ENERGY AUDIT REPORT

OF

GOVT. COLLEGE KHERTHA, BALOD, CHHATTISGARH

ADDRESS: - KHERTHA BAZAR ROAD, KHERTHA, CHHATTISGARH
KHERTHA, BALOD (C.G.)-491771

Prepared By -

AUDITTECH

Audittech Industrial Services Private Limited

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AUGUST-2021

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ACKNOWLEDGEMENT

We express our sincere gratitude to **M/s. Govt. College Khertha, Balod** for giving us the opportunity to be a part of their mission towards Energy Conservation.

We are thankful to all officers and employees of **M/s. Govt. College Khertha, Balod** with whom we interacted during the field study for their whole hearted support in undertaking measurements and eagerness to assess the system/equipment efficiencies and saving potential. The willingness of these key personnel to participate in this program and acknowledge the call for energy efficiency is more than half the issues received.

Auditech Industrial Services Pvt. Ltd.

Signature:

Date: AUG 2021

Mr. Aashish Bafna, Director

Place: Raipur

Certified Energy Auditor

Energy Auditor Certificate

Reg No.: EA-28916

Certificate No.: 9780/19

National Productivity Council

(National Certifying Agency)

PROVISIONAL CERTIFICATE

This is to certify that Mr./Mrs./Ms. **AASHISH BAFNA**

son / daughter of Mr. **ASHOK BAFNA** *has passed the National certification Examination for Energy Auditors held in September 2018, conducted on behalf of the Bureau of Energy Efficiency, Ministry of Power, Government of India. He / She is qualified as* ***Certified Energy Manager*** *as well as* ***Certified Energy Auditor.***

He / She shall be entitled to practice as Energy Auditor under the Energy Conservation Act 2001, subject to the fulfillment of qualifications for Accredited Energy Auditor and issuance of certificate of Accreditation by the Bureau of Energy Efficiency under the said Act.

This certificate is valid till the Bureau of Energy Efficiency issues an official certificate.

Digitally Signed by K V R RAJU
Mon Apr 22 16:23:39 IST 2019
Controller of Examination, NPC AIP Chennai

Place : Chennai, India

Date : **22nd April, 2019**

Controller of Examination

1. EXECUTIVE SUMMARY

An Energy Audit is a study of a Plant or facility to do determine how & where energy is used and to identify methods for Energy Savings. There is now a Universal recognition of the fact that new Technologies and much greater use of some that already exist provide the most hopeful prospects for the future. The Opportunities lie in the use of existing Renewable Energy Technologies, greater efforts at Energy Efficiency and the dissemination of these Technologies and Options.

This report is just one step, a mere Mile Marker towards our destination of Achieving Energy Efficiency and we would like to emphasize that an Energy Audit is a Continuous Process. We have compiled a list of Possible actions to Conserve and Efficiently utilize our scarce Resources and identified their Savings Potential. The next step would be to prioritize their Implementation.

We look forward with Optimism that the College Authorities, staffs and students shall ensure the maximum execution of the recommendations and the success of this work.

Govt. College Khertha Facility

Government college, Khertha affiliated to Hemchand Yadav Vishwavidyalaya comes under higher education department of Chhattisgarh government in district Balod. This college was established in the year 2008. This college was established to provide higher education to young and deserving students. Arts, science, commerce faculties are functioning in this College. The co-curricular and sports activities are organized to stimulate the creativity and to maintain physical fitness of the students. The units of National Service Scheme and Youth Red Cross Society create a sense of social responsibility among the students. Career counselling and coaching classes for entering into various services are also organized under the banner of Career guidance scheme.

Electrical power:

The establishment has a dedicated 11 KV connection from Chhattisgarh state power distribution company Ltd. The facility also installed a Dedicated 25 KVA Transformer for College.

SN.	Energy saving measures	Investment Rs. Lakhs	Yearly energy savings				Cost saving /year (Rs.Lakhs)	Payback Period (Year)
			Oil	Gas	Coal (MT)	Electricity (kWh)		
1	2	3	4	5	6	7	9	10
1	Replacement of Tube Light of 40W + 15 W(Choke) with Energy Efficient 20W LED Tube	0.08	.....	.....	.....	1837	0.143	0.52
2	Replacement of Ceiling Fan of 80W With EESL Energy Efficient 35W BLDC Ceiling Fan	3.00	.....	.....	.....	11340	0.88	3.39
3	Installation of 20 kW Solar Power Generation Unit in Roof Top	10.00	.....	.....	.....	30000	2.34	4.20
	Total	**13.08**	.....	.....	.....	**43177**	**3.37**	**3.88**

Total implementation cost proposed	**13.08**	**Rs. Lakhs**
Total Energy saving Potential identified (in kWh)	**0.43**	**Lakhs kWh**
Total cost Saving Potential	**3.37**	**Rs. Lakhs**
Simple Pay Back Period	**3.88**	**Yrs.**

Note: Consider Electricity unit rate- Rs. 7.80/kWh

1.1 Need for Energy Audit

In any Educational Institute, the three top operating expenses are often found to be Energy, Manpower, Operational Expenses. If one were to relate to the manageability of the cost or potential cost savings in each of the above components, Energy would invariably emerge as a Key Component, and thus Energy Management function constitutes a strategic area for cost reduction. Energy Audit will help to understand more about ways Energy and Fuel are used in any identity, and help in identifying the areas where waste car occurs and where scope for improvement-exists.

The Energy Audit would give a Positive Orientation to the Energy cost reduction, preventive maintenance and quarterly Central Programmes which are vital for production and utility activities. Such an Audit Programme will help to keep focus on variations which occur in the Energy costs, availability and reliability of supply of Energy, decide on approximate Energy mix, identify Energy Conservation Technologies, retrofit for Energy Conservation Equipment etc.

In General, Energy Audit is the translation of conservative ideas into realities, by lending Technically feasible solutions with economic and other Organizational considerations within a specified time frame.

The Primary Objective of Energy Audit is to determine ways to reduce Energy Consumption per unit of Product Output or to lower Operating costs. Energy Audit provides a "Bench-Mark" for managing Energy in the Organization and also provides the basis for Planning a more effective use of Energy throughout the Organization.

1.2 Introduction

This Project is the vision to make Govt. College Khertha Energy Efficient. Govt. College Khertha campus Energy bill keeps up around INR **0.70 Lakhs per year**. This amount is huge and thus naturally attracts attention when we understand that quite a lot of energy is being wasted, which in turn would mean that huge amount of Financial resources is being wasted.

Making the Campus Energy Efficient will not only help the College reduce its expenses but also helps us fulfil our moral responsibility of not wasting this precious resource, which is scarcely available to rest of the people of the country.

We are confident that the results that will come out of this exercise are bound to be of interest to everyone and can be the first step to make Govt. College khertha campus energetically the most efficient campus in India.

1.3 Energy Audit Objectives

Primary: -

1) The first objective is to acquire and analyze data and finding the necessary consumption pattern of these facilities.

2) The second objective will be to calculate the wastage pattern based on the results of the first objective.

3) The final objective is to find and implement solutions that are acceptable and feasible.

Secondary: -

1) This would be our first exposure to this field hence experience gain would be vital.

2) This project will precede many follow up projects and hence helps to gain technical and management exposure required for future energy projects.

3) It is sure to help create a repertoire of vital contacts hence will develop interaction with alumni, faculty and students.

1.4 Source of Energy

Govt. College Khertha uses Energy in Following Forms:

a. Electricity from CSPDCL

The Following are the Major consumers of Electricity in the facility

a. Lightning
b. Fans
c. Computers
d. Other Lab Equipment

1.5 Indirect Benefits of Energy Audit

Every time the Energy Audit is carried out it rekindles the interest in Energy Conservation as an important function. Energy Auditors sharing their experience and knowledge with the Plant Personnel, helps in fuelling the innovative ideas for further action of reduction in Specific Power consumption (SPC). Any loose connections or heating of cables come to timely vision. For an external agency due to unbiased vision, a few points for Energy Conservation may be visible each time they perform the audit and this would help in achieving further saving. Inform any irregularities in Energy meter CT connections for rectification.

1.6 Introduction of Auditing Firm

M/s. Audittech Industrial Services Private Limited is an empanelled Accredited Energy Audit Firm from Bureau of Energy Efficiency, Ministry of Power, Government of India. It is one of the fast growing Energy Audit & Energy services providing company executed several projects covering all the energy Intensive Sectors & states of India. The directors and associate team members are very well experienced in the field of Energy Audit and executed more than 150 no's Detailed Energy Audit so far.

The associate team and expert are highly qualified and experienced in the field of Energy Audit and Services. Individual credential of each member in the field of Energy Audit is very rich due to their past association with very reputed organization of Energy Audit Services.

Name of Firm:	**Audittech Industrial Services Private Limited**
Address:	**Opps. Mahavir Bhawan, Tikarapara, Balod, Chhattisgarh-491226**
Contact details:	**9827143100 / 9407702444, Email id: info@audittech.co.in, aispl.rpr@gmail.com**

Company have Head office at Balod (C.G.) & Branch offices at Durg, Bhopal, Mumbai & Delhi.

Directors Details

Sr. No.	Name	Designation / Technical Experience	Technical Experience /Qualification
1	Mr. Aashish Bafna	Managing Director - 10yrs	B.E (E&I)., MBA(Energy Management), Certified Energy Auditor, Surveyor & Loss Assessor
2	Mr. Rakesh Khichariya	Director- 25Yrs	B.E (Elect.)., Accredited Energy Auditor
3	Mr. Ramesh Patel	Director- 25Yrs	B.E.(Mtech), Govt Approved Valuer, Competent Person for Factory Act
4	Mr. Isshant Chainani	Director- 10 Yrs	B.E. (Elect & telecom)
5	Mrs. Shikha Golchha	Director- 8 yrs	B.E., MBA (Finance)

1.7 Energy audit team

Following are the team involved in the Energy Audit of the Govt. College Khertha

SN	Name	Designation/ Qualification	Experience	Contact Details
1	Mr. Rakesh khichariya	Accredited Energy Auditor (AEA-0295)	25 yrs.	9827411444
2	Mr. Aashish Bafna	Certified Energy Auditor (EA-28916)	10 yrs.	9827143100
3	Mr. Isshant Chainani	Certified Energy Manager (EA-29062)	10 yrs.	9407702444
4	Mr. Dhaleshwar Prasad	Certified Energy Manager (EA-27299)	9 yrs.	9179294953
5	Mr. Sumit Singh Thakur	Certified Energy Manager (EA-28549)	9 yrs.	8770632688
6	Mr. Mahaveer Bafna	Energy Engineer	3 yrs	8962369293
7	Mr. Tukeshwar Yadav	Energy Engineer	1 yrs	6260997416

1.8 List of Instruments

Following are the instrument used at the time of the Energy Audit.

Sr.No.	Instrument	Make/Sr.No.
1	Power & Harmonics Analyser, 1 Set (With CT, PT) LT	Krykard ALM 31/ 123673RCH
2	Power & Harmonics Analyser, 1 Set (With CT, PT) LT	Krykard ALM 20/ 28107280
3	Ultrasonic Flow meter, 1 Set (With 3Sized Transducer & Pressure gauge	Chinese/ 28107280
4	Lux Meter 1Set (Digital Lux Meter)	MECO G 930P/201704004601

1.9 Methodology of Energy Audit

The purpose of the Audit was to ensure that the practices followed in the campus with the criteria, methods and recommendations used in the audit were based on the identified risks. The methodology includes: preparation and filling up of questionnaire, Physical inspection of the campus, observation and review of the document, interviewing responsible persons and data analysis, measurements and recommendations. The methodology adopted for this Audit was a three-step process comprising of:

1. **Data Collection** – In preliminary data collection phase, exhaustive data collection was performed using different tools such as observation, survey communicating with responsible persons and measurements. Following steps were taken for data collection:

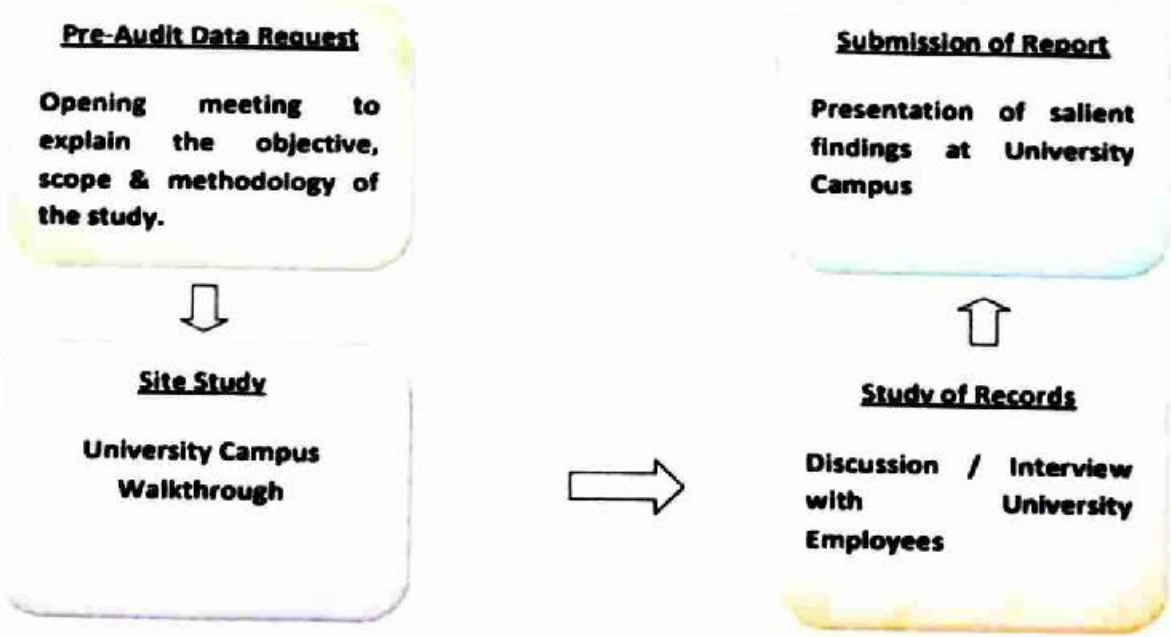
   The team went to each department, centres, Library, canteen, Student Blocks, labs, etc.

   Data about the general information was collected by observation and interview.

   The power consumption of appliances was recorded by taking an average value in some cases.

2. **Data Analysis** - Detailed analysis of data collected include: calculation of energy consumption, analysis of latest electricity bill of the campus, understanding the tariff plan provided by the. Chhattisgarh State Power Distribution Company (CSPDCL). Data related to water usages were also analysed using appropriate methodology.

3. **Recommendation /Suggestions** – On the basis of results of data analysis and observations, some steps for reducing power and water consumption were recommended. Proper treatments for waste were also suggested. Use of fossil fuels has to be reduced for the sake of community health.



AUDIT FLOW CHART

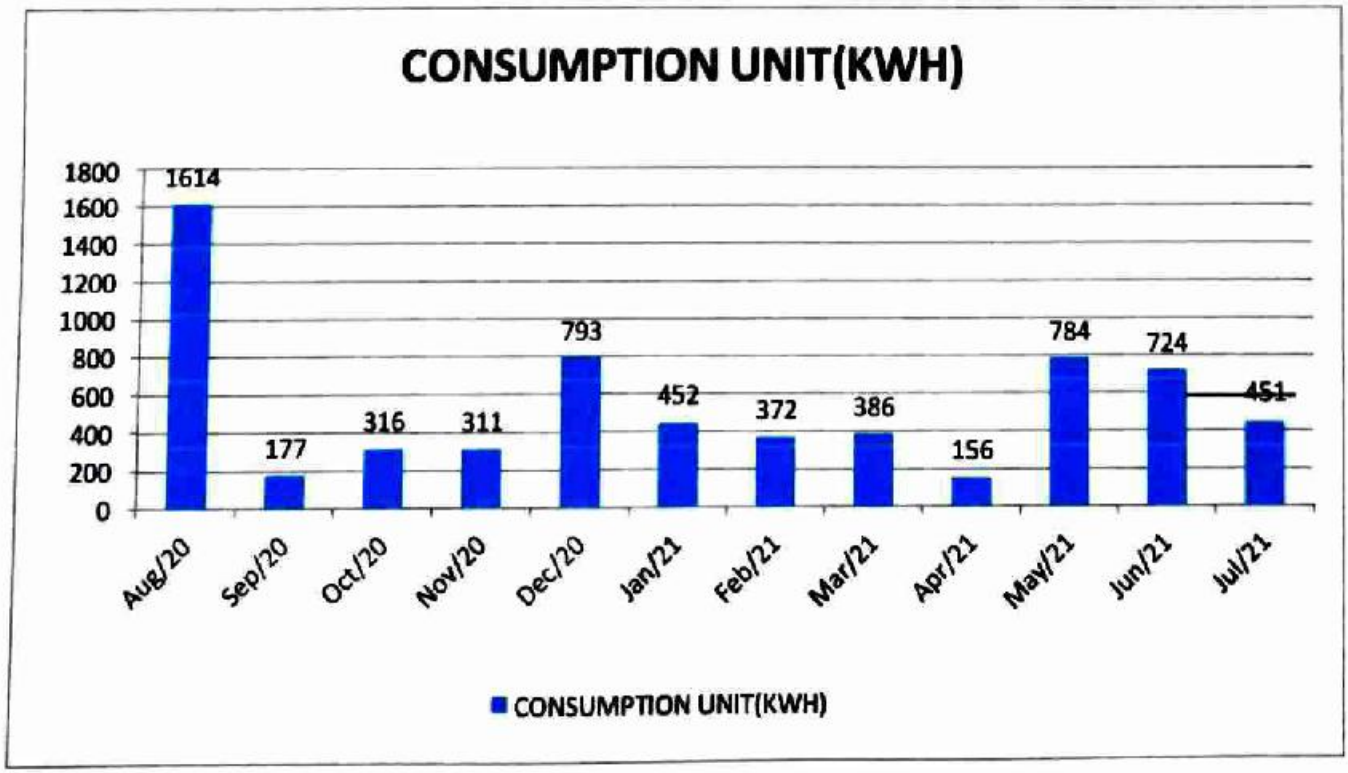
2.ELECTRICAL SYSTEM

2.1 Electricity Bill Summary-

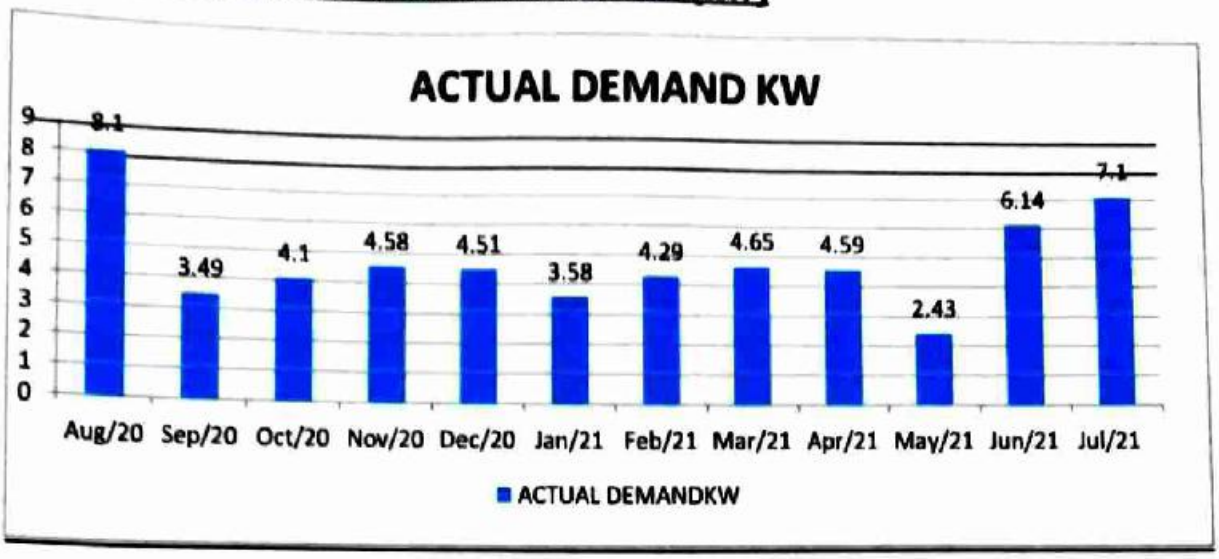
This table shows the Electricity Bill of last 12 Months From August 2020 to July 2021.

Govt. College Khertha Electricity Consumption Details						
Bill Month	**Consumption Unit(kWH)**	**Contract Demand (kW)**	**Actual Demand (kW)**	**Amount (In Rs.)**	**Power Factor**	**Unit Cost (In Rs.)**
Aug-20	1614	12	8.10	18760.00	0.69	7.80
Sep-20	177	12	3.49	2300.00	0.75	6.50
Oct-20	316	12	4.10	3240.00	0.86	6.50
Nov-20	311	12	4.58	3190.00	0.78	6.50
Dec-20	793	12	4.51	6920.00	0.72	7.80
Jan-21	452	12	3.58	4220.00	0.69	7.80
Feb-21	372	12	4.29	3630.00	0.71	7.80
Mar-21	386	12	4.65	6616.89	0.73	7.80
Apr-21	156	12	4.59	4450.45	0.74	7.80
May-21	784	12	2.43	751.49	0.82	7.80
Jun-21	724	12	6.14	5590.00	0.82	7.80
Jul-21	451	12	7.10	9850.00	0.83	7.80
Total	**6536**	--	--	**69518.83**	--	--
Average	**544.67**	**12**	**4.80**	**5793.24**	**0.76**	**7.48**
Max	**1614**	**12**	**8.10**	**18760**	**0.86**	**7.80**
Min	**156**	**12**	**2.43**	**751.49**	**0.69**	**6.50**

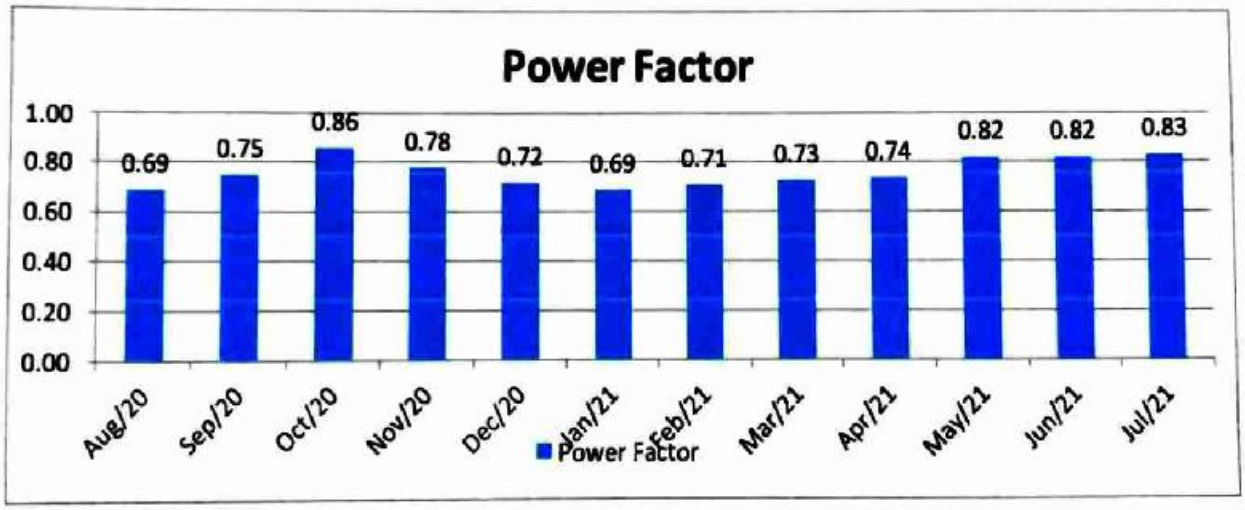
Graphical Representation of Consumption Unit (KWH)



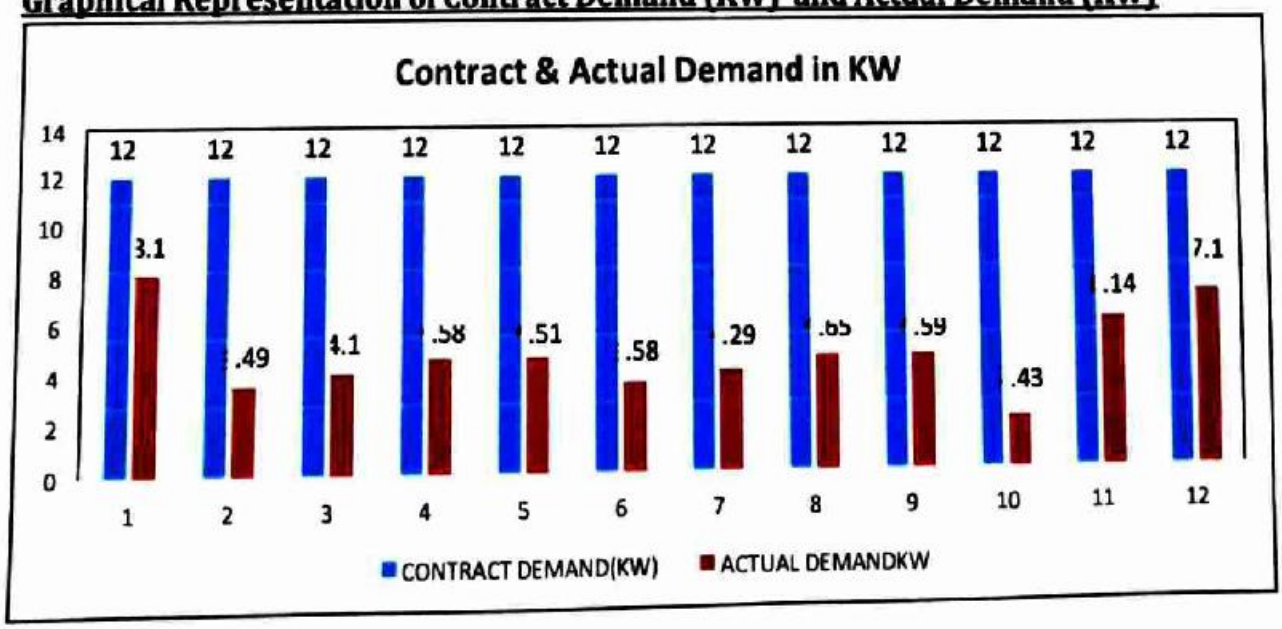
Graphical Representation of Actual Demand (KW)



Graphical Representation of Power Factor



Graphical Representation of Contract Demand (KW) and Actual Demand (KW)



2.2 Transformer Load Profile-

The Below Table Shows the Transformer Load Profile of Govt. College Khertha.

Parameter	Unit	Min	Max	Average
R RMS Voltage	V	406.3	430.7	424
Y RMS Voltage	V	430.4	439.3	433.89
B RMS Voltage	V	410.2	439.7	425.78
R RMS Current	Amp	0.3	11.96	10.98
Y RMS Current	Amp	0.65	26.43	18.8
B RMS Current	Amp	5.44	17.76	12.95
L1 PF	-	0.204	0.999	0.974
L2 PF	-	0.416	0.999	0.966
L3 PF	-	0.892	0.991	0.974
R Active Power	KW	0.066	2.908	2.597
Y Active Power	KW	0.066	6.352	4.634
B Active Power	KW	1.263	4.38	3.167
Total Active Power	**KW**	**1.395**	**13.64**	**10.398**
R Apparent Power	KVA	0.063	2.913	2.62
Y Apparent Power	KVA	0.159	6.526	4.791
B Apparent Power	KVA	1.372	4.426	3.243
Total Apparent Power	**KVA**	**1.594**	**13.865**	**10.654**
R THD Voltage	%	1.8	3.2	2.14
Y THD Voltage	%	1.6	2.1	1.92
B THD Voltage	%	2.1	2.6	2.42
R THD Current	%	4.3	25.2	6.44
Y THD Current	%	2.7	20	5.67
B THD Current	%	9.1	42.1	15.99

Note: Total Load profile of Transformer is enclosed in Annexure-1

Observation:

1. All the electrical Parameters shown in above table are within acceptable Limit.

2.3 Voltage Unbalance of Transformer –

The Below Table Shows the Voltage Unbalance of Transformer, Govt. College Khertha

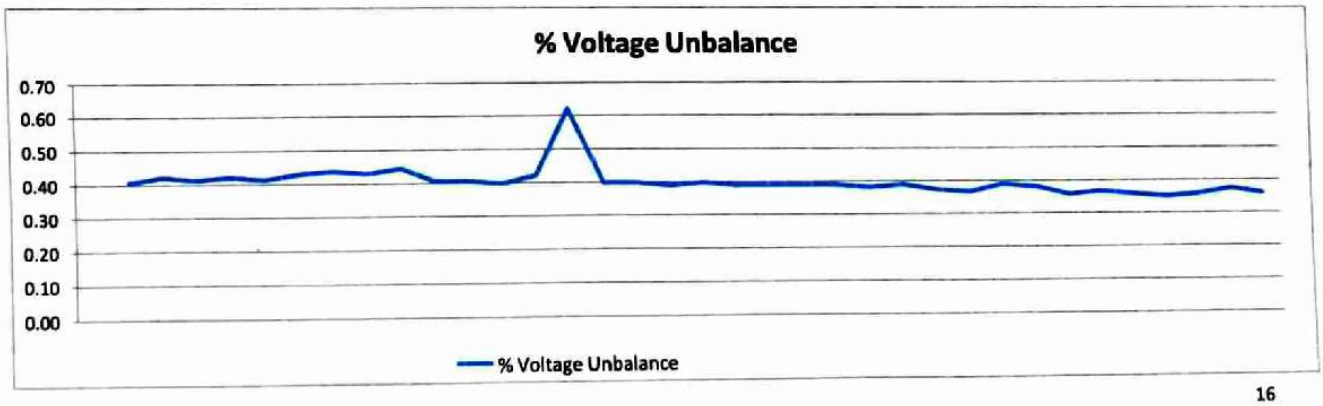
Voltage Unbalance of Main Transformer											
S.No.	Rated voltage	Measured Voltage			Average Voltage	Calculated Unbalance			Maximum unbalance	% Voltage Unbalance	%Temperature rise
		R	Y	B		R	Y	B			
1	440.00	420.80	417.50	419.00	419.10	1.70	1.60	0.10	1.70	0.41	0.33
2	440.00	420.90	417.50	419.00	419.13	1.77	1.63	0.13	1.77	0.42	0.36
3	440.00	420.80	417.50	418.90	419.07	1.73	1.57	0.17	1.73	0.41	0.34
4	440.00	420.80	417.40	418.90	419.03	1.77	1.63	0.13	1.77	0.42	0.36
5	440.00	420.70	417.40	418.80	418.97	1.73	1.57	0.17	1.73	0.41	0.34
6	440.00	420.50	417.20	418.40	418.70	1.80	1.50	0.30	1.80	0.43	0.37
7	440.00	420.50	417.20	418.30	418.67	1.83	1.47	0.37	1.83	0.44	0.38
8	440.00	420.40	417.10	418.30	418.60	1.80	1.50	0.30	1.80	0.43	0.37
9	440.00	420.60	417.30	418.30	418.73	1.87	1.43	0.43	1.87	0.45	0.40
10	440.00	420.60	417.70	418.40	418.90	1.70	1.20	0.50	1.70	0.41	0.33
11	440.00	420.70	417.80	418.50	419.00	1.70	1.20	0.50	1.70	0.41	0.33
12	440.00	420.70	417.80	418.60	419.03	1.67	1.23	0.43	1.67	0.40	0.32
13	440.00	420.80	417.80	418.50	419.03	1.77	1.23	0.53	1.77	0.42	0.36
14	440.00	420.80	417.90	418.50	418.20	2.60	0.30	0.30	2.60	0.62	0.77
15	440.00	420.40	417.50	418.30	418.73	1.67	1.23	0.43	1.67	0.40	0.32
16	440.00	420.50	417.60	418.40	418.83	1.67	1.23	0.43	1.67	0.40	0.32
17	440.00	420.50	417.70	418.40	418.87	1.63	1.17	0.47	1.63	0.39	0.30
18	440.00	420.60	417.70	418.50	418.93	1.67	1.23	0.43	1.67	0.40	0.32
19	440.00	420.50	417.70	418.40	418.87	1.63	1.17	0.47	1.63	0.39	0.30
19	440.00	420.50	417.70	418.40	418.87	1.63	1.17	0.47	1.63	0.39	0.30
19	440.00	420.40	417.60	418.30	418.77	1.63	1.17	0.47	1.63	0.39	0.30
20	440.00	420.40	417.60	418.30	418.77	1.63	1.17	0.47	1.63	0.39	0.30
21	440.00	420.30	417.50	418.30	418.70	1.60	1.20	0.40	1.60	0.38	0.29

22	440.00	420.40	417.60	418.30	418.77	1.63	1.17	0.47	1.63	0.39	**0.30**
23	440.00	420.50	417.70	418.60	418.93	1.57	1.23	0.33	1.57	0.37	**0.28**
24	440.00	420.50	417.70	418.70	418.97	1.53	1.27	0.27	1.53	0.37	**0.27**
25	440.00	420.60	417.70	418.60	418.97	1.63	1.27	0.37	1.63	0.39	**0.30**
26	440.00	420.40	417.50	418.50	418.80	1.60	1.30	0.30	1.60	0.38	**0.29**
27	440.00	420.20	417.50	418.40	418.70	1.50	1.20	0.30	1.50	0.36	**0.26**
28	440.00	420.30	417.50	418.50	418.77	1.53	1.27	0.27	1.53	0.37	**0.27**
29	440.00	420.20	417.50	418.40	418.70	1.50	1.20	0.30	1.50	0.36	**0.26**
30	440.00	420.10	417.30	418.50	418.63	1.47	1.33	0.13	1.47	0.35	**0.25**
31	440.00	420.20	417.30	418.60	418.70	1.50	1.40	0.10	1.50	0.36	**0.26**
32	440.00	420.30	417.30	418.60	418.73	1.57	1.43	0.13	1.57	0.37	**0.28**
33	440.00	420.10	417.20	418.50	418.60	1.50	1.40	0.10	1.50	0.36	**0.26**

Observation: -

1. It is Observed that the voltage unbalance is not Exceed 1%, and the Voltage Unbalance as per above Table is within acceptable range

Graphical Representation of Percentage Voltage Unbalance



Transformer

2.4 Power Quality

Power Quality & Harmonics

Equipment based on frequency conversion techniques generates harmonics. With the increased use of such equipment's, harmonics related problems have enhanced.

The harmonic currents generated by different types of loads, travel back to the source. While traveling back to the source, they generate harmonic voltages, following simple Ohm's Law. Harmonic voltages, which appear on the system bus, are harmful to other equipment connected on the same bus. In general, sensitive electronic equipment connected on this bus, will be affected.

The Harmonics Level on the LT side of the Transformers was measured, details of which is as under:-

- Maximum Individual Frequency Voltage Harmonic: 3%
- Total Harmonic Distortion of the Voltage: 5%

harmonic current limitations

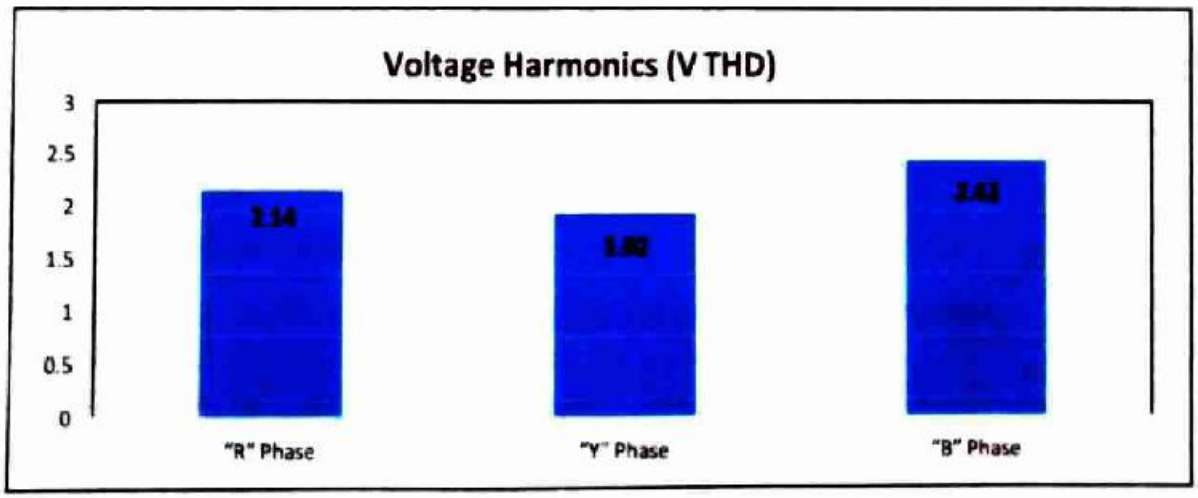
Maximum Harmonic Current Distortion in Percent of IL
120 Volt through 69 KV
Individual Harmonic Order (Odd Harmonics)

ISC/IL	h<11	11<h<17	17<h<23	23<h<35	35<h	TDD
<20*	4.0	2.0	1.5	0.6	0.3	5.0
20<50	7.0	3.5	2.5	1.0	0.5	8.0
50<100	10.0	4.5	4.0	1.5	0.7	12.0
100<1000	12.0	5.5	5.0	2.0	1.0	15.0
>1000	15.0	7.0	6.0	2.5	1.4	20.0

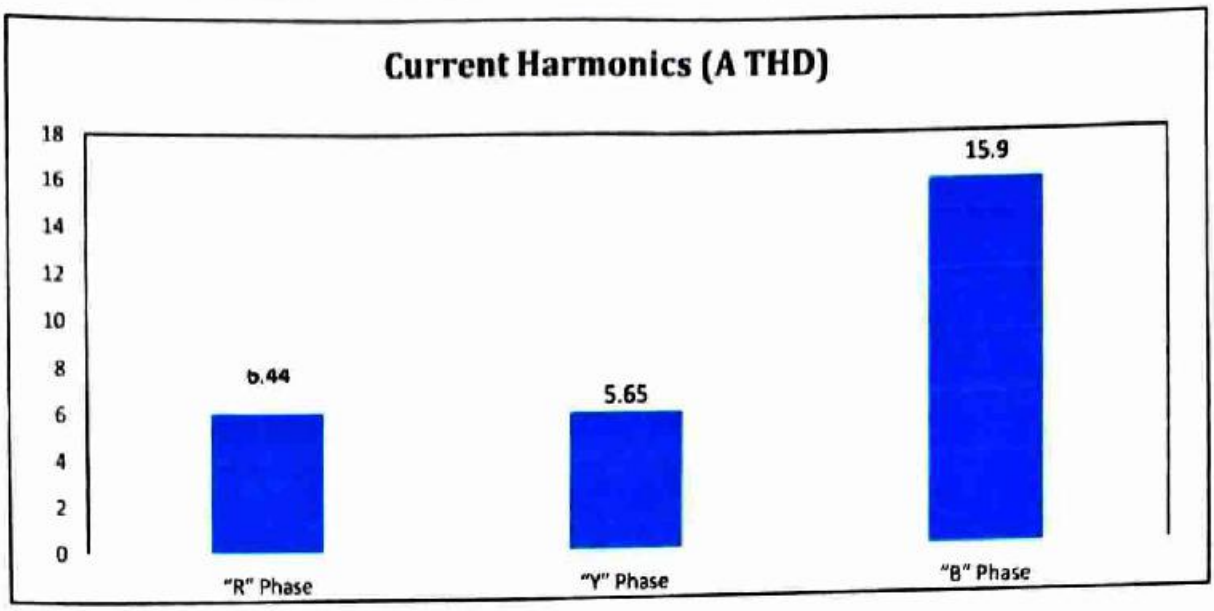
Even harmonics are limited to 25% of the odd harmonic limits
TDD refers to Total Demand Distortion based on the average demand current at the fundamental frequency and measured at the PCC (Point of Common Coupling
*All power generation equipment is limited to these values of current distortion regardless of ISC/IL value
ISC = Maximum short-circuit current at PCC
IL = Maximum demand load current (fundamental) at the PCC
h = Harmonic number

Particulars	TR
Overall	
Voltage Harmonics (V THD)	
"R" Phase	2.14
"Y" Phase	1.92
"B" Phase	2.42
Current Harmonics (A THD)	
"R" Phase	6.44
"Y" Phase	5.65
"B" Phase	15.9

Graphical Representation of Voltage Harmonics (V THD)



Graphical Representation of Current Harmonics (A THD)



OBSERVATIONS & SUGGESTIONS:

As detailed above, the voltage harmonics levels were around 1.92-2.42 % and the current harmonics levels were 5.65-15.9%. **The Overall harmonics are within limits**.

If Harmonics level is on higher side then appropriate harmonic filters may have to be installed in the system.

Different technologies are available mitigating the harmonics from the system. These include: **Detuned or broadband harmonic filters:** these filter banks are tuned to a frequency just below the predominant harmonic frequency. If the predominant harmonic frequency is say, 5th, it is normal practice to tune the filters to 189 Hz, or 3.78th harmonic, in 50 Hz systems.

Active Harmonic Filters: these units are designed in such manner that, they will inject harmonic frequencies in the system, which will be in anti-phase of the load harmonic frequencies. This will effectively free the source being loaded due to harmonics.

MAJOR CAUSES OF HARMONICS

Devices that draw non-sinusoidal currents when a sinusoidal voltage is applied create harmonics. Frequently these are devices that convert AC to DC. Some of these devices are listed below:

Electronic Switching Power Converters

- Computers, Uninterruptible power supplies (UPS), Solid-state rectifiers
- Electronic process control equipment, PLC's, etc.
- Electronic lighting ballasts, including light dimmer
- Reduced voltage motor controllers
- Arcing Devices
- Discharge lighting, e.g. Fluorescent, Sodium and Mercury vapor

- Arc furnaces, Welding equipment, Electrical traction system, Ferromagnetic Devices
- Transformers operating near saturation level
- Magnetic ballasts (Saturated Iron core)
- Induction heating equipment, Chokes, Motors, Appliances
- TV sets, air conditioners, washing machines, microwave ovens
- Fax machines, photocopiers, printers
- These devices use power electronics like SCRs, diodes, and thyristors, which are a growing percentage of the load in industrial power systems.

Many problems can arise from harmonic currents in a power system. Some problems are easy to detect; others exist and persist because harmonics are not suspected. Higher RMS current and voltage in the system are caused by harmonic currents, which can result in any of the problems listed below:

Blinking of Incandescent Lights	Transformer Saturation
Capacitor Failure	Harmonic Resonance
Circuit Breakers Tripping	Inductive Heating and Overload
Conductor Failure	Inductive Heating
Electronic Equipment Shutting down	Voltage Distortion
Flickering of Fluorescent Lights	Transformer Saturation
Fuses Blowing for No Apparent Reason	Inductive Heating and Overload
Motor Failures (overheating)	Voltage Drop
Neutral Conductor and Terminal Failures	Additive Triplen Currents
Electromagnetic Load Failures	Inductive Heating
Overheating of Metal Enclosures	Inductive Heating
Power Interference on Voice Communication	Harmonic Noise
Transformer Failures	Inductive Heating

3.LIGHTING SYSTEM

3.1 Introduction

Lighting is an essential service in all the industries, Universities, Hospitals, Malls etc. Innovation and continuous improvement in the field of lighting, has given rise to tremendous energy saving opportunities in this area. Lighting is an area, which provides a major scope to achieve energy efficiency at the design stage, by incorporation of modern energy efficient lamps, luminaries and gears, apart from good operational practices.

3.2 Basic Terms in Lighting System and Features

- **Lamps**

Lamp is equipment, which produces light. The most commonly used lamps are described briefly as follows:

- **Incandescent lamps:**

Incandescent lamps produce light by means of a filament heated to incandescence by the flow of electric current through it. The principal parts of an incandescent lamp, also known as GLS (General Lighting Service) lamp include the filament, the bulb, the fill gas and the cap.

- **Reflector lamps:**

Reflector lamps are basically incandescent, provided with a high quality internal mirror, which follows exactly the parabolic shape of the lamp. The reflector is resistant to corrosion, thus making the lamp maintenance free and output efficient.

- **Gas discharge lamps:**

The light from a gas discharge lamp is produced by the excitation of gas contained in either a tubular or elliptical outer bulb. The most commonly used discharge lamps are as follows:

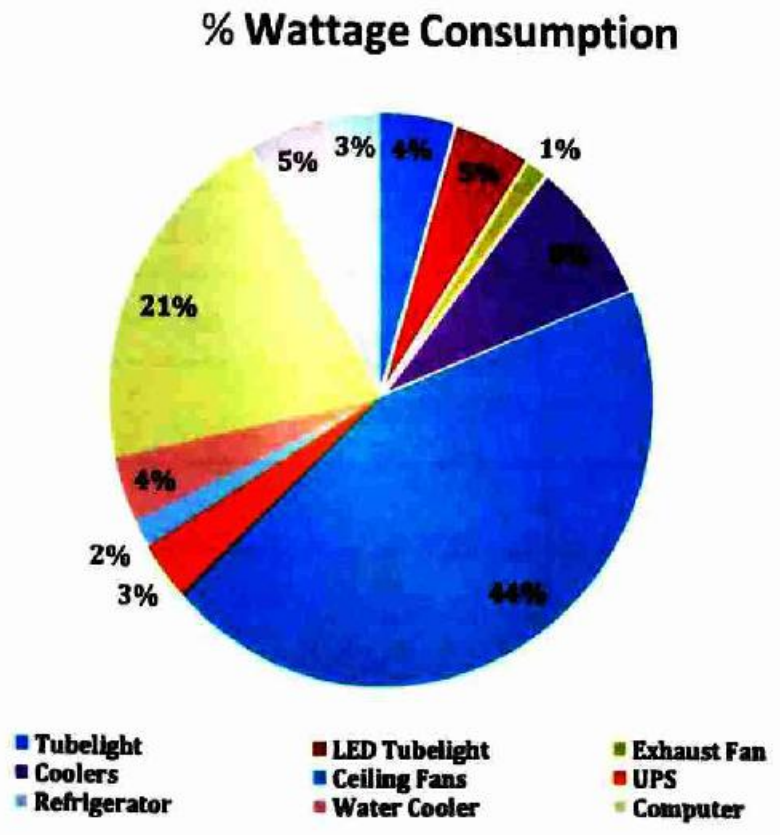
- Fluorescent tube lamps (FTL)
- Compact Fluorescent Lamps (CFL)
- Mercury Vapour Lamps
- Sodium Vapour Lamps
- Metal Halide Lamps

3.3 Light Details

Audit team done the Inventory with Wattage analysis of different type of lighting installed in the across the campus. Below table shows the overall fixtures install in the College.

Inventory Details				
S.No.	**Lighting Details/Type of light**	**Quantity**	**Wattage**	**Total load (Watt)**
1	Tubelight	25	40	1000
2	LED Tubelight	50	20	1012
3	Exhaust Fan	2	150	300
4	Coolers	4	450	1800
5	Ceiling Fans	120	80	9600
Some other Energy Consuming Equipments				
6	UPS	2	360	720
7	Refrigerator	1	350	350
8	Water Cooler	1	800	800
9	Computer	15	300	4500
10	Oven	1	1000	1000
11	Submersible Pump	1	746	746

Representation of Percentage Wattage Consumption



Observation:

1. It is Observed from above table there are unconventional Tube Lights and fans are Installed in College Premises.

Recommendation:

1. It is Recommended to Replace all unconventional 40 Watt + 15 W (Choke) Tubelights Lights
2. It is Recommended to Replace inefficient Fans with BLDC Energy Efficient Fans.

Energy Saving Potential

The Below Table Shows the Energy Saving Potential of Govt. College Khertha.

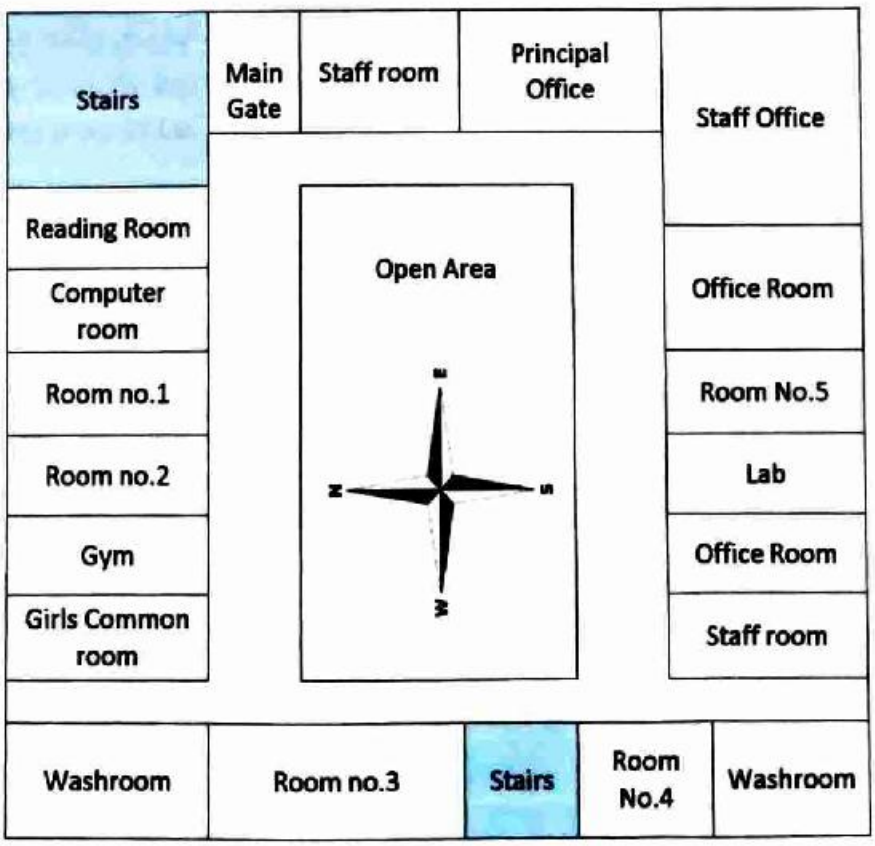
Replacement of Tube Light of 40W+15 W (choke) with 20W LED Tube		
Particulars	**Value**	**Units**
Total Number of 55 Watt Tube Light	25	Nos.
Measured Watt	55	Watts
Total Watts	1375	Watts
Proposed watt after replacement	20	Watts
Total Watt After Replacement	875	Watts
Operating Hours in a day	7	Hours
Estimated Energy Saving after Replacement Annual KWH	1837.5	KWH
Per Unit Cost as Per CSPDCL Bill	7.8	Rs/kWh
Estimated Cost Saving Per Year	14332.5	Rs
Cost of Per Fixtures	300	Rs
Total Investment Cost	7500	Rs
Payback	0.52	Year

Replacement of Ceiling Fan of 80W With EESL Energy Efficient BLDC 35W Ceiling Fan		
Particulars	**Value**	**Units**
Total Number of 80 Watt	120	No.s
Measured Watt	80	Watts
Total Watts	9600	Watts
Proposed watt after replacement	35	Watts
Total Watt After Replacement	5400	Watts
Operating Hours in a day	7	Hours
Estimated Energy Saving after Replacement Annual KWH	11340	KWH
Per Unit Cost as Per CSPDCL Bill	7.80	Rs/kWh
Estimated Cost Saving Per Year	88452	Rs
Cost of Per Fixtures	2500	Rs
Total Investment Cost	300000	Rs
Payback	3.39	Year

3.4. Lux Level: -

Lux is a standardised unit of measurement of light level intensity, which is commonly referred to as "illuminance" or "illumination". A measurement of **1 lux is equal to the illumination of a one metre square surface** that is one metre away from a single candle.

Ground Floor Layout



Ground Floor

This table Shows the Average value of Lux

Location	Average Lux level with Open Window & Light	Average Lux level with Open Window only	Average Lux level with Light Only
Reading Room	661	553	132
Computer room	658	551	129
Room No.1	660	555	135
Room No.2	665	553	131
Gym	659	549	127
Girls Common Room	663	554	124
Room No.3	664	546	136
Room No.4	602	545	140
Staff Room	850	932	175
Office Room	848	929	169
Lab	850	935	171
Room No.5	855	927	177
Office Room	845	936	166
Principal Office	853	933	159
Staff Room	856	925	179

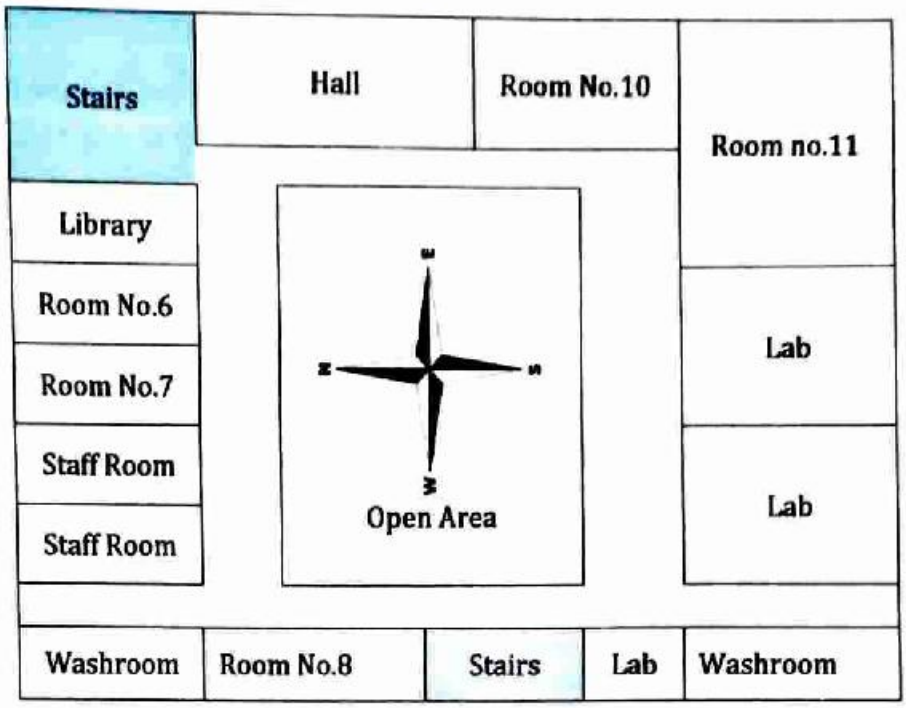
Observation:

1. It is observed from above table that the Average LUX Level is between 500 to 925 when all Windows are Open in Rooms and No Lights are Switched ON, **which is above Standard Level for Class Rooms i.e. 300 LUX.**

Recommendation:

1. It is recommended to switch off all the Lights during day time or off the half of the Total Lights of the Rooms if Required, which can save too Much Energy.

First Floor Layout



First Floor

This Table Shows the Average Value of Lux

Location	Average Lux level with Open Window & Light	Average Lux level with Open Window only	Average Lux level with Light Only
Library	653	557	136
Room No.6	658	551	129
Room No.7	669	559	135
Store Room	659	549	127
Store Room	663	554	124
Room No.8	664	546	138
Lab	602	545	140
Lab	620	932	175
Lab	627	938	169
Room No.11	850	935	171
Conference Hall	855	933	159

Observation:

1. It is Observed from above table that the Average LUX Level is between 500 to 925 with only all Windows are Open in Rooms and No Lights are Switched ON, **which is above Standard Level for Class Rooms i.e. 300 LUX.**

Recommendation:

1. It is Recommended that Switch off all the Lights during day time or Can Switch ON Half of the Lights of the Rooms if Required, which can save too Much Energy.

4.SOLAR POWER GENERATION SYSTEM

4.1 Introduction

Solar energy is the energy obtained by capturing heat and light from the Sun. Energy from the Sun is referred to as solar energy. Technology has provided a number of ways to utilize this abundant resource. It is considered a green technology because it does not emit greenhouse gases. Solar energy is abundantly available and has been utilized since long both as electricity and as a source of heat.

Solar technology can be broadly classified as –

- **Active Solar** – Active solar techniques include the use of photovoltaic systems, concentrated solar power and solar water heating to harness the energy. Active solar is directly consumed in activities such as drying clothes and warming of air.
- **Passive Solar** – Passive solar techniques include orienting a building to the Sun, selecting materials with favorable thermal mass or light-dispersing properties, and designing spaces that naturally circulate air.

4.2 Salient Benefits of Solar Energy

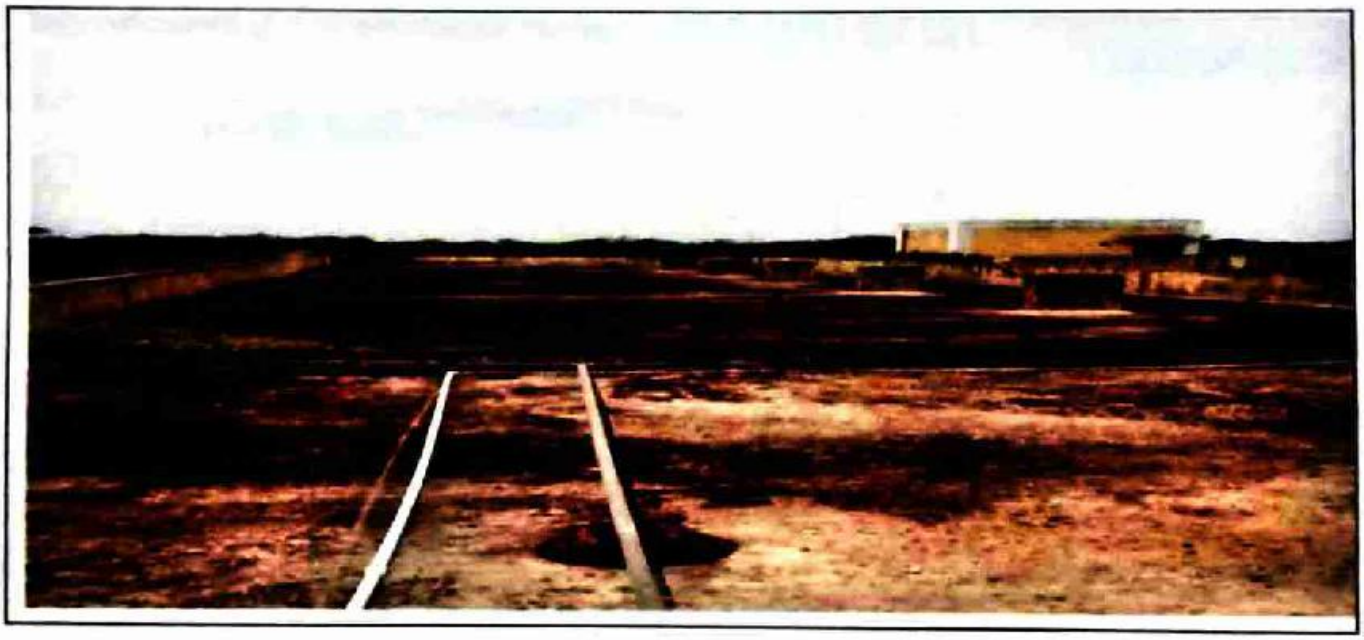
1. Energy Saving
2. Reduce Operating Cost
3. Provides Unlimited and reliable Energy
4. A clean, silent and eco-friendly source of power
5. Energy Independence
6. Available throughout the year
7. Protection against future escalation of energy costs
8. Solar modules convert sunlight into electricity without pollution
9. Modular design and easily expandable

4.3 Proposed Solar Power Plant

There is a proposed plan for on-grid solar power plant of 10kwp at Govt. College Khertha

Benefits of on-grid Solar power System

1. Huge Reduction in Electricity Bill
2. Easy Maintenance
3. Synchronize with other source of Power
4. Huge Saving in Energy
5. Generated more power than other solar system



Proposed Site for 10kwp Solar Power Plant

College Proposed around 10000 Sq.ft. Space at roof of Govt. College Khertha for Installation of Maximum 20kwp on-grid solar power plant.

Our Suggestion –

During Energy Audit we have measured the electrical power at different blocks of Govt. College Khertha and we observed that the proposed site for the solar power plant has more than connected load.

We Suggest to install Solar power plant at the roof of college because the maximum load of College has connected in the said building.

Generally as a thumb rule, the solar module of 1kW generate approximately 4-5 kWh per day which requires 100 sq.ft area for installation.

The potential capacity of Solar module is depend upon the availability of shadow free area. Considering all the above points and present scenario of energy, there is potential of installation of capacity upto 10 kW. However considering the CAPEX issue, it is advisable to Installed Solar module Phase wise. Initially on pilot project basis, 5 KW modules can be installed and after desirable result, the management can look forward to install the Maximum capacity considering Techno-Economic Viability.

The suitable operating day considered for Govt. College Khertha is 300 days.

The resultant monitory benefit has been worked out as follows:

Installation cost	Rs. 10.00 Lakhs
Daily Power generation	20 kW
Daily estimated power generation Hours	100 kwh
Annual estimated power generation (300 Days)	0.30 Lakh kWh
Electricity Cost per unit	Rs. 7.80
Annual cost saving	Rs. 2.34 Lakhs
Simple Payback period	4.2 Years

List of Solar Energy System Suppliers

Name	Contact Details
1. Shankheshwar Energies	Sai Plaza , 2nd floor , Beside National Convent School, Kushalpur Chowk, Raipur. HIG-C/1, infront of HDFC Bank, Shailendra Nagar , Raipur. Mo.-9755020202
2. Avarnaa Alliance,LLP.	C-31 Rameshwaram Delux, Baghmugaliya , Bhopal-462043. Mail:- support@avarnaalliance.in , Contact:-Mr. Arpan -9977176764 (Director), www.avarnaalliance.in.
3. API Corporations.	Ward No.-4 Marar Para Balod , Dist-Balod Pin-491226, Chhattisgarh. Contact:- Pradeep Kumar Shrishrimal (Director) , Mo:-9685424400 , 9644443000 , Mail:-niknet16@gmail.com

5. GENERAL TIPS FOR ENERGY CONSERVATION IN DIFFERENT UTILITIES SYSTEMS

5.1 ELECTRICITY

- Schedule your operations to maintain a high load factor
- Minimize maximum demand by tripping loads through a demand controller
- Use standby electric generation equipment for on-peak high load periods.
- Correct power factor to at least 0.99 under rated load conditions.
- Set transformer taps to optimum settings.
- Shut off unnecessary computers, printers, and copiers at night.

5.2 FANS

- Use smooth, well-rounded air inlet cones for fan air intakes.
- Avoid poor flow distribution at the fan inlet.
- Minimize fan inlet and outlet obstructions.
- Clean screens, filters, and fan blades regularly
- Use aerofoil-shaped fan blades.
- Minimize fan speed.
- Use low-slip or flat belts.
- Check belt tension regularly.
- Eliminate variable pitch pulleys.
- Use variable speed drives for large variable fan loads.
- Use energy-efficient motors for continuous or near-continuous operation
- Eliminate leaks in ductwork.
- Minimize bends in ductwork
- Turn fans off when not needed

5.3 PUMPS

- Operate pumping near best efficiency point.
- Modify pumping to minimize throttling.
- Adapt to wide load variation with variable speed drives or sequenced control of smaller units.
- Stop running both pumps -- add an auto-start for an on-line spare or add a booster pump in the problem area.
- Use booster pumps for small loads requiring higher pressures.
- Increase fluid temperature differentials to reduce pumping rates.
- Repair seals and packing to minimize water waste.
- Balance the system to minimize flows and reduce pump power requirements.
- Use siphon effect to advantage: don't waste pumping head with a free-fall (gravity) return.

5.4 LIGHTING

- Reduce excessive illumination levels to standard levels using switching, delamping, etc. (Know the electrical effects before doing delamping.)
- Aggressively control lighting with clock timers, delay timers, photocells, and/or occupancy sensors.
- Install efficient alternatives to incandescent lighting, mercury vapor lighting, etc.
- Efficiency (lumens/watt) of various technologies range from best to worst approximately as follows: low pressure sodium, high pressure sodium, metal halide, fluorescent, mercury vapor, incandescent.
- Select ballasts and lamps carefully with high power factor and long-term efficiency in mind.
- Upgrade obsolete fluorescent systems to Compact fluorescents and electronic ballasts
- Consider lowering the fixtures to enable using less of them.
- Consider day lighting, skylights, etc.
- Consider painting the walls a lighter color and using less lighting fixtures or lower wattages.
- Use task lighting and reduce background illumination.
- Re-evaluate exterior lighting strategy, type, and control. Control it aggressively.
- Change exit signs from incandescent to LED.

5.5. WATER & WASTE WATER

- Recycle water, particularly for uses with less-critical quality requirements.
- Recycle water, especially if sewer costs are based on water consumption.
- Balance closed systems to minimize flows and reduce pump power requirements.
- Eliminate once-through cooling with water.
- Use the least expensive type of water that will satisfy the requirement.
- Fix water leaks.
- Test for underground water leaks. (It's easy to do over a holiday shutdown.)
- Check water overflow pipes for proper operating level.
- Automate blowdown to minimize it.
- Provide proper tools for wash down -- especially self-closing nozzles.
- Install efficient irrigation.
- Reduce flows at water sampling stations.
- Eliminate continuous overflow at water tanks.
- Promptly repair leaking toilets and faucets.
- Use water restrictors on faucets, showers, etc.
- Use self-closing type faucets in restrooms.
- Use the lowest possible hot water temperature.

6. ENERGY MANAGEMENT STRATEGY

Energy Management should be seen as a continuous process. Strategies should be reviewed annually and revised as necessary. The key activities suggested have been outlined below:

6.1 IDENTIFY A STRATEGIC CORPORATE APPROACH

The starting point in energy management is to identify a strategic corporate approach to energy management. Clear accountability for energy usage needs to be established, appropriate financial and staffing resources must be allocated and reporting procedures initiated. An energy management program requires commitment from the whole organization in order to be successful. A record of Energy consumption must be kept and monitored on regular basis, to optimize the Energy consumption. For this, various meters may have to be installed.

6.2. DESIGNATE AN ENERGY MANAGER

An Energy Manager must be identified and time bound responsibility must be given to him in getting implemented the findings of the Energy Audit points, which the Plant Establishment has planned to implement.

6.3. SET UP AN ENERGY MONITORING AND REPORTING SYSTEM

Successful energy management requires the establishment of a system to collect/ analyze and report the energy costs and consumption pattern. This will enable an overview of energy use and its related costs, as well as facilitating the identification of savings that might `otherwise not be detected. The system needs to record both historical and ongoing energy use, as well as cost information from billing data, and capable of producing summary reports on a regular basis. This information will provide the means by which trends can be analyzed and reviewed for corrective measures.

6.4. IMPLEMENT A STAFF AWARENESS AND TRAINING PROGRAM

A key ingredient to the success of an energy management program is maintaining a high level of awareness among staff. This can be achieved in a number of ways, including formal training, newsletters, posters and publications. It is important to communicate program plans and case studies that demonstrate savings, and to report results at least at 12-month intervals. Staff may need training from specialists on energy saving practices and equipments.

List of Energy Efficient Equipment Suppliers

Product/ Equipment	Contact Details
Automation, Panel Meters	Conzerv System 44P Electronic City Phase –II, East Hosur Road,
Automation, Panel Meters	Bangalore – 560100 Ph: 080-51189700 www.conzerv.com Selec controls Pvt Ltd E – 121, Ansa Industrial Estate, Saki Vihar Road, Mumbai 400072 Ph: 022-28471882, 28476443
Plant Automation, sensors,	www.selecindia.com Electro Art Plot No K-11, MIDC Area, Ambad, Nashik –422010, Ph: 0253-5603954, 2380918 www.electronicswitchesindia.com
Capacitors	Asian Electronics Ltd. Plot 68, MIDC, Satpur, Nasik, Nashik - 422 007
Capacitors	Shreem Capacitors Pvt. Ltd. 7/39, Vikram Vihar, Lajpat Nagar-IV, New Delhi – 110 024
Capacitors and APFC Panels	Matrix Controls & Engineers Pvt Ltd Rajeev Batra 9811624440, Rajeev@matrixcapacior.com E- 725 DSIDC, Industrial Complex, Narela, GT Road, Delhi – 110040 Ph: 01127786945 / 46 / 47 www.matrixcapacitor.com
Capacitors and APFC Panels	Standard Capacitors B-70/43, DSIDC Complex, Lawrence road Industrial Area, Delhi – 110035 Ph: 011 –27181490, 27151027 www.standardcapacitors.com
Capacitors and APFC Panels	Saif Electronics 174, Hira Plant, 1st Floor, Carnac Road, Opposite Police Commissioner office , Mumbai – 400002 Ph : 022 – 22064626 , 22086613 www.saifel.com
LED lighting	Synergy Solar (P) ltd SCO 133, sector 28D, Chandigarh Ph 0172-6451133 www.synergysolars.com
Lighting Systems	Philips India Ltd Regional office-North, 9th floor Ashoka Estate, 24, Barakhamba Road New Delhi – 110 001 Telephone No.: 3353280, 3317442, Fax No.: 3314332
Lighting Systems	Crompton Greaves Ltd. Lighting Business Group, 405, Concorde, RC Dutt Road, Baroda – 390 007
Lighting Systems	OSRAM India Ltd. Signature Towers, 11th Floor, Tower B, South City-I, Gurgaon 122001,

Product/ Equipment	Contact Details
	Fax: 0124- 6526184
Lighting Systems	Asian Electronics Surya Place, First Floor, K-185/1, Sarai
Lighting Systems	Julena, New Friends Colony, New Delhi – 110 025 Asian Electronics Surya Place, First Floor, K-185/1, Sarai
Lighting Systems	Julena, New Friends Colony, New Delhi – 110 025 Philips India Limited , Technopolis Knowledge Park, Nelco Complex, Mahakali Caves Road, Chakala, Andheri (East), Mumbai 400 093. Tel : 022 56912000
Lighting Systems	Surya Roshni Ltd. Padma Tower-I, Rajendra Palace, New Delhi 110 006.
Lighting Systems	Wipro Limited Sco 196-197, Sector 34-A, Chandigarh - 160 022
Lighting Systems	OSRAM India Ltd. Signature Towers, 11th Floor, Tower B, South City-I, Gurgaon 122001, Haryana Tel: 0124- 6526175, 6526178, 6526185 Fax: 0124- 6526184

Note: - The suppliers mentioned above are not the only ones or the best in the market. The management may contact other suppliers for competitive rates/ specifications.

Load Profile of TR with Normal Load

Annexure1

Date:24.08.2021

Time:	Voltage			Current			Load (KW)			Total Load		Power factor
Time:	R-phase	Y-phase	B-Phase	R-phase	Y-phase	B-Phase	R-phase	Y-phase	B-Phase	PT (KW)	ST (KVA)	PFT
01:05:00 PM	409.7	439.3	411	0.3	1.66	5.63	0.07	0.41	1.31	1.78	1.91	0.93
01:05:01 PM	409.5	439.3	411	0.3	1.66	5.59	0.07	0.41	1.30	1.78	1.90	0.94
01:05:02 PM	409.7	439.1	410.9	0.3	1.66	7.28	0.07	0.41	1.66	2.14	2.32	0.92
01:05:03 PM	409.5	439.3	410.8	0.3	1.66	6.65	0.07	0.41	1.55	2.03	2.16	0.94
01:05:04 PM	409.4	439.2	410.6	0.3	1.66	6.6	0.07	0.41	1.54	2.01	2.15	0.94
01:05:05 PM	409.4	439	410.6	0.3	1.66	6.6	0.07	0.41	1.54	2.01	2.15	0.94
01:05:06 PM	409.4	438.9	410.6	0.3	1.66	6.51	0.07	0.41	1.52	1.99	2.13	0.94
01:05:07 PM	409.1	438.7	410.3	0.3	1.66	5.75	0.07	0.41	1.33	1.81	1.94	0.93
01:05:08 PM	409	438.6	410.2	0.3	1.66	5.52	0.07	0.41	1.28	1.76	1.88	0.94
01:05:09 PM	409.5	438.9	410.6	0.3	1.86	5.53	0.07	0.42	1.28	1.77	1.93	0.92
01:05:10 PM	409.8	439.3	410.8	0.3	1.68	5.54	0.07	0.41	1.29	1.76	1.89	0.93
01:05:11 PM	409.8	439.2	410.9	0.3	1.67	5.56	0.07	0.41	1.29	1.77	1.89	0.93
01:05:12 PM	409.4	439	410.6	0.3	1.67	5.52	0.07	0.41	1.28	1.76	1.88	0.93
01:05:13 PM	409.2	439	410.4	0.3	1.67	5.51	0.07	0.41	1.28	1.75	1.88	0.93
01:05:14 PM	409.1	439	410.3	0.3	1.67	5.53	0.07	0.41	1.28	1.76	1.88	0.93
01:05:15 PM	409.2	439.1	410.5	0.3	1.67	5.55	0.07	0.41	1.29	1.76	1.89	0.93
01:05:16 PM	409.1	439	410.5	0.3	1.67	5.49	0.07	0.41	1.27	1.75	1.87	0.93
01:05:17 PM	415.1	438.7	416.7	0.41	1.67	5.47	0.09	0.41	1.27	1.76	1.89	0.93
01:05:18 PM	424.1	438.7	429.9	1.8	1.67	5.48	0.12	0.41	1.27	1.79	2.24	0.80
01:05:19 PM	429.9	438.6	438.6	2.43	1.66	6.13	0.13	0.41	1.42	1.95	2.57	0.76
01:05:20 PM	429.8	438.5	438.5	2.43	1.66	6.19	0.13	0.41	1.45	1.98	2.58	0.77
01:05:21 PM	429.9	438.5	438.4	2.43	1.66	6.21	0.13	0.41	1.45	1.99	2.59	0.77
01:05:22 PM	430	438.6	438.6	2.43	1.66	6.09	0.12	0.41	1.42	1.95	2.56	0.76
01:05:23 PM	429.9	438.7	438.9	2.43	1.66	5.51	0.12	0.41	1.28	1.81	2.41	0.75
01:05:24 PM	430	438.9	439.2	2.43	1.66	5.55	0.12	0.41	1.29	1.82	2.43	0.75
01:05:25 PM	430.4	439	439.5	2.43	1.66	5.47	0.12	0.41	1.27	1.80	2.41	0.75

01:05:26 PM	430.5	439	439.7	2.43	1.66	5.49	0.12	0.41	1.27	1.80	2.41	0.75
01:05:27 PM	430.6	438.9	439.5	2.43	1.66	5.48	0.12	0.41	1.27	1.80	2.41	0.75
01:05:28 PM	430.7	439.1	439.5	2.43	1.66	5.44	0.13	0.41	1.26	1.79	2.40	0.75
01:05:29 PM	430.5	438.9	439.3	2.43	1.66	5.45	0.13	0.41	1.26	1.79	2.40	0.75
01:05:30 PM	430.4	438.9	439.3	2.43	1.66	5.53	0.13	0.41	1.28	1.81	2.42	0.75
01:05:31 PM	430.4	439.1	439.6	2.44	1.66	5.5	0.13	0.41	1.28	1.81	2.42	0.75
01:05:32 PM	429.8	439.1	438.3	2.59	1.66	6.04	0.21	0.41	1.36	1.97	2.59	0.76
Total	**418**	**439**	**422**	**1.18**	**1.67**	**5.78**	**0.09**	**0.41**	**1.34**	**1.84**	**2.17**	**0.86**

Load Profile with Full load

Date:24.08.2021

Time:	Voltage			Current			Load (KW)			Total Load		Power factor
Time:	R-phase	Y-phase	B-Phase	R-phase	Y-phase	B-Phase	R-phase	Y-phase	B-Phase	PT (KW)	ST (KVA)	PFT
01:10:01 PM	426.9	435.3	428	11.93	20.06	9.91	2.899	4.801	2.409	10.108	10.405	0.971
01:10:11 PM	427.1	435.3	428.4	11.94	20.12	9.94	2.903	4.818	2.416	10.137	10.433	0.972
01:10:21 PM	426.6	434.7	427.5	11.92	20.02	11.53	2.898	4.788	2.822	10.508	10.794	0.974
01:10:31 PM	426.8	434.8	427.2	11.94	20.1	13.64	2.901	4.811	3.327	11.039	11.346	0.973
01:10:41 PM	426.9	434.9	427.4	11.93	20.04	12.74	2.901	4.799	3.118	10.818	11.11	0.974
01:10:51 PM	426.9	435	427.3	11.93	20.06	12.04	2.899	4.804	2.945	10.647	10.936	0.974
01:11:01 PM	426.6	434.8	426.7	11.91	20.06	13.7	2.891	4.806	3.34	11.037	11.343	0.973
01:11:11 PM	426.8	434.9	426.5	11.92	20.08	15.57	2.896	4.812	3.811	11.519	11.82	0.975
01:11:21 PM	426.8	434.7	426.7	11.93	20.04	14.78	2.9	4.801	3.612	11.313	11.612	0.974
01:11:31 PM	427.2	434.9	426.8	11.93	20.04	15.49	2.902	4.802	3.792	11.496	11.796	0.975
01:11:41 PM	427.4	435.1	427.2	11.94	20.04	14.76	2.907	4.806	3.612	11.325	11.626	0.974
01:11:51 PM	426.7	434.7	426.5	11.91	20.02	14.77	2.894	4.797	3.61	11.301	11.598	0.974
01:12:01 PM	426.3	434.4	426	11.9	20.02	15.32	2.886	4.793	3.74	11.419	11.721	0.974
01:12:11 PM	426.9	434.8	426.4	11.92	20.05	14.76	2.894	4.806	3.609	11.31	11.608	0.974
01:12:21 PM	426.8	434.7	426.4	11.91	20.01	14.76	2.893	4.795	3.609	11.297	11.595	0.974

01:17:31 PM	424	431.9	424.4	11.85	19.79	14.05	2.866	4.713	3.442	11.021	11.271	0.978
01:17:41 PM	424	432	424.1	11.84	19.77	14.45	2.863	4.709	3.538	11.11	11.363	0.978
01:17:51 PM	424	431.8	424.1	11.85	19.75	15.26	2.867	4.702	3.706	11.274	11.559	0.975
01:18:01 PM	424.4	432.2	424.8	11.87	19.77	14.02	2.874	4.71	3.44	11.024	11.273	0.978
01:18:11 PM	423.5	432.2	424.6	11.87	19.8	14.68	2.869	4.714	3.602	11.184	11.434	0.978
01:18:21 PM	423.5	432.5	424.6	11.86	19.75	14.02	2.866	4.704	3.442	11.013	11.261	0.978
01:18:31 PM	423.4	432.3	424.4	11.86	19.72	14.04	2.864	4.697	3.444	11.005	11.251	0.978
01:18:41 PM	423.1	432.3	424.1	11.83	19.72	14.04	2.855	4.696	3.443	10.994	11.24	0.978
01:18:51 PM	424.1	432.1	424.7	11.86	19.74	14.05	2.87	4.705	3.445	11.02	11.267	0.978
01:19:01 PM	424.2	432.3	424.5	11.86	19.76	14.51	2.869	4.713	3.552	11.135	11.387	0.978
01:19:11 PM	424.3	431.9	424.4	11.86	19.8	14.04	2.87	4.723	3.439	11.032	11.276	0.978
Total	**425.153**	**433.753**	**425.457**	**11.877**	**19.979**	**14.107**	**2.876**	**4.778**	**3.453**	**11.106**	**11.380**	**0.976**

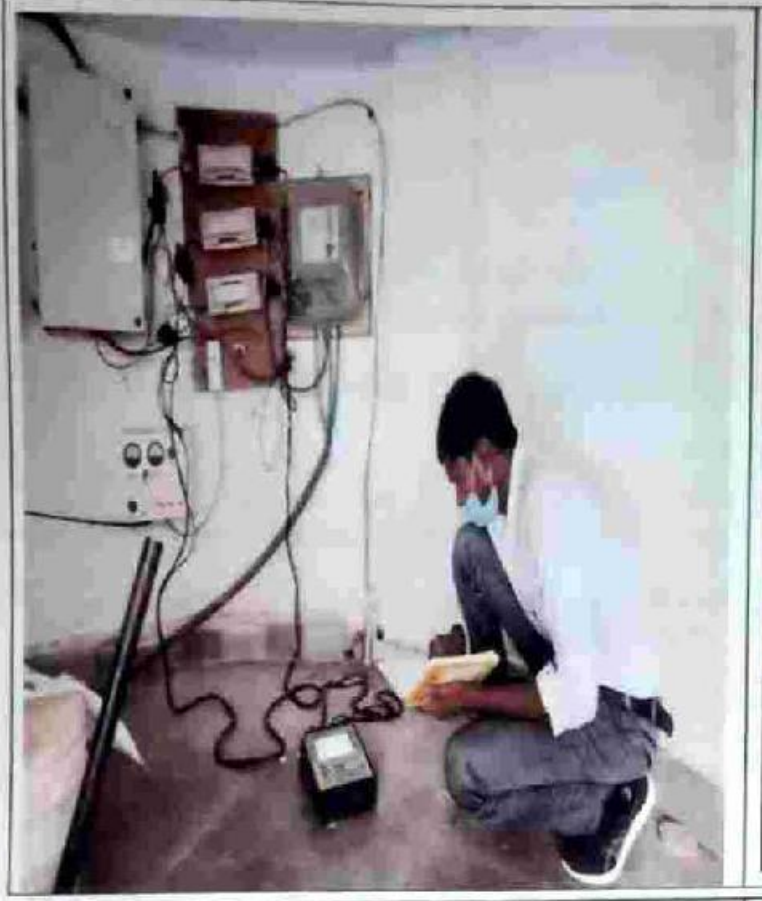
Load Profile With Full Load & Pump

Date-24-08-2021

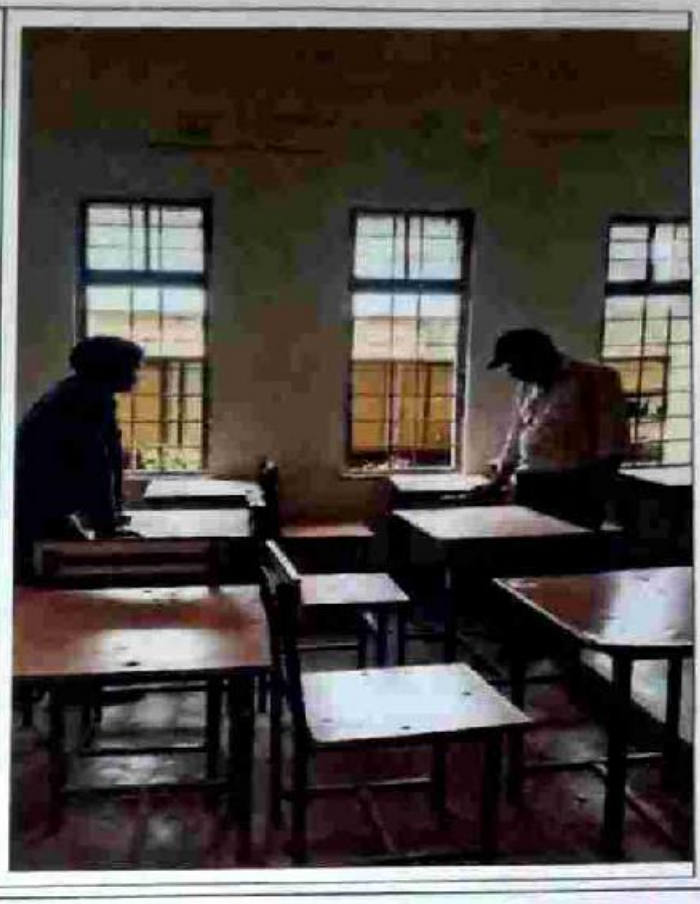
Time:	Voltage			Current			Load (KW)			Total Load		Power factor
Time:	R-phase	Y-phase	B-phase	R-phase	Y-phase	B-phase	R-phase	Y-phase	B-phase	PT (KW)	ST (KVA)	PFT
01:19:26 PM	424.1	432.4	424.5	11.85	21.51	14.02	2.865	4.919	3.437	11.22	11.695	0.959
01:19:36 PM	424	432.4	424.4	11.84	26.37	14.58	2.862	6.343	3.57	12.78	13.034	0.98
01:19:46 PM	423.5	432	423.9	11.82	26.34	13.68	2.854	6.33	3.368	12.55	12.784	0.982
01:19:56 PM	423.7	432.3	424.1	11.85	26.36	13.69	2.861	6.337	3.372	12.57	12.802	0.982
01:20:06 PM	423.4	432.1	423.9	11.84	26.35	13.68	2.856	6.333	3.369	12.56	12.788	0.982
01:20:16 PM	423.4	431.9	423.7	11.82	26.35	13.65	2.852	6.334	3.361	12.55	12.777	0.982
01:20:26 PM	423	431.5	423.2	11.82	26.31	14.37	2.848	6.319	3.532	12.70	12.929	0.982
01:20:36 PM	423.4	431.9	423.9	11.83	26.34	13.64	2.855	6.331	3.358	12.54	12.773	0.982
01:20:46 PM	423.5	431.8	423.5	11.82	26.34	15.18	2.855	6.332	3.714	12.90	13.154	0.981

Site Photograph

Annexure-2



Electrical Data Logging



Measuring Lux Level

Tubelight

BUREAU OF ENERGY EFFICIENCY

Examination Registration No.: EA-5514

Accreditation Registration No.: AEA-0295

Certificate of Accreditation

This is to certify that Mr./Ms. Rakesh Khichariya having its trade/registered office at Bhilai has been given accreditation as accredited energy auditor. The certificate shall be effective from 11th day of February, 2019

The certificate is subject to the provisions of the Bureau of Energy Efficiency (Qualifications for Accredited Energy Auditors and Maintenance of their List) Regulations, 2010.

This certificate shall be valid until it is cancelled under regulation 9 of the Bureau of Energy Efficiency (Qualifications for Accredited Energy Auditors and Maintenance of their List) Regulations, 2010.

On cancellation, the certificate of accreditation shall be surrendered to the Bureau within fifteen days from the date of receipt of order of cancellation.

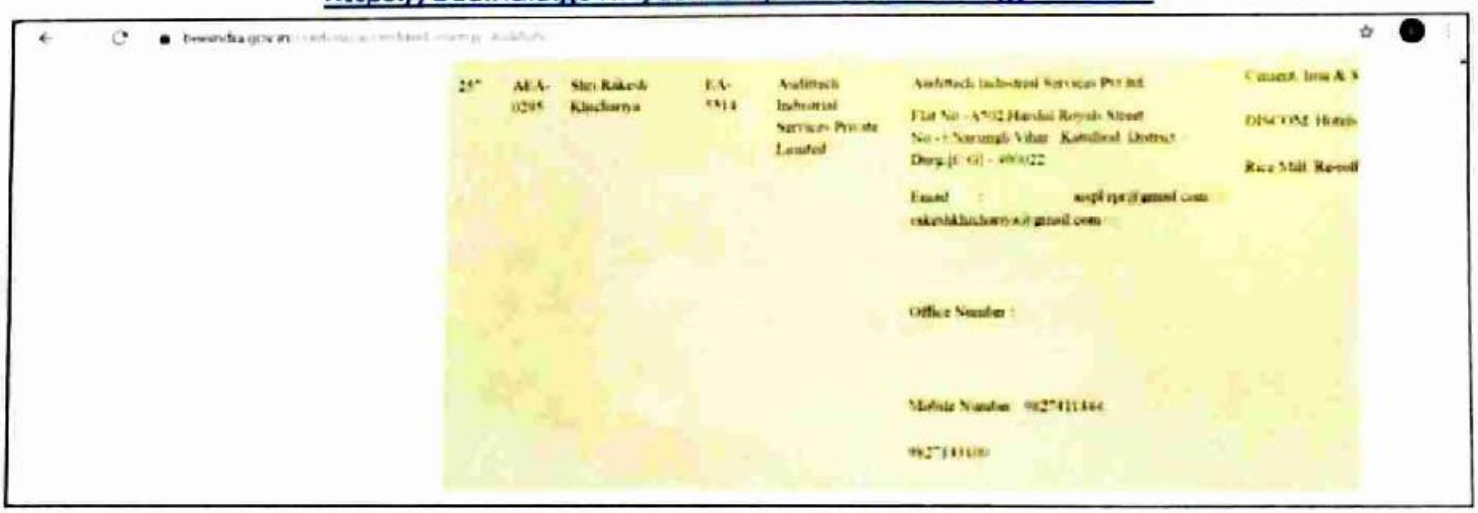
Your name has been entered at AEA No. 0295 in the register of list of accredited energy auditors. Your name shall be liable to be struck out on the grounds specified in regulation 8 of the Bureau of Energy Efficiency (Qualifications for Accredited Energy Auditors and Maintenance of their List) Regulations, 2010.

Given under the seal of the Bureau of Energy Efficiency, Ministry of Power, this 19th day of March, 2019

Secretary,
Bureau of Energy Efficiency
New Delhi

Accreditation details can be check in the BEE official website (Check S.No. 257).Please click below link

https://beeindia.gov.in/content/accredited-energy-auditors



ENVIRONMENT AUDIT REPORT

OF

GOVT. COLLEGE KHERTHA, DIST BALOD (C.G.)

ADDRESS :- KHERTHA BAZAR ROAD, KHERTHA

CHHATTISGARH

KHERTHA, DIST- BALOD (C.G.) - 491771

* Environment Audit Report Prepared By *

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Govt. College Khertha
Khertha
Distt. Balod
Balod (C.G.)

Principal,
Govt. College, Khertha
Distt. Balod (C.G.)

1.0. OBJECTIVES:

For environment audit following parameter is taken on pollution related status regarding air, water and noise at the Govt. college khertha on 28.06.2021 to be a part of environmental audit of the college.

2. A. WATER QUALITY MONITORING:

In order to assess the drinking water quality in Govt. college khertha, drinking water samples were collected from Bore well at Govt. college khertha on 28.06.2021 in a pre-cleaned one liter polythene bottle for the analysis of different physical and chemical parameters. The analysis was carried out in the laboratory of Govt. college khertha using the standard methods given in APHA, 2012(American Public Health Association).

B. RESULTS:

The data table of the water sample at Govt. college khertha is shown in table-1.

Table: 1: Analytical Result of Drinking Water Samples Collected from Govt. college khertha.

S. No.	Parameters	S-1	Indian Standard for Drinking water
1.	pH	6.75	6.5-8.5
2.	Conductivity (µS/cm)	219	-
3.	Turbidity (NTU)	0.31	5
4.	Total suspended solids (mg/l)	16	-
5.	Total dissolved solids (mg/l)	108	500
6.	Total hardness (mg/l)	40.4	300
7.	Calcium (mg/l)	11.65	75
8.	Magnesium (mg/l)	4.82	24.28
9.	Chlorides (mg/l)	15.36	250
10.	Alkalinity (mg/l)	27.57	200
11.	Iron (mg/l)	0.11	0.3
12.	Arsenic (mg/l)	BDL	0.05
13.	Total Coli form (cfu/100ml)	<1.8	<1.8

C. OBSERVATION:

From the result table, it has been observed that, the analyzed values of the said drinking water sample are within the prescribed standards limit of CPCB (central pollution control board).

3. AIR QUALITY MONITORING:

The college is situated in outskirts of village khertha. It is far away from state highway and there is no industry or mining activity within periphery of 25km. So overall status of air quality is good here.

Govt. College Khertha Khertha Distt. Balod Balod (C.G.)

Principal,
Govt. College, Khertha
Distt. Balod (C.G.)

4. A NOISE MONITORING:

College is situated in cool and calm surrounding. No industry or mining activity is operational in adjacent place; we don't feel noise pollution here. Instead we are blessed to here chirping sound of Birds.

B. OBSREVATIONS:

The noise monitoring was carried out at the 2 (two) locations in the college campus covering the main gate inside college and on top of college. Not observed any adverse or high noise which can impact environment.

5. OVERALL CONCLUSION:

The water quality test conducted at the Khertha College revealed that the quality of water quality at the college campus is good with respect to the prescribed standard.

The monitoring of air quality is good and without any containments.

The noise level monitoring revealed that the noise level measured at different locations within tolerable limit.

6. RECOMMENDATION:

To maintain the good environment, more green belt has to be developed in the college campus by planting valuable trees, fruits bearing plants and seasonal blooming trees etc which also helps to increase the beautification of the college.

Overall Conclusion:

The Air Quality, Water Quality and noise quality test conducted at the Govt. College Khertha revealed that the quality of Air and water quality at the college campus are good with respect to the prescribed standard.

The Noise level monitoring revealed that the noise level measured at different locations within the tolerable limit.

To maintain the good environment, more green belt has to be developed in the college campus by planting valuable trees, fruit bearing plants and seasonal blooming trees etc. which also helps to increase the beautification of the college.

Therefore it may be concluded that the Govt. college khertha Environment friendly college.

Govt. College Khertha
Khertha
Distt. Balod
Balod (C.G.)

Principal,
Govt. College, Khertha
Distt. Balod (C.G.)