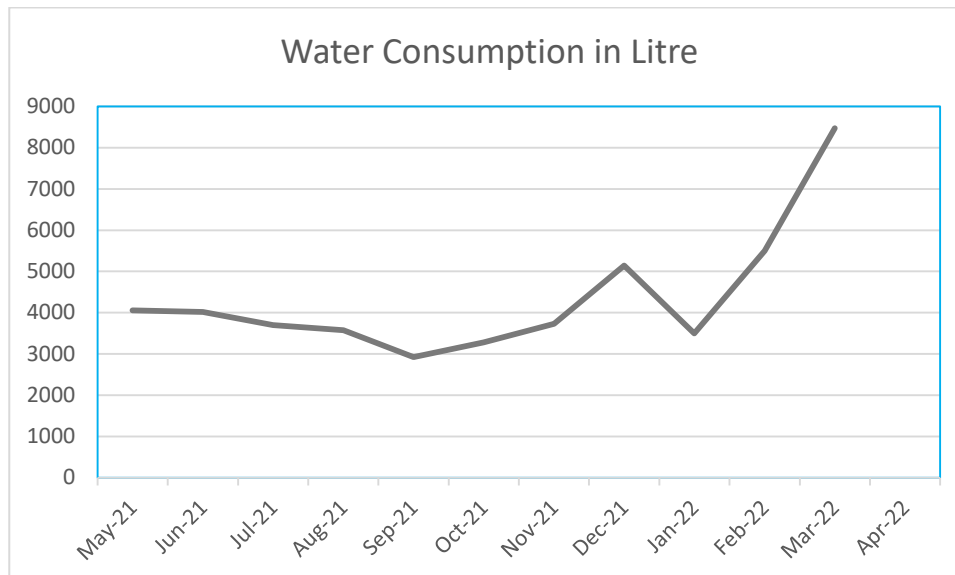
-Bore water

-No. of flow meters attached and their locations.: One near OHT

Location/ Area	Avg. total consumption of water per day
<b>1.College</b>	68330
<b>2. Gardening</b>	41000
<b>3. Labs</b>	27330
<b>4. Hostel</b>	95665
<b>5. Utilities/uses</b>	13665
<b>6. Canteen</b>	27330

#### Water Bill for the last 12 Months (litre)

May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
21	21	21	21	21	21	21	21	22	22	22	22
4058	4020	3699	3579	2925	3279	3734	5141	3496	5497	8471	-



**Remarks:** From May 21 onwards partial lock down for eight month and from Mar 22 Regular off line classes started

It is observed that a number of factors like climate, culture, food habits, work and working conditions, level and type of development, and physiology to determine the requirement of water. As per the standards provided by WHO Regional office for South East Asia Schools require 2 liters per student; 10-15 liters per student if water-flushed toilets, Administration requires 50 liters per person per day, Staff and for sanitation purposes it depends on technology

Water usage can be defined as water used for all activities which are carried out on campus from different water sources. This includes usage in all residential halls, academic buildings, on campus and on grounds. Wastewater is referred as the water which is transported off the campus. The wastewater includes sewerage, residence, hall water used in cooking, showering, clothes washing as well as wastewater from chemical and biological laboratories which ultimately going down in sink or drainage system.

**Good Points:**

1. Reuse of Waste Water

**Recommendations:**

The team of Auditors appreciates the College administration for the good practices in conserving water such as regular plumbing services, regulating the water flow from top and some of the flushes are switched to water efficient flushes. There is willingness to explore the option of Waste Water Treatment thus the (plant based)

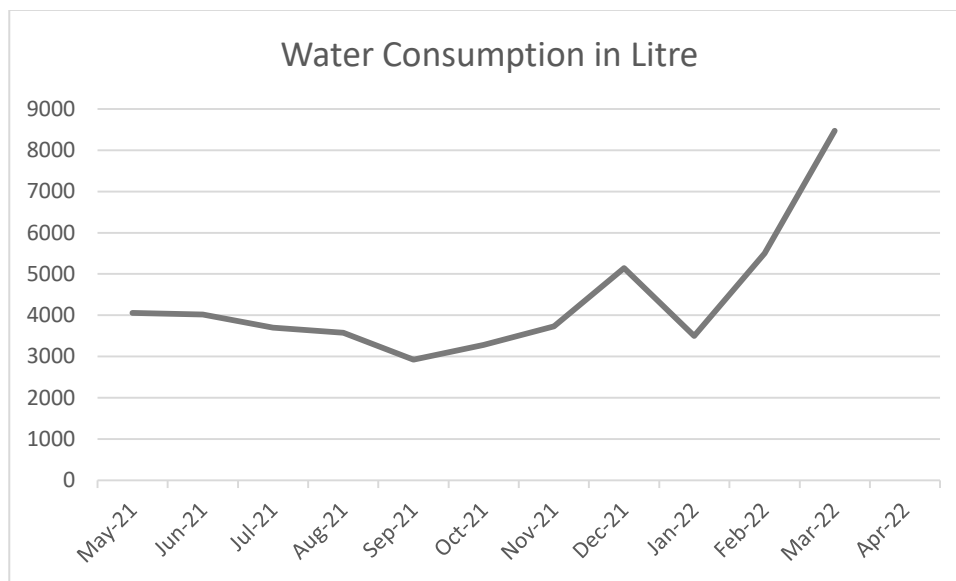
recycled water can be utilized for the toilet flushing and gardening if it is implemented successfully. It is not possible to estimate the exact quantity of water used by different departments. However the highest consumption of water is most likely happening in toilets, hostels, canteen, and in chemical lab in view of the escalation of water scarcity in the region team recommend basic steps be carried out to optimize the water utilization at the college level, which will also contribute to reducing the related expense:

- I. Flow meter to be installed at bore well and well also to monitor the quantity of water used from the source.
- II. Auto sprinkling system to be installed with proper alarm system for irrigation purpose
- III. Putting up notices in all washrooms and near all water coolers about the need for saving water, and simple tips like ensuring all the taps are properly closed, leakages are immediately brought to the notice of the management, respective floor cleaning staff could be given the responsibility to keep a check on every floor if any taps are open or leaking.
- IV. Awareness amongst employees and students and faculty for water saving to be enhanced. It was observed that after cleaning of hands students not closing the tap properly leading to water lost.
- V. Pipes, overhead tanks, cooler and plumbing system should be maintained properly to reduce leakages and wastages of water.
- VI. Water coming out from Air conditioned to be stored and can be used as distilled water after laboratory checks.
- VII. To eliminate the spillage and over usage of water in washbasins, urinals and toiler push taps are highly recommended.
- VIII. Training to the cleaners in economical use of water for cleaning purposes and a system in place for immediate response when issues of water leakage are observed so that water losses are prevented.
- IX. Minimize wastage of water and use of electricity during water filtration process, if used, such as RO filtration (Drinking Water) process and ensure that the equipment's used for such usage are regularly serviced and the wastage of water is not below the industry average for such equipment's used in similar capacity.

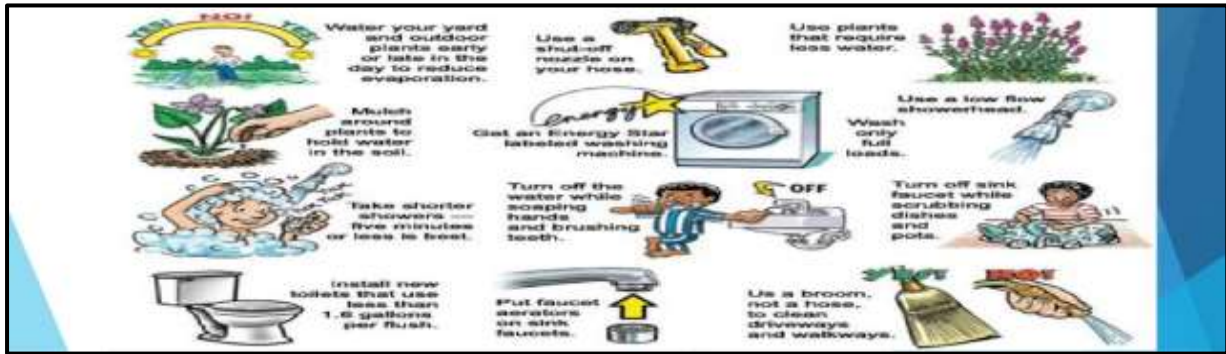
- X. Cleaning schedule of water purifier to be made and followed and displayed on every water purifier.
- XI. Water consumption of the college building wise to be monitored and graphs/table to be prepared.
- XII. Water to be tested from various sources including the potable water purifiers and in canteen.
- XIII. Maintenance of water purifier to be done including replacement of filters.
- XIV. Step by step include the water meter or flow meter to each and every building and monitor the water consumption record.

**Water Bill for the last 12 Months (litre)**

May 21	Jun 21	Jul 21	Aug 21	Sep 21	Oct 21	Nov 21	Dec 21	Jan 22	Feb 22	Mar 22	Apr 22
4058	4020	3699	3579	2925	3279	3734	5141	3496	5497	8471	-



**Remarks:** From May 21 onwards partial lock down for eight month and from Mar 22 Regular off line classes started



### Energy Use and Conservation:

Energy is one of the major inputs for the economic development of any country. The fundamental goal of energy management is to produce goods and provide services with the least cost and least environmental effect. Also it can be said as “the strategy of adjusting and optimizing energy, using system and procedure so as to reduce energy requirements per unit of output while holding constant or reducing total costs of producing the output from these systems”. The energy audit is key to a systematic approach for decision making in the area of energy management. It attempt to balance the total energy inputs with its use, and serve to identify all the energy streams in a facility.

This indicator addresses energy consumption, energy sources, energy monitoring, lighting, appliance, natural gas and vehicles. Energy use is clearly an important aspect of campus sustainability and thus requires no explanation for its inclusion in the assessment. The college primarily uses energy in the form of electricity provided by MSEDCL. A proper analysis of energy consumption, we need to understand the electricity consumption over at least one academic year, and ideally three previous years. Major use of the energy is at office and laboratories of different departments for lighting, practical and laboratory work. The main electric appliances in the college are mechanical workshop, fans, computers , Water cooler, Air condition water pump and LCD projectors, and computers , lab equipments, lifts,



mechanical workshops and accessories Major energy consumption equipments are the high wattage electrical appliances such as Air conditioners, water coolers, geyser installed at boys and girls hostels, deep freezers, etc.



### Good Practices:

In all sections of campus lecture rooms, office rooms, laboratories etc are spacious voluminous and airy, having proper natural light and ventilation. Hence actual requirement energy consumption in lightening is minimal. The air conditioners in the management chamber or in Principal Chamber are rarely used and avoiding unnecessary use of the same is a part of the green practice in the College. Besides this, **solar system is also installed in the campus as an alternate renewable source of energy**,. Equipments like Computers are used with power saving mode. Also, campus administration runs switch –off drill on regular basis.

This indicator addresses energy consumption, energy sources, energy monitoring, lighting, appliance, natural gas and vehicles. Energy use is clearly an important aspect of campus sustainability and thus requires no explanation for its inclusion in the assessment.

### Aim and objective:

- To save conventionally produce electric energy
- Use of non- conventional source of energy
- Use carbon neutral electricity
- Minimization of electric expenses

### Observations

Following Energy Sources are used in the college:

- **Solar**

- **Electrical**
- **Diesel**
- **LPG**
- **Petrol**

Some of the “Green Practices” on the Campus includes; the display of the instruction boards/notices displayed on each classrooms/ lab for switching of the fans and lights when not required. Switching to star rating electric appliances in phase wise manner, new fans are installed in phases, step by step process of replacing CFL with LED light,. The College building has 4 lifts; the lift is operated for disabled person and for old person only. The instructions are displayed.

Study of Variation of Monthly Units consumption & Power Factor:

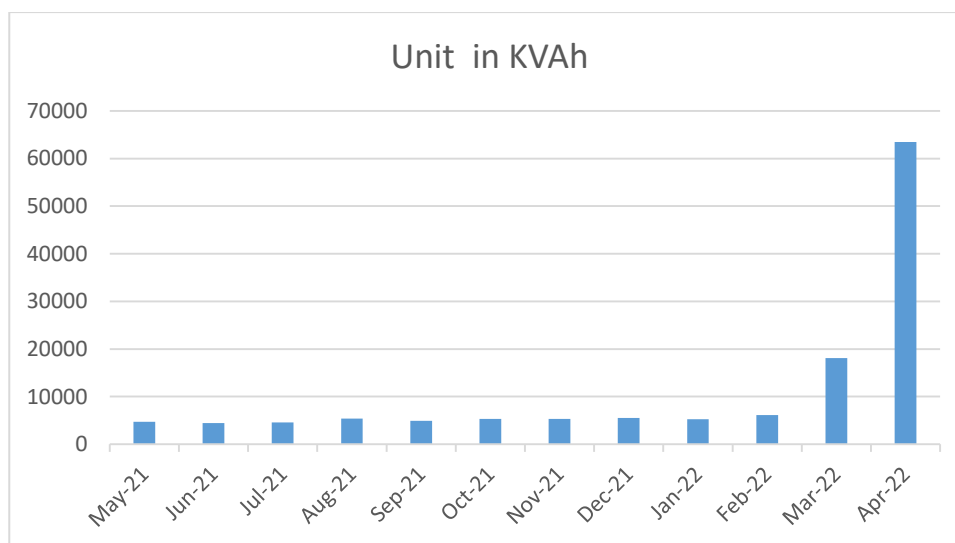
**TableNo1.1VariationinUnitsConsumption**

<b>Sr. No.</b>	<b>Month</b>	<b>No. UnitsKVAH</b>
<b>1.</b>	May 21	<b>4694</b>
<b>2.</b>	Jun 21	<b>4420</b>
<b>3.</b>	Jul 21	<b>4607</b>
<b>4.</b>	Aug 21	<b>5377</b>
<b>5.</b>	Sept 21	<b>4936</b>
<b>6.</b>	Oct 21	<b>5332</b>
<b>7.</b>	Nov 21	<b>5315</b>
<b>8.</b>	Dec 21	<b>5504</b>
<b>9.</b>	Jan 22	<b>5255</b>
<b>10.</b>	Feb 22	<b>6130</b>
<b>11.</b>	Mar 22	<b>18073</b>
<b>12.</b>	<b>Apr 22</b>	<b>63489</b>

**Remarks:** From May 21 onwards partial lock down for eight month and from Mar 22 Regular off line classes started

### MonthwiseUnitConsumption

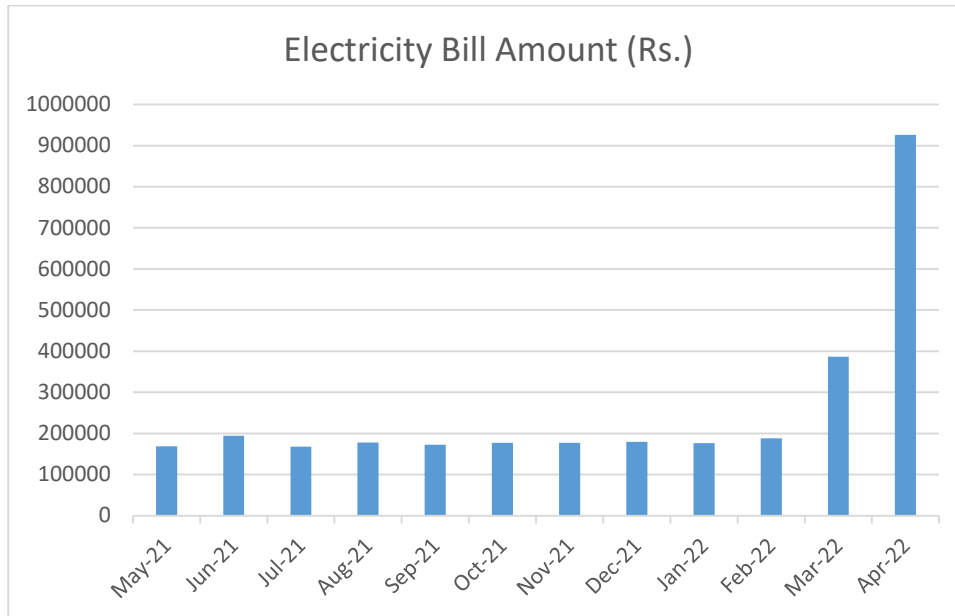
( For May 21 to Apr 22)



### 1.2 Study of Month wise Electricity Bill Variation:

Sr. No.	Month	Electricity BillAmount(Rs.)
1	May 21	169052
2	Jun 21	194214
3	Jul 21	167957
4	Aug 21	178221
5	Sept 21	172292
6	Oct 21	177545
7	Nov 21	177288
8	Dec 21	179812
9	Jan 22	176476
10	Feb 22	188240
11	Mar 22	386653
12	Apr 22	926245

**Conclusion:** Monthly Electricity Bill Variation has been identified and increased from Mar 22 as regular classes started after lock down



### 1.3: Study of Month wise Maximum Demand Variation

**TableNo1.2MonthwiseMaximumDemandVariation**

Sr.N o.	Month	Maximum Demand(kVA/Month)
1	May 21	204
2	Jun 21	204
3	Jul 21	204
4	Aug 21	204
5	Sept 21	204
6	Oct 21	204
7	Nov 21	204
8	Dec 21	204
9	Jan 22	204
10	Feb 22	204
11	Mar 22	204
12	<b>Apr 22</b>	<b>291</b>

**Conclusion:** Monthly Electricity Demand has been identified and increased in Apr 22 as regular classes started after lock down

## Actual Measurements and its Analysis

### 1. Details of Energy used

Sr.No.	Source/Utility	Star Rating	Quantity	Consumption/Hr	Annual Consumption
1.	Tube Lights(Fluorescent)		425	17	48960
2.	Tube Light(LED)		1955	43.01	123868
3.	Bulb (LED)		1427	21.45	61646
4.	Bulb (Normal)		293	7.6	21939
5.	Air conditioners (Split)		134	335	964800
6.	Air conditioners (Windows)		2	4	1520
7.	Laptops		76	7.6	10944
8.	Desktops		1874	374.8	539712
9.	Generators		<b>2</b>	<b>256</b>	
10.	Compressors		2	4	2880
11.	Fans		1904	114.3	329184
12.	Printers(Dot matrix)		0	0	0
13.	Printers(Laser)		230	11.5	4140
14.	Xerox		5	5	5400
15.	Flood Lights		34	3.4	9792
16.	Pumping motors		37	98.5	35460
17.	CCTV		189	0.94	8164
18.	Projectors(DLP)				
19.	Projector(LCD)		129	38.7	13932
20.	Projector(LED)				
21.	Router system		1	0.1	864
22.	Ovens/Microwave		5	12	4320
23.	Water Coolers		56	168	48384
24.	Refrigerators		8	8	34560

ACs used are-

Sr.No	Type	Tot. No.
1	Split AC	140
2	Cassette AC	30
3	Window AC	2
4	Tower AC	1
5	VRF AC	5
<b>Total</b>		<b>178</b>

Only 6-7 ACs are 5 star rating ACs. Consumption of energy because of ACs is not estimated. No. of Electrical equipment used & electrical Energy Consumed Equipment wise is not estimated.

Sr.No.	Equipment	Quantity
1	Computer	1933
2	Printers	203
3	3D Printer	2
4	Xerox	4
5	Projector	115
6	Water cooler	34
7	Air Cooler	125
8	Generator	2(1:320KVA, 2:140KVA)
9	Geezers in girls & boys hostel	25( Each:3KW capacity)
10	No. of Lift in the college	04





**Energy consumption details**

- No. of LPG Cylinder in canteen:25
- No. of Two Wheeler Vehicle:3500
- No. of Four Wheeler: 125
- No. of Cycle:3
- Pickup vans:4
- Avg. Driving: 2 Wheeler15-25 Km
- Last year Generators run: 45Hrs.
- Total diesel consumption amount Rs.1066358/- for 2017-18
- No. of solar panels installed: 1132Nos. of Capacity 340KWP(kilo Watt Peak)
- Significant amount of energy generated through solar

Sr. No.	18-19	19-20	20-21	21-22
<b>Electrical Consumption</b>	761652 Units	447401.50 Units		

**Following simple ways to reduce electricity consumption can be followed:**

1. Don't Leave Electronic Appliances On Standby Mode: It is a common tendency among the people to switch off their electrical appliances using

the remote, leaving them on standby mode. They fail to realize that the device is still consuming 85% of electricity energy and wasting the valuable energy reserve. Instead, by switching off the main power button or by unplugging the socket, they can make a commendable contribution in saving electricity energy.

2. **Avoid Using Electric Tumble Dryer:** An electric tumble dryer consumes a large amount of electricity energy in a home. To save the exhaustible electrical energy, user must switch over to the traditional method of line-drying the clothes.
3. **Lighting:** The traditional bulbs and tube lights consume a large amount of electricity energy, making a contribution of almost 10 to 15 percent in the electricity bill. In lieu of these outdated bulbs, one must prefer purchasing an energy saving bulb and the fluorescent tubes that glows brightly without consuming more energy.
4. **Bring Home Solar Garden Lights:** To lighten your garden and add grace to its look, one can easily bring home the highly efficient solar garden lights as they do not entail you to dig trenches or set up wiring connections. Users can easily arrange these fitting anywhere they desire and highlight the dark areas of their gardens. These lights get charged up during the day and illuminate the garden at night.
5. **Check out The Energy Star Label:** While purchasing electronic appliances like air conditioner, refrigerator, microwave and other household appliances, one must make sure that the appliance has an energy star label on it that can help to cut almost 30 percent of the electricity bills.
6. **Install solar water heater at boys and girls hostels**

#### **Recommendations:**

1. Solar Generation in month of Nov 21, Dec 21 is less compared to other period to be analyzed.
2. IOT based Sprinkling System is provided to 375 panels for cleaning Out of 1505 solar panels, In Sprinkling system 65 to 70 % water is saved, & yield 13% more generation, Cleaning for other panels is done manually. Recommended to install sprinkler system for cleaning to other panels,
3. For monitor working of Sprinkler System Pressure Transmitter to be installed on inlet water pipe line,

4. Old 7 to 8 panels are deteriorated, may be replaced with New one In Phased manner,
5. Effectiveness of Solar Generation May be monthly calculated & recorded as under:

Actual Generation in a month in KWH

-----  
Maximum possible generation possible during the month in KWH

6. Water percolating after sprinkling activity may be utilized for roof Gardening
7. Use of EV vehicles in campus for movement of Delicate instruments, Staff Visitors, Guest
  - i. To save fuel energy hence reduction in carbon Foot Print
8. Street lights, Stare case Lightings in Hostel ON off operation to be done in auto mode by installing Photo sensors or timers, presently it is done in manually
9. All ACs to be locked to 26 Degree settings except where instruments in laboratories require less temperatures, All ACs regular cleaning of filters & out door units to be ensured & recorded will help in energy reduction . ( Optimized Temperature at 26<sup>o</sup>C)
10. Electric Geysers installed in Hostel Thermostats provided are periodically checked to ensure tripping at desired temperature, thus will avoid over heating & save energy.
11. Switch off computers from source after operation, all lights Fans to made off after vacating, Provide master switch for ON OFF operation after rooms & halls to ensure un due on of accessories, Provide Sign Boards at Lighting Boars for Switch Off operation
12. All ELCBs to be periodically checked for current leakages & ensure tripping in case of electric short circuits, thus will save energy & hazards
13. STP plant efficiency to be calculated monthly :Total water recycled during the month in KL Divided By energy consumed during the month This will help in energy saving
14. Bench Marks ,Key performance indicators to be fixed for all Green parameters after fixing base line Like Tree Plantation, Fuel consumption, Water & electricity ,paper consumption, Air Noise pollution













15. In order to have proper energy conservation Energy Meters are to be provided at each Departments , this will help to achieve energy balance &reduce energy losses

**Tips to Save the Energy:**

1. All electrical loose wire to be dressed up properly.
2. Electrical Earthing of the college to be checked regularly.
3. Awareness for the use of electricity and paper to be developed in the college.
4. Instruction such as all electrical appliances (lights/fans/AC) shall be switched off when not in use or at the end of the day to be displayed.
5. College takes steps to purchase fans, refrigerators and air conditioners with low energy consumptions with maximum star ratings.
6. Use of Diesel generator to be avoided (to reduce the consumption of oil, record of consumption of diesel to be maintained.
7. The display of the instruction boards/to be displayed on each classrooms/ lab for switching of the fans and lights when not required.
8. Switching to star rating electric appliances in phase wise manner.
9. Carbon Sequestration study shall be carried out before plantation of Green Belt.
10. Energy Consumption for each building should be estimated to design the energy conservation plan.
11. Encourage natural ventilation and illumination by alteration in the building structures whenever going for new constructions.
12. All the lifts must have the following legal requirement as
  - a. Emergency phone No.
  - b. Lift license

No. of solar panels installed: 1132Nos of Capacity 340KWP(kilo Watt Peak)

Total Energy (Power)Required by the college(kWh)	Power Requirements met by renewable energy Sources	Source of Renewable energy (Solar/Wind)	Renewable energy generated and used	Energy Sold
<b>447401.50</b>	<b>541928</b>	<b>Solar</b>	<b>541928</b>	<b>281804</b>

1  Turn off lights when leaving a room	2  Switch to energy efficient appliances	3  Use LED lights
4  Unplug devices when not in use	5  Keep thermostat at low temperature	6  Reduce water consumption
7  Use smart automated devices	8  Switch to double glazing	9  Cook with the lid on
10  Use a smart meter to track usage	11  Wash at a cold temperature	12  Use solar powered devices







### Carbon Foot Print:

A carbon footprint is a measure of how much someone is contributing to the gases that contribute to global climate change. More scientifically, it is the amount of anthropogenic carbon dioxide (CO<sub>2</sub>) emissions (those resulting from or produced by human beings) attributable to an individual or a household or an organisation, generally resulting from their direct or indirect use of energy. Although we talk about a 'carbon footprint', it would be more accurate to talk about a 'carbon dioxide footprint'. A carbon footprint is normally calculated in tonnes of carbon dioxide equivalent (tCO<sub>2</sub>e) but occasionally footprints are calculated in tonnes of carbon equivalent (tC). You will need to multiply by 44 and divide by 12 to convert from tonnes of carbon to tonnes of CO<sub>2</sub> equivalent. In this unit we may talk interchangeably about carbon emissions, carbon dioxide emissions and CO<sub>2</sub> emissions.

Carbon footprints may also include other gases that contribute to global climate change – the so called 'greenhouse gases' (GHGs). The most common of these is methane (CH<sub>4</sub>), but they also include nitrous oxide, hydro fluorocarbons, per fluorocarbons and sulphur hexafluoride (SF<sub>6</sub>). These other gases tend to be produced from agriculture or industrial processes. Most are much more powerful contributors to global warming than CO<sub>2</sub>. Water vapour (H<sub>2</sub>O) is also a significant contributor to global warming but, as its concentration varies little with time, it is not considered to be an anthropogenic greenhouse gas, except from aircraft vapour trail. However, the largest contributor to global warming is carbon dioxide itself, which is produced from burning fossil fuels such as coal, oil or gas. As well as the direct use of fossil fuels, people's carbon footprints normally include the use of



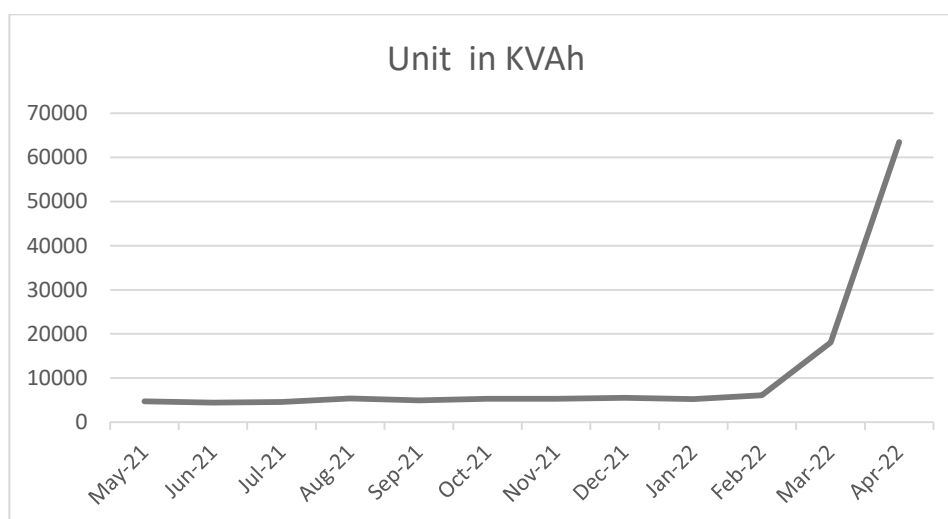
electricity (where CO<sub>2</sub> is emitted at the power station) and as a result of collective travel, such as on trains, buses and aircraft.

### Carbon Di-Oxide Emission

In this Chapter we compute the CO<sub>2</sub> emissions. For consumption of 1 Unit (1 kWh) of Electricity, the CO<sub>2</sub> emitted is 0.8 Kg. OR the Emission is 0.8 Kg/kWh. In the following Table we present the total units consumed and CO<sub>2</sub> emitted as under:

Sr. No.	Month	kVAh	CO <sub>2</sub> Emitted in kg
1	May 21	16823	3755
2	Jun 21	10740	3536
3	Jul 21	8025	3686
4	Aug 21	3797	4302
5	Sept 21	4972	3949
6	Oct 21	5811	4266
7	Nov 21	6726	4252
8	Dec 21	7388	4403
9	Jan 22	6774	4204
10	Feb 22	6665	4904
11	Mar 22	5561	14458

**Remarks:** From May 21 onwards partial lock down for eight month and from Mar 22 Regular off line classes started so CO<sub>2</sub> emission increased in Mar 22 and Apr 22



### Recommendation:

1. College to identify all its activities.
2. Calculate the carbon foot print.



#### OVERALL RECOMMENDATIONS:

1. Summarization of all the recommendations made earlier which is not complied yet and process of compliance to be started.
2. Process of cleaning of potable water tanks and drinking water coolers to be displayed along with cleaning schedule and also identification to be provided to all the water coolers.
3. Water meter to be installed at different water sources and plan for providing the same to different buildings particularly at hostels.
4. Energy policy to be displayed at prominent locations.
5. Energy objectives to be set in measurable form and to be displayed at prominent location.
6. All Electrical loose wire needs to be dressed up particularly in hostels (girls).
7. Earthing to be check on regular basis at least once in a year and record to be maintained for building wise.
8. List of batteries to be prepared section wise.
9. College to procure Electrical vehicles for internal movement particularly for guest visiting the college.
10. Awareness for energy and water conservation among students and staff by displaying boards.
11. D. G. stack monitoring/Exhaust gas analysis shall be done.
12. Solar Generation in month Of Nov 21 , Dec 21 is less compared to other period to be analysed,
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\*\*\*\*\* END OF REPORT\*\*\*\*\*