ENERGY AUDIT & GREEN BUILDING REPORT
OF GOVT. GHANSHYAM SINGH GUPT P.G. COLLEGE BALOD

ADDRESS: - Durg Dalli-Rajhara Rd, Balod, Chhattisgarh 491226

Prepared By–

AUDITTECH

Audittech Industrial Services Private Limited

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ACKNOWLEDGEMENT

We express our sincere gratitude to **Higher Education Institute Govt. Ghanshyam Singh Gupt P.G. College 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 **HEI Govt. Ghanshyam Singh Gupt P.G. College 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.

Signature:

Date: Dec 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 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.

Place : Chennai, India

Date : **22nd April, 2019**

Controller of Examination

1.EXECUTIVE SUMMARY

An Energy Audit is a study of a facility to 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.

The rapid urbanization and economic development at local, regional and global level has led to several environmental and ecological crises. On this background it becomes essential to adopt the system of the Green Campus for the institute which will lead for sustainable development.
Govt. Ghanshyam Singh Gupt P.G. College Balod is deeply concerned and unconditionally believes that there is an urgent need to address these fundamental problems and reverse the trends. The purpose of the audit was to ensure that the practices followed in the campus are in accordance with the Green Policy & Energy Policy adopted by the institution. The methodology included: preparation and filling up of questionnaire, physical inspection of the campus, observation and review of the documentation, interviewing key persons and data analysis, measurements and recommendations. It works on the several facets of 'Green Campus' including Water Conservation, Tree Plantation, Waste Management, Paperless Work, Alternative Energy and Mapping of Biodiversity. With this in mind, the specific objectives of the audit was to evaluate the adequacy of the management control framework of environment sustainability as well as the degree to which the Departments are in compliance with the applicable regulations, policies and standards. It can make a tremendous impact on student health and learning college operational costs and the environment. The criteria, methods and recommendations used in the audit were based on the identified risks.

Higher Education Institute Govt. Ghanshyam Singh Gupt P.G. College Balod Facility.

Govt. Ghanshyam Singh Gupt P.G. College Balod affiliated to Hemchand Yadav Vishwa vidyalaya comes under higher education department of Chhattisgarh government in district Balod. This college was established in the year 1983. 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 Electricity Connection of 1.5 KW connection from Chhattisgarh state power distribution company Ltd. The transformer is installed outside of the boundary of campus which is not dedicated for the college.

SN.	*Energy saving measures*	*Investment in Rs.*	Yearly Energy savings		
			Electricity (kWh)	*Cost saving /year (in Rs.)*	*Payback Period (Year)*
1	**2**	**3**	**4**	**5**	**6**
1	Replacement of Tube Light of 40W + 15 W(Choke) with Energy Efficient 20W LED Tube	76000.00	18595.5	121000.00	0.62
2	Replacement of Ceiling Fan of 80W With Energy Efficient 35WBLDC Ceiling Fan	615000.00	23247	151000.00	4.07
3	Installation of 10 kW Solar Power Generation Unit in Roof Top	500000.00	15000	97000.00	5.15
4	To reduce the contract demand of electricity connection (BP No 1000690098) from 18.81 kW to 10 kW.	0.00	0	12000.00	Immediate
	Total	**1191000.00**	**56842**	**381000.00**	**3.22**

Total implementation cost proposed	**11.91**	**Rs. Lakhs**
Total Energy saving Potential identified (in kWh)	**0.56**	**Lakhs kWh**
Total cost Saving Potential	**3.81**	**Rs. Lakhs**
Simple Pay Back Period	**3.22**	**Yrs.**

Note: Consider Electricity unit rate- Rs. 6.5/kWh

Green Audit Summary

S.No.	Area	Observation	Remark
1	Solid Waste Management	Waste bins are placed separately for dry and wet waste at some corner of the corridor, Organic waste like leaves food waste etc. Had outside vendors to manage the paper waste also. Old furniture and other wood and metal scrap found in so many location.	Good initiative taken by college towards use of solid waste Management System. But in some more places dustbins should need to be placed for proper disposal of the solid wastage. Old scrap wood and metal need to be dispose or to be sell for recycle to make campus clean.
2	Liquid waste Management	However rain water harvesting system not found to recharge the ground level Water. Water wastage through taps of washroom and flush system is maximum	Initiative need to be taken by college Towards Water Conservation through rain water harvesting. Using ecomist water saver tap nozzles to save 80% of water wastage. Using solar water sprinkler for gardening can save energy as well as water also
3	Plastic free campus	College is taking initiative by displaying banner about awareness of plastic free campus.	Good initiative by college towards to implement Plastic Free Campus.
4	E- waste Management	There is no such process found for the disposal of E-waste	College should take some measures for the proper management of E-Waste material.

1.1 Need for Green Audit & Energy Audit

Green Audit & Energy audit can be defined as systematic identification, quantification, recording, reporting and analysis of components of environmental diversity, energy usage. The 'Green Audit' aims to analyze environmental practices within and outside the college campus, which will have an impact on the eco- friendly ambience. It was initiated with the motive of inspecting the work conducted within the organizations whose exercises can cause risk to the health of inhabitants and the environment. Through Green Audit, one gets a direction as how to improve the condition of environment and there are various factors that have determined the growth of carrying out Green Audit.

In any Educational Institute, the three top operating expenses are often found to be Energy, Manpower, and 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. Ghanshyam Singh Gupt P.G. College Balod Energy Efficient. Campus Energy bill keeps up around INR **0.89 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. Ghanshyam Singh Gupt P.G. College Balod 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

HEI Govt. Ghanshyam Singh Gupt P.G. College Balod 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. Ghanshyam Singh Gupt P.G. College Balod .

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)	10 yrs.	9179294953
5	Mr. Sumit Singh Thakur	Certified Energy Manager (EA-28549)	10 yrs.	8770632688
6	Mr. Mahaveer Bafna	Energy Engineer	3 yrs	8962369293
7	Mr. Chandra Prakash	Energy Engineer	1 yrs	8817255897

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
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:

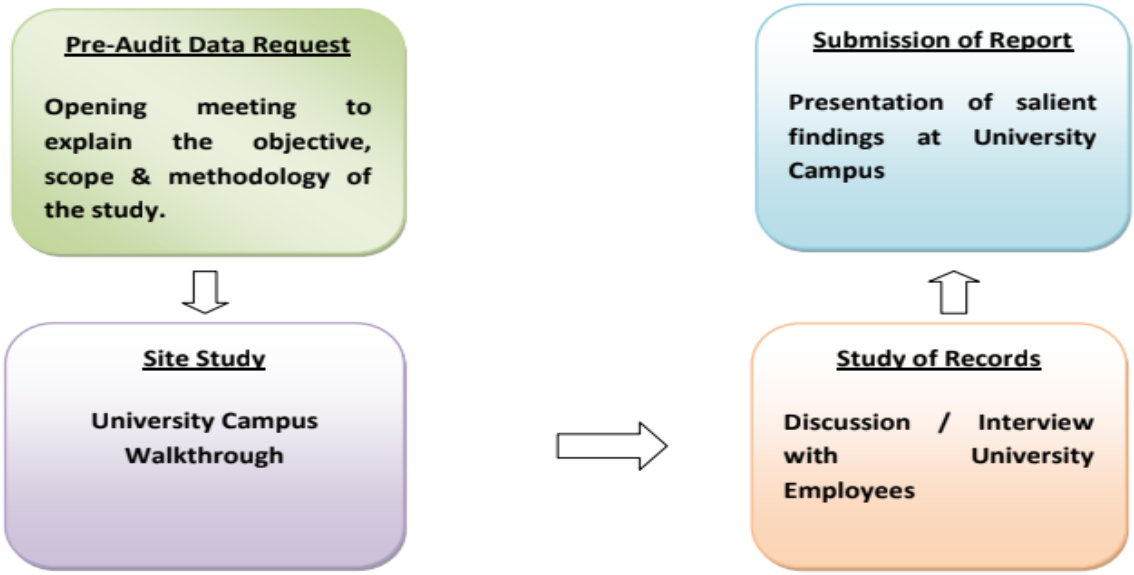
   The team went to each department, centres, Library, canteen, Student Blocks, labs, etc.

   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-

In college campus total there are 5 electricity connections out of which 2 connections are of single phase and three connections are of 3 phase.

Details of all 5 connections are shown below

1. Meter No 1 (BP No 1000690098) Situated Just Left Side Of College Entering Main Gate from which all the lighting load of old building & new building is connected

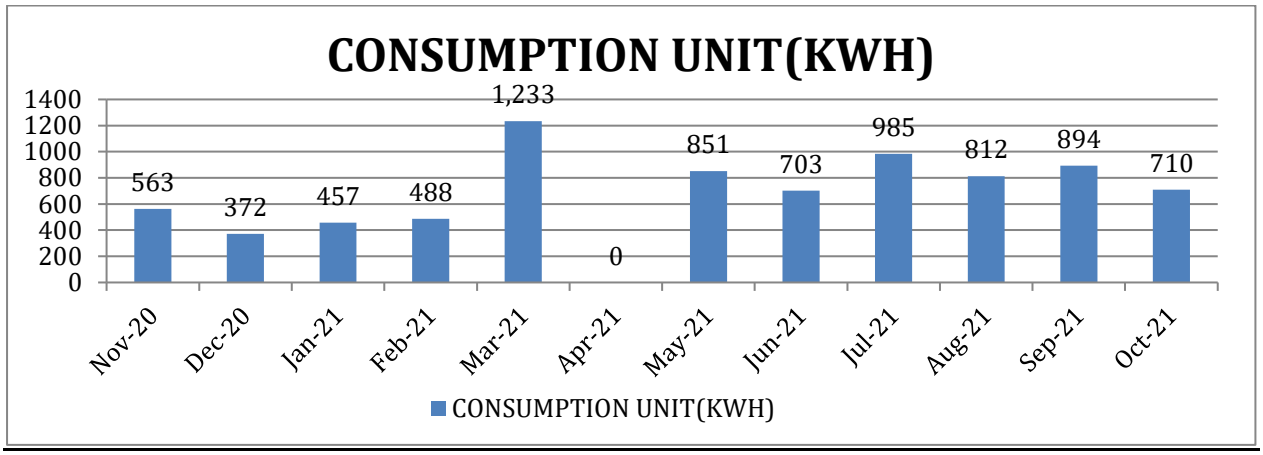
This table shows the Electricity Bill of last 12 Months for the above electricity connection from Nov. 2020 to Oct. 2021.

Govt. Ghanshyam Singh Gupt P.G. College Balod ELECTRICITY CONSUMPTION DETAILS (METER NO.1- BP NO.1000690098)						
BILL MONTH	**CONSUMPTION UNIT(KWH)**	**CONTRACT DEMAND(KW)**	**ACTUAL DEMAND(KW)**	**AMOUNT (In Rs.)**	**POWER FACTOR**	**Unit Cost (In Rs./KW)**
Nov-20	**563**	18.81	5.07	4081.75	0.94	7.25
Dec-20	372	18.81	3	2697	0.94	7.25
Jan-21	457	18.81	2.69	3313.25	0.87	7.25
Feb-21	488	18.81	6.34	3,538	0.88	7.25
Mar-21	1,233	18.81	9.39	8939	0.92	7.25
Apr-21	0	18.81	9.39	0	0.92	0
May-21	851	18.81	5.98	6170	0.98	7.25
Jun-21	703	18.81	8.14	5096.75	0.98	7.25
Jul-21	985	18.81	5.87	7141.25	0.98	7.25
Aug-21	812	18.81	5.6	6008.8	0.96	7.4
Sep-21	894	18.81	6.2	6615.6	0.97	7.4
Oct-21	710	18.81	6.34	5254	0.96	7.4
Total	**8068**			**58855.4**		
Average	**672.33**	**18.81**	**6.17**	**4904.62**	**0.94**	**7.29**
Max	**1233**	**18.81**	**9.39**	**2002**	**0.98**	**7.4**
Min	**0**	**18.81**	**2.69**	**182**	**0.87**	**7.25**

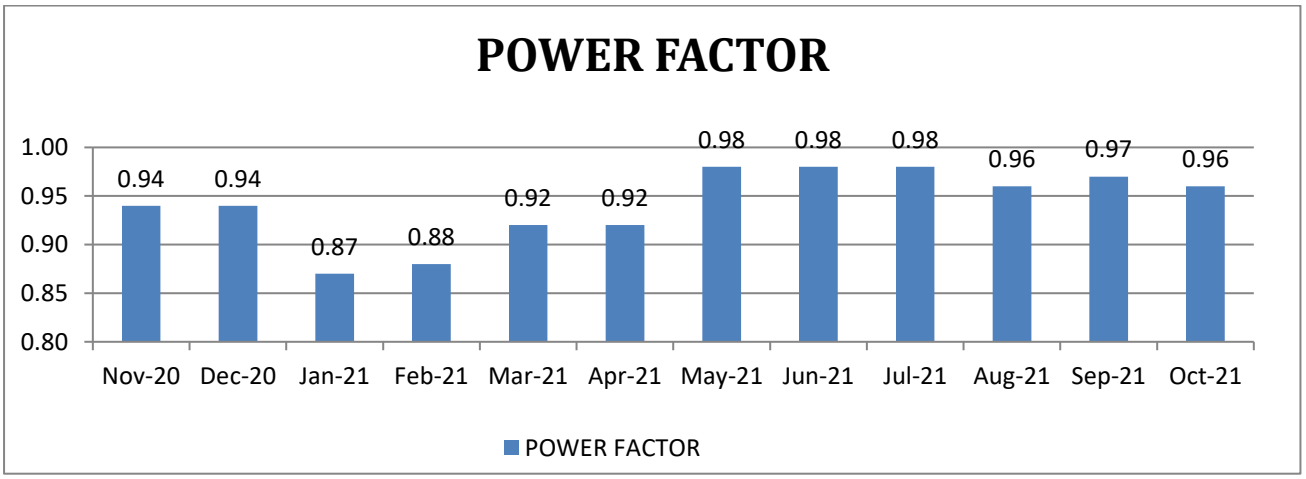
Observation: - It is clearly observed from the above table that contracted demand of this connection is 18.81 kW but the average actual demand of last 12 months is 6.17 kW only which is only 33 % of the contracted demand.

Recommendation:- It is recommended to reduce the contract demand from 18.81 kW to 10 kW , which will save fixed contract demand charges by Rs 1000.00 every month.

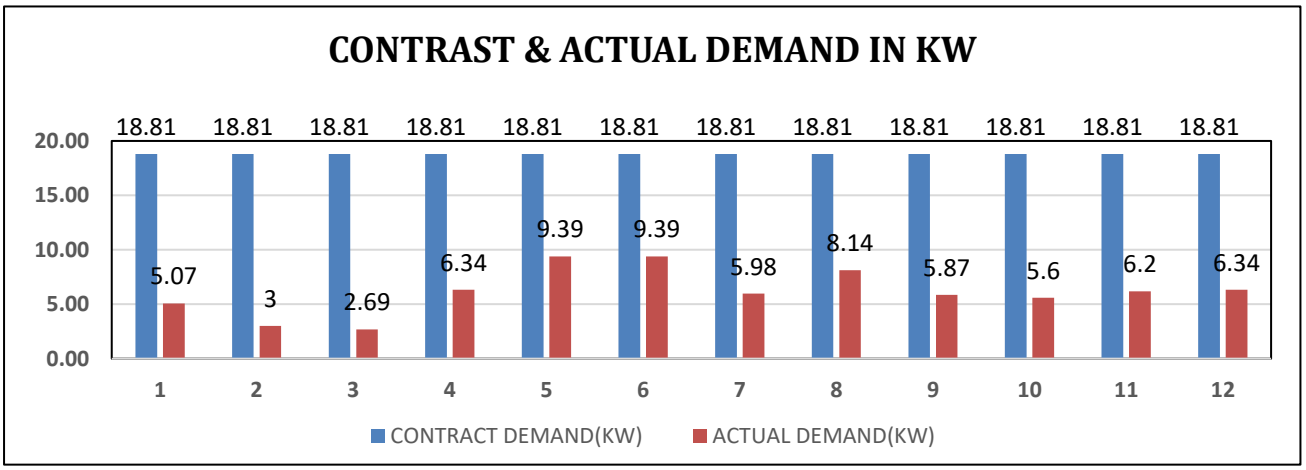
Graphical Representation of Consumption Unit (KWH)



Graphical Representation of Power Factor



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



2.2 Electricity Bill Summary-

Meter No 2 (BP No 1000690101) :- Situated Just Left Side Of College Entering Main Gate from which only one Submersible Pump of 1.5 HP is connected .

But as per the electricity bill average consumption of last 12 Months From Nov. 2020 to Oct. 2021 is zero.

Observation: - No proper meter reading taken from the CSPDCL for billing.

2.3 Electricity Bill Summary-

Meter No. 3 (BP No 1000690128):- Situated at College Sports Room. This Meter is Single Face Connection Which is connected with Submersible Pump, and lighting load of Sports Room and Whole Law Building of The College.

This table shows the Electricity Bill of last 12 Months From Nov. 2020 to Oct. 2021.

Govt. Ghanshyam Singh Gupt P.G. College Balod
ELECTRICITY CONSUMPTION DETAILS (METER NO.3- BP NO.1000690128)

BILL MONTH	CONSUMPTION UNIT(KWH)	CONTRACT DEMAND(KW)	ACTUAL DEMAND(KW)	AMOUNT (In Rs.)	POWER FACTOR	Unit Cost (In Rs./KW)
Nov-20	**205**	1.50	0	528.5	0.00	2.58
Dec-20	118	1.5	0	657	0.00	5.57
Jan-21	170	1.50	0	995	0.00	5.85
Feb-21	239	1.5	0	1,444	0.00	6.04
Mar-21	239	1.5	0	1444	0.00	6.04
Apr-21	36	1.5	0	194.4	0.00	5.4
May-21	275	1.5	0	1678	0.00	6.1
Jun-21	281	1.5	0	1716.5	0.00	6.11
Jul-21	160	1.5	0	930	0.00	5.81
Aug-21	91	1.5	0	518.7	0.00	5.7
Sep-21	86	1.5	0	490.2	0.00	5.7
Oct-21	142	1.5	0	851.4	0.00	6.00
Total	**1803**			**11446.2**		
Average	**163.91**	**1.50**	**0.00**	**953.85**	**0.00**	**5.81**
Max	**281**	**1.5**	**0.00**	**1716.5**	**0.00**	**6.11**
Min	**36**	**1.5**	**0.00**	**490.2**	**0.00**	**2.58**

2.4 Electricity Bill Summary-

Meter No 4 (BP No 1002910114) Situated at College Library Room. This Meter is Three Face Connection Which is connected with total load of Whole Library Building of the College.

This table shows the Electricity Bill of last 12 Months from Nov. 2020 to Oct. 2021.

Govt. Ghanshyam Singh Gupt P.G. College Balod ELECTRICITY CONSUMPTION DETAILS (METER NO.4- BP NO.1002910114)						
BILL MONTH	**CONSUMPTION UNIT(KWH)**	**CONTRACT DEMAND(KW)**	**ACTUAL DEMAND(KW)**	**AMOUNT (In Rs.)**	**POWER FACTOR**	**Unit Cost (In Rs./KW)**
Nov-20	**0**	5.00	0	1498	0.00	0
Dec-20	0	5	0	1498	0.00	0
Jan-21	144	5.00	0	3558	0.00	24.71
Feb-21	69	5	0	449	0.00	6.5
Mar-21	69	5	0	449	0.00	6.5
Apr-21	0	5	0	1498	0.00	0
May-21	104	5	0	822	0.00	7.90
Jun-21	171	5	0	1111.5	0.00	6.5
Jul-21	139	5	0	903.5	0.00	6.5
Aug-21	0	5	0	1498	0.00	0
Sep-21	0	5	0	1498	0.00	0
Oct-21	0	5	0	92	0.00	0
Total	**696**			**14874**		
Average	**58.00**	**5.00**	**0.00**	**1239.50**	**0.00**	**4.88**
Max	**171**	**5**	**0.00**	**1498**	**0.00**	**24.71**
Min	**0**	**5**	**0.00**	**92**	**0.00**	**0.00**

2.5 Electricity Bill Summary-

Meter No 5 (BP No 10006411380) Situated at College Canteen Room. This Meter is One Face Connection Which is Connected with lighting load of Canteen of The College.

This table shows the Electricity Bill of last 12 Months From Nov. 2020 to Oct. 2021.

Govt. Ghanshyam Singh Gupt P.G. College Balod ELECTRICITY CONSUMPTION DETAILS (METER NO.5- BP NO.10006411380)						
BILL MONTH	**CONSUMPTION UNIT(KWH)**	**CONTRACT DEMAND(KW)**	**ACTUAL DEMAND(KW)**	**AMOUNT (In Rs.)**	**POWER FACTOR**	**Unit Cost (In Rs./KW)**
Nov-20	**0**	2	0	0	0	0
Dec-20	0	2	0	0	0	0
Jan-21	0	2	0	0	0	0
Feb-21	0	2	0	0	0	0
Mar-21	0	2	0	0	0	0
Apr-21	15	2	0	81	0	5.4
May-21	0	2	0	0	0	0
Jun-21	222	2	0	1333	0	6.0
Jul-21	206	2	0	1229	0	6.0
Aug-21	131	2	0	777.7	0	5.9
Sep-21	26	2	0	148.2	0	5.7
Oct-21	44	2	0	250.8	0	5.7
Total	**644**			**3819.7**		
Average	**53.67**	**2.00**	**0.00**	**318.31**	**0.00**	**5.93**
Max	**222**	**2**	**0.00**	**1333**	**0.00**	**6**
Min	**0**	**2**	**0.00**	**0**	**0.00**	**0**

2.6 Transformer Load Profile-

The Below Table Shows the Transformer Load Profile of Govt. Ghanshyam Singh Gupt P.G. College Balod **. Meter No 1 (BP No 1000690098)**

Parameter	Unit	Min	Max	Average
R RMS Voltage	V	250.2	260.4	256.5
Y RMS Voltage	V	208.3	223.4	218.4
B RMS Voltage	V	255.5	265.2	260.5
R RMS Current	Amp	16.45	24.38	18.85
Y RMS Current	Amp	0.30	1.13	0.56
B RMS Current	Amp	16.34	23.50	18.63
L1 PF	-	0.50	0.56	0.53
L2 PF	-	0	0.04	0.02
L3 PF	-	0.53	0.55	0.54
R Active Power	W	2469	3299	2600
Y Active Power	W	0	5.290	2.557
B Active Power	W	2512	3235	2637
Total Active Power	**W**	**4998**	**6.533**	**5239**
R Apparent Power	VA	4612	6043	4837
Y Apparent Power	VA	115.2	150.9	123.8
B Apparent Power	VA	4643	5952	4855
Total Apparent Power	**VA**	**9389**	**12120**	**9815**
R THD Voltage	%	1.8	2.4	2.2
Y THD Voltage	%	3.3	4.0	3.6
B THD Voltage	%	2.3	2.7	2.5
R THD Current	%	9.2	15.80	14.55
Y THD Current	%	76.10	93.30	82.06
B THD Current	%	12.00	15.60	14.32

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

Observation:

1. It is observed from the above table that Load is not properly distributed phase wise, load is distributed in the R phase & B phase i.e. 16.45 & 16.34 Amps as compared to Y phase.
2. Maximum running load is 6.54 kW which is higher that the contracted demand as per the electricity bill i.e. 18.81 kW.

2.7 Transformer Load Profile-

The Below Table Shows the Transformer Load Profile of Govt. Ghanshyam Singh Gupt P.G. College Balod **. Meter No 2 (BP No 1000690101)**

Parameter	Unit	Min	Max	Average
R RMS Voltage	V	254.6	262.0	256.8
Y RMS Voltage	V	215.4	215.4	225.8
B RMS Voltage	V	244.0	244.0	259.1
R RMS Current	Amp	2.70	2.93	2.81
Y RMS Current	Amp	2.42	2.71	5.54
B RMS Current	Amp	2.58	2.85	2.70
L1 PF	-	0.68	0.72	0.70
L2 PF	-	0.75	0.78	0.76
L3 PF	-	0.82	0.84	0.83
R Active Power	W	486.8	529.0	507.4
Y Active Power	W	424.9	465.0	441.1
B Active Power	W	562.4	601.8	583.2
Total Active Power	**W**	**1481**	**1594**	**1532**
R Apparent Power	VA	707.9	739.8	721.9
Y Apparent Power	VA	555.1	595.1	574.2
B Apparent Power	VA	682.0	717.1	701.7
Total Apparent Power	**VA**	**1961**	**2046**	**1998**
R THD Voltage	%	2.20	2.60	2.37
Y THD Voltage	%	3.50	3.90	3.67
B THD Voltage	%	2.50	3.00	2.71
R THD Current	%	4.70	5.30	5.02
Y THD Current	%	5.30	6.00	5.59
B THD Current	%	4.80	6.30	5.01

2.4 Power Quality

- 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.

Power Quality & Harmonics

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

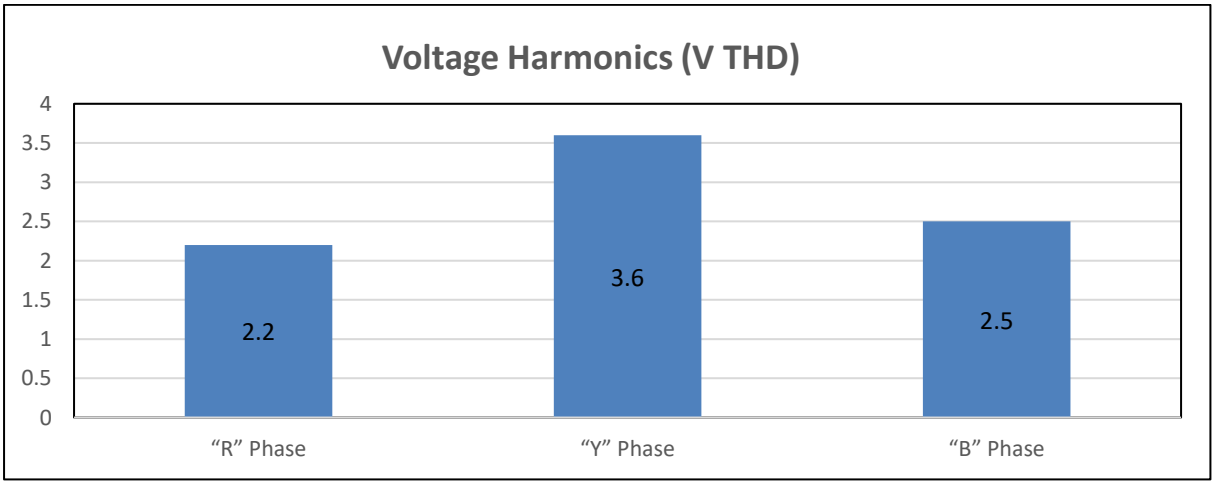
The harmonic currents generated by different types of loads, travel back to the source. While travelling back to the source, they generate harmonic voltages, following simple Ohm's Law. Harmonic voltages, which appear on the system bus, are harmful to other equipment connected on the same bus.

In general, sensitive electronic equipment connected on this bus, will be affected.

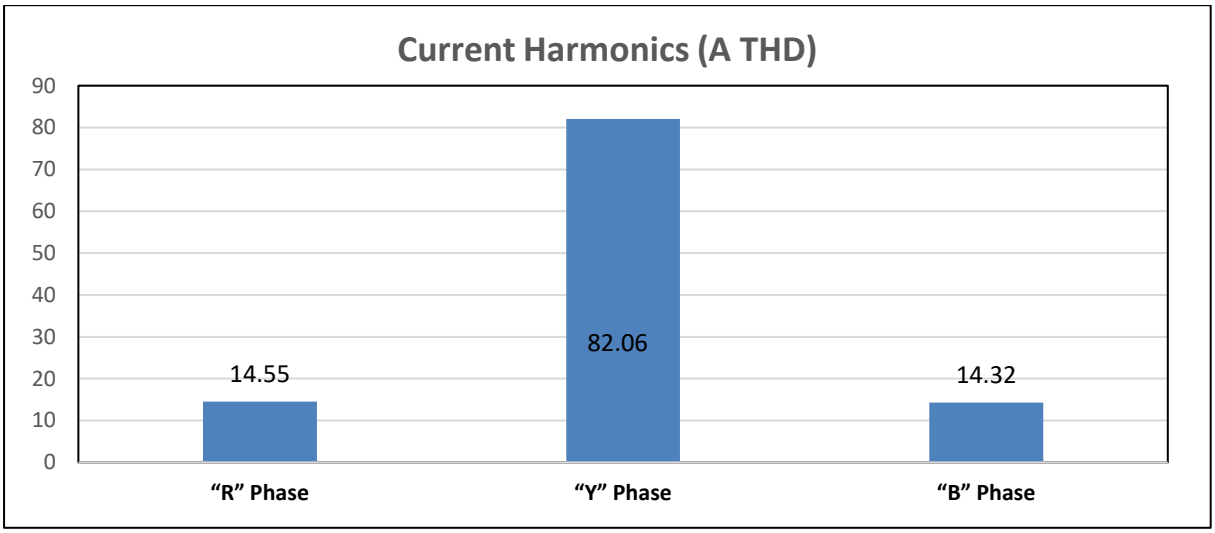
The Harmonics Level on the LT side of the Transformers was measured, details of which is as under:-

Particulars	TR
Voltage Harmonics(VTHD)	
"R"Phase	2.2
"Y"Phase	3.6
"B"Phase	2.5
Current Harmonics(ATHD)	
"R"Phase	14.55
"Y"Phase	82.06
"B"Phase	14.32

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 3.6-2.6% and the current harmonics levels were 82.06-14.32%. **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
- 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
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

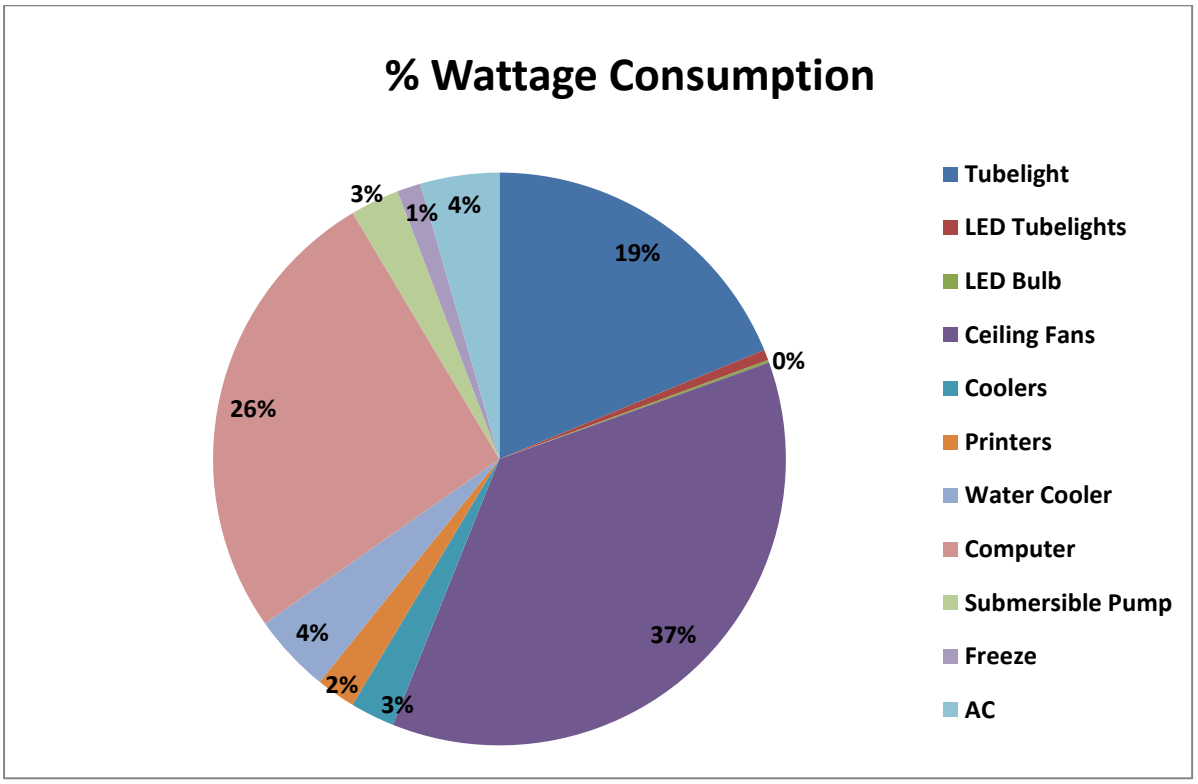
3.3 Light Details

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

Inventory Details				
S.No.	**Lighting Details/Type of light**	**Quantity**	**Wattage/HP**	**Total load (Watt)**
1	Tube light	253	40	10120
2	LED Tube lights	16	20	320
3	LED Bulb	9	9	81
4	Ceiling Fans	246	80	19680
5	Coolers	3	450	1350
6	Printers	4	300	1200
7	Water Cooler	3	800	2400
8	Computer	47	300	14100
9	Submersible Pump	2	746	1492
10	Freeze	4	180	720
11	AC	2	1200	2400
			Total	**53863**

Total connected load of the campus is 53.86 kW as per the inventory of the equipments and the running load of the campus is 12 kW.

Representation of Percentage Wattage Consumption



Inventory Details Of Ground Floor (Old Building)

Room No.	Location	Tube light of 40w	LED Tube light	Fan Of 80W
1	Principal Room	0	2	2
2	Office	2	2	2
3	Result Distribution	1	1	1
4	Commerce Department	2	0	1
5	English Department	2	1	1
6	Examination Department	0	0	0
7	Computer Lab	1	6	7
8	Class Room	0	0	0
9	Class Room	0	0	1
10	Class Room	0	0	2
11	Store Room	2	0	5
12	Boys Washroom	0	0	0
13	Girls Washroom	0	0	0
14	Girls Comman Room	0	0	0
15	Chemistry Lab	5	0	8
16	Physics Lab	4	0	8
17	Class Room	3	0	5
18	Office	2	4	4
19	Passage	3	0	3
Total		**26**	**16**	**47**

Inventory Details Of Ground Floor (New Building)

Room No	Location	Tube light Of 40w	Fan Of 80W
1	Class Room	8	6
2	Class Room	8	6
3	Class Room	8	6
4	Class Room	8	6
5	Class Room	8	6
6	Class Room	8	6
7	Class Room	8	6
8	Store Room	2	1
9	Washroom	2	0
10	Passage	11	1
Total		**71**	**44**

Inventory Details Of First Floor (Old Building)

Room No.	Location	Tube light of 40w	LED Tube light	Fan Of 80W
19	Staff Room	0	3	4
20	Sociology Department	3	1	2
21	Economics Department	0	3	4
22	Class Room	3	1	1
23	Botany Lab	4	0	6
24	Zoology Lab	1	1	6
25	Class Room	1	2	4
26	Class Room	1	0	0
27	Washroom	1	0	0
28	Washroom	1	0	0
29	Class Room	2	0	5
30	Class Room	2	0	5
31	Home Science Lab	0	4	5
32	Class Room	7	0	7
33	Class Room	2	0	4
34	Class Room	0	0	6
35	Passage	2	0	0
Total		**30**		**61**

Inventory Details Of First Floor (New Building)

Room No	Location	Tube light Of 40w	Fan Of 80W
1	Class Room	8	6
2	Class Room	8	6
3	Class Room	8	6
4	Class Room	8	6
5	Class Room	8	6
6	Class Room	8	6
7	Class Room	8	6
8	Store Room	2	1
9	Washroom	2	0
10	Passage	11	1
Total		**71**	**44**

UGC Department

Room No	Location	Tube light Of 40w	Fan Of 80W
1	Classes	4	4
2	Classes	4	4
3	Classes	6	4
4	Washroom	2	0
Total		**16**	**12**

Law department

Room No.	Location	Tube light Of 40w	Fan Of 80W
1	Class Room	1	2
2	Class Room	1	1
3	Class Room	1	2
4	Class Room	1	1
5	Class Room	1	1
6	Staff Room	2	2
7	Washroom	0	0
Total		**7**	**9**

Library, Canteen & Sports Room

S. No.	Location	Tube light Of 40w	Fan Of 80W	LED Bulb
1	Books Store Room	22	18	0
2	Reading Passage	5	5	3
3	Maim Room	5	2	0
4	**Canteen Room**	0	4	1
5	**Sports Room**	0	0	0
Total		**32**	**29**	**4**

Some Other Energy Consuming Equipment			
Sr. No.	**Location**	**Equipment**	**Quantity**
1	Principal Room	computer	1
2	Office	Computer	3
3	English Department	Computer	1
4	Computer lab	Computer	35
5	Office	Computer	2
6	Library	Computer	5
7	Rooms	Printers	4
8	Labs	Freeze	4
9	Passage	Water Cooler	2
10	Library	Water Cooler	2 (Not Running)
11	LLB Department	Water Cooler	1
12	Principal Rooms	AC	1
13	Maths Department	AC	1
14	Rooms	Cooler	3

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) Tube lights with 20 W retrofit LED tube lights.
2. It is recommended to replace inefficient Fans with Brushless Direct current Energy Efficient Fans (BLDC Fan)

Energy Saving Potential

The below table shows the energy saving potential of Govt. Ghanshyam Singh Gupt P.G. College Balod .

Replacement of Tube Light of 40W with 20W LED Tube		
Particulars		**Units**
Total Number of 40 Watt Tube Light	**253**	No.s
Measured Watt	55	Watts
Total Watts	13915	Watts
Proposed watt after replacement	20	Watts
Total Watt After Replacement	8855	Watts
Operating Hours in a day	7	Hours
Estimated Energy Saving after Replacement Annual KWH	18595.5	KWH
Per Unit Cost as Per CSPDCL Bill	6.5	Rs/kWh
Estimated Cost Saving Per Year	120870.75	Rs
Cost of Per Fixtures	300	Rs
Total Investment Cost	75900	Rs
Payback	0.627943485	Year

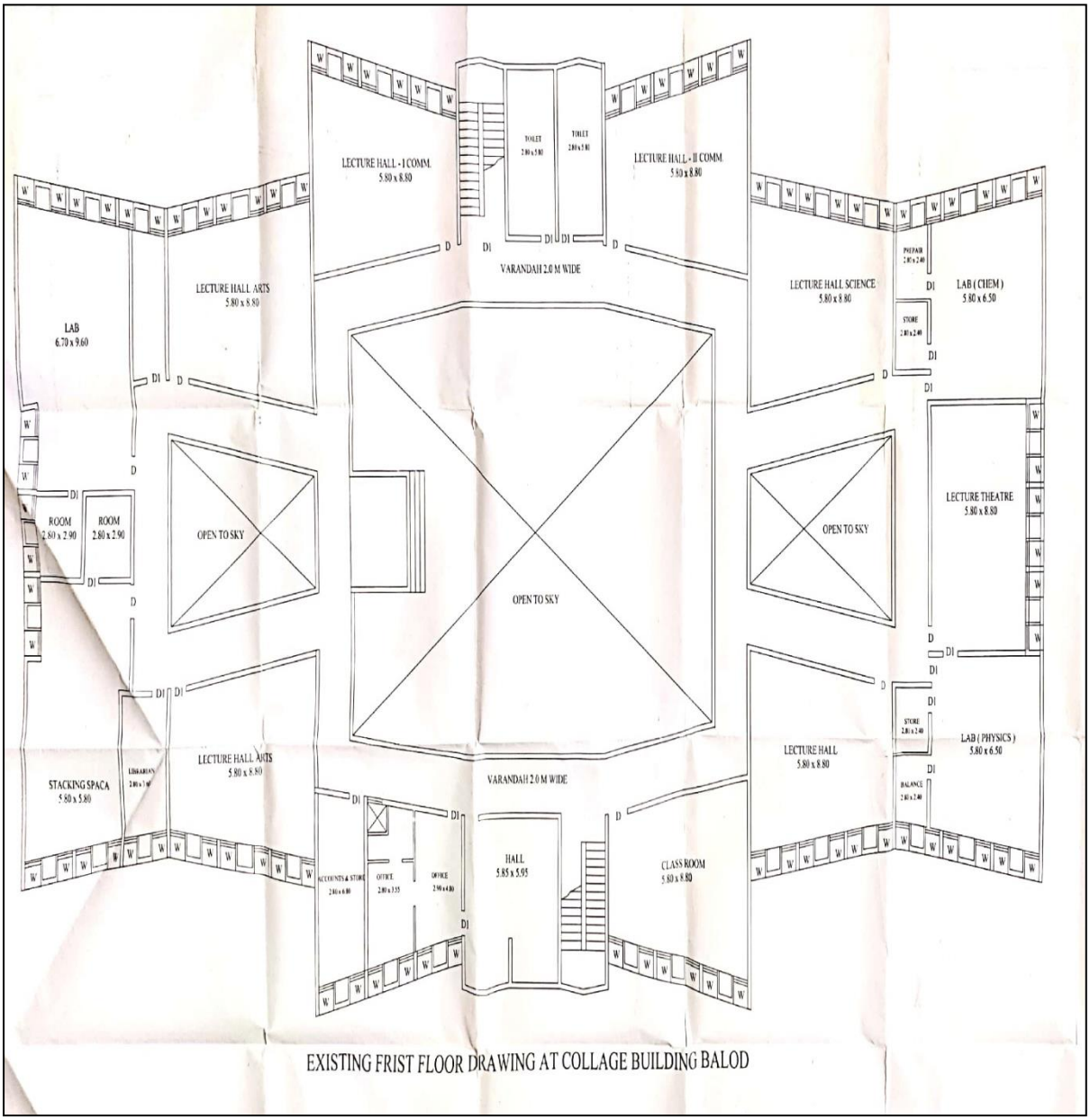
Replacement of Ceiling Fan of 80W With EESL Energy Efficient 50W Ceiling Fan		
Particulars		**Units**
Total Number of 80 Watt	246	No.s
Measured Watt	80	Watts
Total Watts	19680	Watts
Proposed watt after replacement	35	Watts
Total Watt After Replacement	11070	Watts
Operating Hours in a day	7	Hours
Estimated Energy Saving after Replacement Annual KWH	23247	KWH
Per Unit Cost as Per CSPDCL Bill	6.5	Rs/kWh
Estimated Cost Saving Per Year	151105.5	Rs
Cost of Per Fixtures	2500	Rs
Total Investment Cost	615000	Rs
Payback	4.07000407	Year

OUTSIDE LIGHTING OF COLLEGE (OLD BUILDIND, NEW BUILDING, PLAY GROUND)

3.4. Lux Level:

Lux is a standardised unit of measurement of light level intensity, which is commonly referred to as "luminance" 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 (Old Building)



EXISTING FRIST FLOOR DRAWING AT COLLAGE BUILDING BALOD

College Building	1481.07
Open Area	425.85

Law Building Layout-

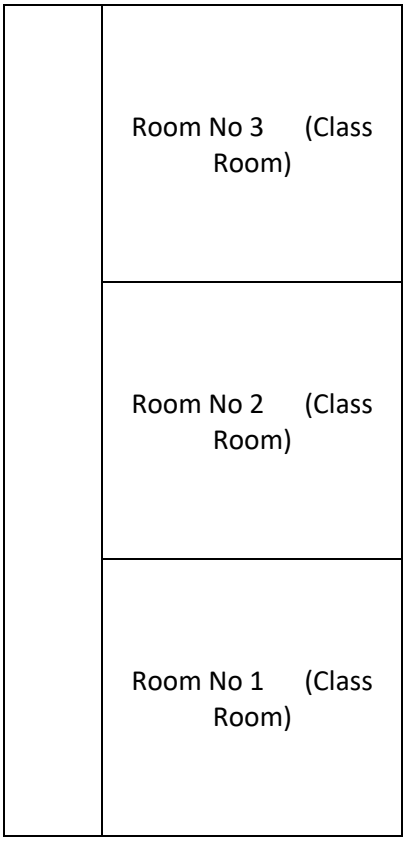
Room No 1	Room No 2	Room No 3 (Class	Room No 4 (Class	Room No 5

(Class Room)	(Class Room)	Room)	Room)	(Class Room)
				Wash Room
		375.08 Sqm		Wash Room
				Staff Room

Library Building Layout

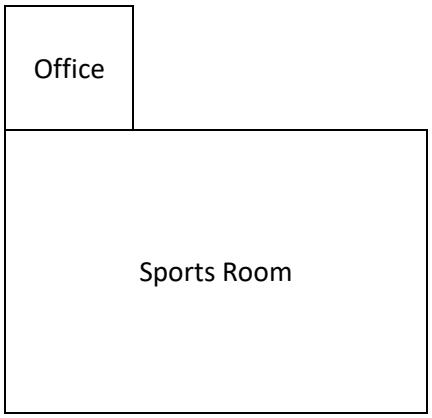
Library	Reading passage	**358.64 Sqm**
Store Room	Wash Room	Staff Room

UGC Building Layout



165.33 Sqm.

Sports Room Layout-



77.96 Sqm.

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Law Building	375.08 Sqm.
Library Building	358.64 Sqm.
Sports Building	77.96 Sqm.
UGC Building	165.33 Sqm.

Ground Floor Of Old & New Building.

This table Shows the Average value of Lux

Ground Floor (Old Building)				
Room No	**AREA**	**Average Lux with Open Window & Light**	**Average Lux with Open Window only**	**Average Lux with Light Only**
1	Principal Room	70	65	55
2	Office	80	75	60
3	Result Distribution	180	160	120
4	Commerce Department	190	180	160
5	English Department	160	158	140
6	Examination Department	170	140	130
7	Computer Lab	150	130	90
8	Class Room	125	97	80
9	Class Room	125	97	80
10	Class Room	120	95	85
11	Store Room	86	80	46
12	Boys Washroom	95	85	70
13	Girls Washroom	90	85	75
14	Girls Common Room	85	75	60
15	Chemistry Lab	75	50	45
16	Physics Lab	75	55	40
17	Class Room	110	95	85
18	Office	180	150	130

Ground Floor (New Building)				
Room No	**AREA**	**Average Lux with Open Window & Light**	**Average Lux with Open Window only**	**Average Lux with Light Only**
1	Class Room	280	250	190
2	Class Room	280	250	190
3	Class Room	280	250	190
4	Class Room	280	250	190
5	Class Room	280	250	190
6	Class Room	280	250	190
7	Class Room	280	250	190
8	Store Room	280	250	190
9	Washroom	280	250	190

UGC Department				
Room No	**AREA**	**Average Lux with Open Window & Light**	**Average Lux with Open Window only**	**Average Lux with Light Only**
1	Class Room	300	280	270
2	Class Room	300	280	270
3	Class Room	300	280	270
4	Washroom	220	180	160

Library, Canteen & Sports Room				
Room No	AREA	Average Lux with Open Window & Light	Average Lux with Open Window only	Average Lux with Light Only

1	Books Store Room	40	36	15
2	Reading Passage	85	55	40
3	Maim Room	55	50	35
4	**Canteen Room**	220	190	140
5	**Sports Room**	190	165	110

Law Department				
Room No	**AREA**	**Lux with Open Window & Light**	**Lux with Open Window only**	**Lux with Light Only**
1	Class Room	280	240	190
2	Class Room	280	235	195
3	Class Room	260	225	160
4	Class Room	290	265	170
5	Class Room	225	210	145
6	Staff Room	186	145	135
7	Washroom	155	125	110

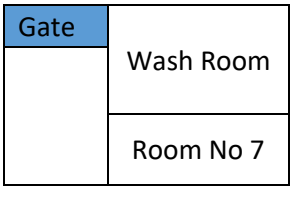
Observation:

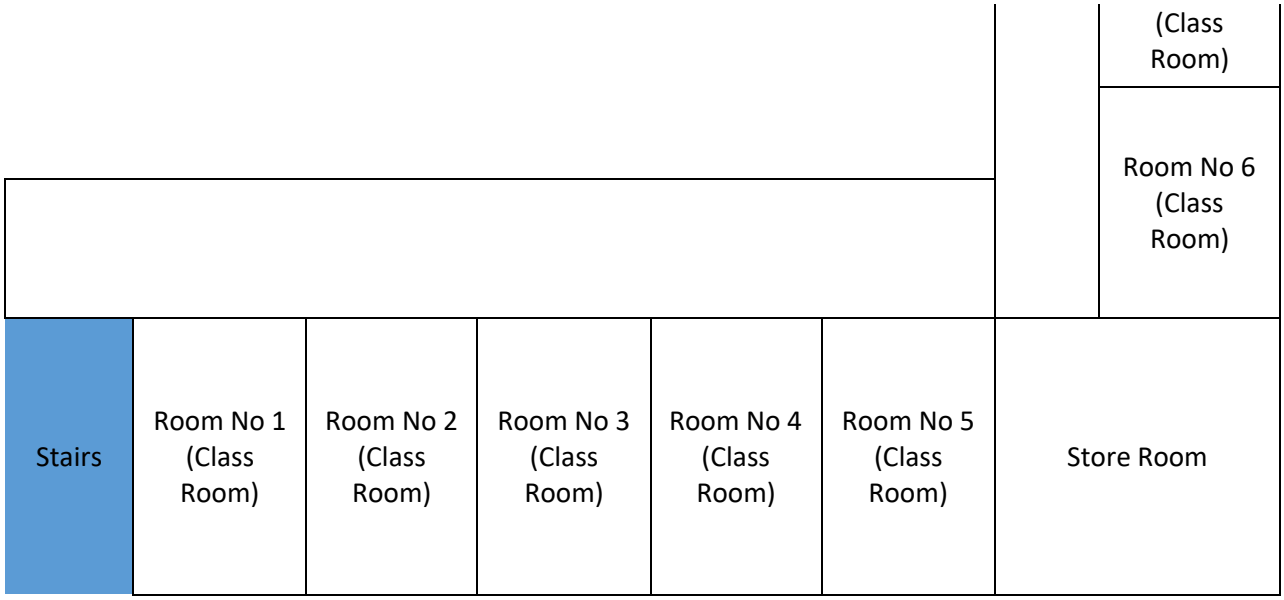
1. 1. It is observed from above table that the Average LUX Level is between 300 to 50 when all Windows are Open in Rooms and No Lights are Switched ON, **which is above Standard Level for Class Rooms i.e. 300 LUX.**
2. Day light is full available and as per the timing of classes it can be used properly to save much energy.

Recommendation:

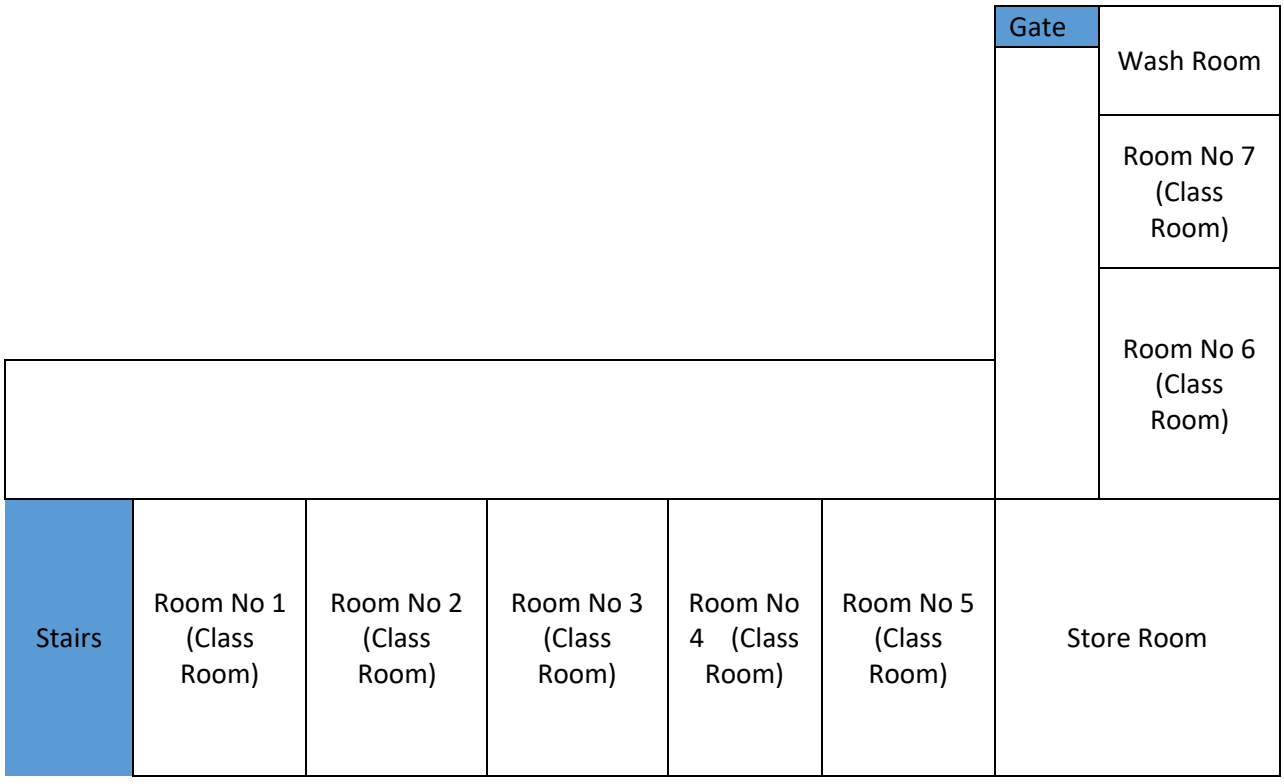
1. It is recommended to switch off all the Lights during day time or off the half of the Total Lights of the Rooms if Required, which can save too Much Energy.

Ground Floor Layout(New Building)





Ground Floor Layout(New Building)



First Floor Of Old & New Building.

This table Shows the Average value of Lux .

First Floor (Old Building)				
Room No	**AREA**	**Lux with Open Window & Light**	**Lux with Open Window only**	**Lux with Light Only**
19	Staff Room	300	280	250

20	Sociology Department	550	410	350
21	Economics Department	50	45	40
22	Class Room	160	155	150
23	Botany Lab	170	165	140
24	Zoology Lab	150	140	135
25	Class Room	200	180	160
26	Class Room	750	700	650
27	Washroom	95	80	70
29	Class Room	90	60	55
30	Class Room	110	45	40
31	Home Science Lab	200	190	180
32	Class Room	240	240	40
33	Class Room	100	55	50
34	Class Room	100	80	40

First Floor (New Building)				
Room No	**AREA**	**Average Lux with Open Window & Light**	**Average Lux with Open Window only**	**Average Lux with Light Only**
1	Class Room	280	250	190
2	Class Room	280	250	190
3	Class Room	280	250	190
4	Class Room	280	250	190
5	Class Room	280	250	190
6	Class Room	280	250	190
7	Class Room	280	250	190
8	Store Room	280	250	190
9	Washroom	280	250	190

Observation:

1. It is Observed from above table that the Average LUX Level is between 300 to 50 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. Green Building Analysis

4.1 Water Use

This indicator addresses water consumption, water sources, irrigation, storm water, appliances and fixtures. A water audit is a non-site survey and assessment to determine the water use and hence improving the efficiency of its use.

WATER CONNECTION OLD BUILDING (G.F.& F.F.)			
S. No.	**Location**	**No. Of Taps**	**No Of Flush**
1	Principal Room	2	1
2	Boys Washroom(G.F.)	2	0
3	Girls Washroom(G.F.)	2	0
3	Chemistry Lab	4	0
4	Physics Lab	1	0
5	Staff Room	4	
6	Botany Lab	1	0
7	Zoology Lab	1	0
8	Boys Washroom(F.F.)	1	0
9	Girls Washroom(F.F.)	1	0
Total		**19**	**1**

WATER CONNECTION NEW BUILDING (G.F.& F.F.)			
S.No.	**Location**	**No. Of Taps**	**No Of Flash**
1	Store Room(G.F.)	1	0
2	Passage(G.F.)	2	0
3	Boys Washroom(G.F.)	4	0
4	Girls Washroom(G.F.)	4	0
5	Store Room(F.F.)	1	0
6	Passage(F.F.)	2	0
7	Boys Washroom(F.F.)	4	0
8	Girls Washroom(F.F.)	4	0
Total		**22**	**0**

WATER CONNECTION (LLB & LIBRARY)			
S. No.	**Location**	**No. Of Taps**	**No Of Flush**
1	Staff Room(LLB)	2	1
2	Boys Washroom(LLB)	3	-
3	Girls Washroom(LLB)	3	-
3	Washroom	3	-
4	Wash Room(Library)	3	-
5	Staff Room(Library)	2	-
6	Girls Common Room	2	-
7	Kitchen	3	-
8	Garden	2	-
Total		**23**	**1**

a) Observation

The Source of Water is only from the ground water through pumps the study observed that the bore wells are major sources for water collection in the tanks of college. Water is used for drinking purpose, toilets and gardening. The waste water from the RO water purifier is not being used in any other purpose. During the survey no loss of water is observed neither by any leakages nor by over flow of water from overhead tanks.

The data collected from all the departments' is examined and verified. On an average the total use of water in the college is 10000 L/day, which include 8000 L/day for domestic, gardening purposes and 2000 L/day for drinking purpose.

b) Recommendation

- In campus small scale/medium scale/ large scale reuse and recycle of water system is necessary.
- Minimize wastage of water and use of electricity during water filtration process, if used, such as RO filtration process and ensure that the equipment's used for such usage are regularly serviced.
- Ensure that all cleaning products used by college staff have a minimal detrimental impact on the environment, i.e. they are biodegradable and non-toxic, even where this exceeds the Control of Substances Hazardous to Health (COSHH) regulations.
- Gardens should be watered by using drip/sprinkler irrigation system to minimize water use.
- It is recommended to use ecomist water saver retrofit tap nozzles which can save 80% of wastage tap water.

4.2 Waste Generation

This indicator addresses waste production and disposal of different wastes like paper, food, plastic, biodegradable, construction, glass, dust etc. and recycling. Furthermore, solid waste often includes wasted material resources that could otherwise be channeled into better service through recycling, repair, and reuse. Solid waste generation and management is a burning issue.

Unscientific handling of solid waste can create threats to everyone. The survey focused on volume, type and current management practice of solid waste generated in the campus.

a) Observation

Waste generation from tree droppings and lawn management is a major solid waste generated in the campus. The waste need to be segregated at source by providing separate dustbins for Bio-degradable and Plastic waste.

Single sided used papers reused for writing and printing in all departments and recently both side printing is carried out as per requirements.
The waste generated by newspapers 50kg/year, magazine and other booklets 100kg/year and of cartons is 20kg/year. Very less plastic waste (0.1Kg/day) is generated by the department, office, garden etc. but it is neither categorized at point source nor sent for recycling. Metal waste and wooden waste is stored and given to authorized scrap agents for further processing.

The solid waste is collected by the municipal corporation and disposed by their methods.

b) Recommendations

- Reduce the absolute amount of waste that is produced from college staff offices.
- Make full use of all recycling facilities provided by Municipality and private suppliers, including glass, cans, white, colored and brown paper, plastic bottles, batteries, print cartridges, cardboard and furniture.
- Provide sufficient, accessible and well-publicized collection points for recyclable waste, with responsibility for recycling clearly allocated.
- Important and confidential papers after their validity to be sent for pulping.
- Vermi composting should be adopted on at least 100 sq.ft. of land.


waterwell
waterwell

4.3 E-Waste Generation

E-waste can be described as consumer and business electronic equipment that is near or at the end of its useful life. This makes up about 5% of all municipal solid waste worldwide but is much more hazardous than other waste because electronic components contain cadmium, lead, mercury, and Polychlorinated biphenyls (PCBs) that can damage human health and the environment.

a) Observation

E-waste generated in the campus is very less in quantity. Administration should conduct the awareness programs regarding E-waste Management with the help of various departments. The E-waste and defective item from computer laboratory is being stored properly. The institution should decide to contact approved E-waste management and disposal facility in order to dispose E-waste in scientific manner.

b) Recommendations

- Recycle or safely dispose of white goods, computers and electrical Appliances or tie up with agency.
- Use reusable resources and containers and avoid unnecessary packaging where possible.
- Always purchase recycled resources where these are both suitable and available.

4.4 Green Area

This includes the plants, greenery and sustainability of the campus to ensure that the buildings conform to green standards. This also helps in ensuring that the Environmental Policy is enacted, enforced and reviewed using various environmental awareness programs.

a) Recommendations

- Review periodically the list of trees planted in the garden, allot numbers to the trees and keep records. Assign scientific names to the trees.
- Promote environmental awareness as a part of course work in various curricular areas, independent research projects, and community service.
- Create awareness of environmental sustainability and take actions to ensure environmental sustainability.
- Establish a College Environmental Committee that will hold responsibility for the enactment, enforcement and review of the Environmental Policy.

- The Environmental Committee shall be the source of advice and guidance to staff and students on how to implement this Policy.

- Ensure that an audit is conducted annually and action is taken on the basis of audit report, recommendation and findings.

- Celebrate every year 5th June as 'Environment Day' and plant trees on this day to make the campus more Green.

- Indoor plantation to inculcate interest in students, Bonsai can be planted in corridor to bond a relation with nature.

5.SOLAR POWER GENERATION SYSTEM

5.1 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.

5.2 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

5.3 Proposed Solar Power Plant

There is a proposed plan for on-grid solar power plant of 10kwp at Govt. Ghanshyam Singh Gupt P.G. College Balod .

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 1000 Sq.ft. Space at roof of Govt. Ghanshyam Singh Gupt P.G. College Balod for Installation of Maximum 10kwp on-grid solar power plant.

Our Suggestion –

During Energy Audit we have measured the electrical power at different blocks of Govt. Ghanshyam Singh Gupt P.G. College Balod 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.

Thesuitable operating day considered for Govt. Ghanshyam Singh Gupt P.G. College Balod 300 days.

The resultant monitory benefit has been worked out as follows:

Installation cost	Rs. 5.00 Lakhs
Daily Power generation	10 kW
Daily estimated power generation Hours	50 kwh
Annual estimated power generation (300 Days)	0.15 Lakh kWh
Electricity Cost per unit	Rs. 6.5
Annual cost saving	Rs. 0.97 Lakhs
Simple Payback period	5.15 Years

6. GENERAL TIPS FOR ENERGY CONSERVATION IN DIFFERENT UTILITIES SYSTEMS

6.1 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.

6.2 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

6.3 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.

6.4LIGHTING

- Reduce excessive illumination levels to standard levels using switching, de-lamping, etc.(Know the electrical effects before doing de-lamping.)
- 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.

6.5. 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 blow down 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.

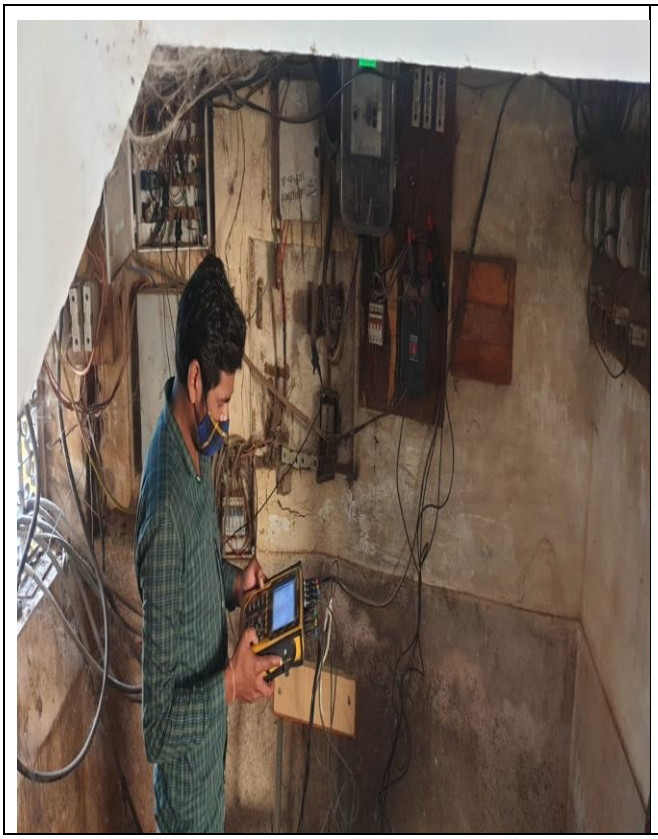
List of Energy Efficient Equipment Suppliers

Product/Equipment	ContactDetails
LED lighting	Synergy Solar (P)ltd SCO 133, sector 28D, Chandigarh Ph 0172- 6451133 www.synergysolars.com
Lighting Systems	Philips IndiaLtd 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. SignatureTowers, 11th Floor, Tower B, South City-I, Gurgaon 122001,

Product/Equipment	Contact Details
	Fax: 0124- 6526184
Lighting Systems	AsianElectronics Surya Place, First Floor, K-185/1, Sarai
Lighting Systems	Julena, New Friends Colony, New Delhi – 110 025 AsianElectronics Surya Place, First Floor, K-185/1, Sarai
Lighting Systems	WiproLimited Sco 196-197, Sector 34-A, Chandigarh - 160 022
Lighting Systems	OSRAM India Ltd. SignatureTowers, 11th Floor, Tower B, South City-I, Gurgaon 122001, Haryana Tel: 0124- 6526175, 6526178, 6526185 Fax: 0124- 6526184
Solar Implementation	Avarna Alliance Rameshwaram Delux, Baghmugaliya Bhopal-462043 Mr. Raghvendra – 9713912340 support@avarnaalliance.in
Solar Implementation	Shankeshwar Energies HIG C-1 Infront of HDFC Bank , Shailendra Nagar Raipur Mr. Govinda – 9755020202 Energies.shankeshwar@gmail.com

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.

Site Photograph **Annexure-2**

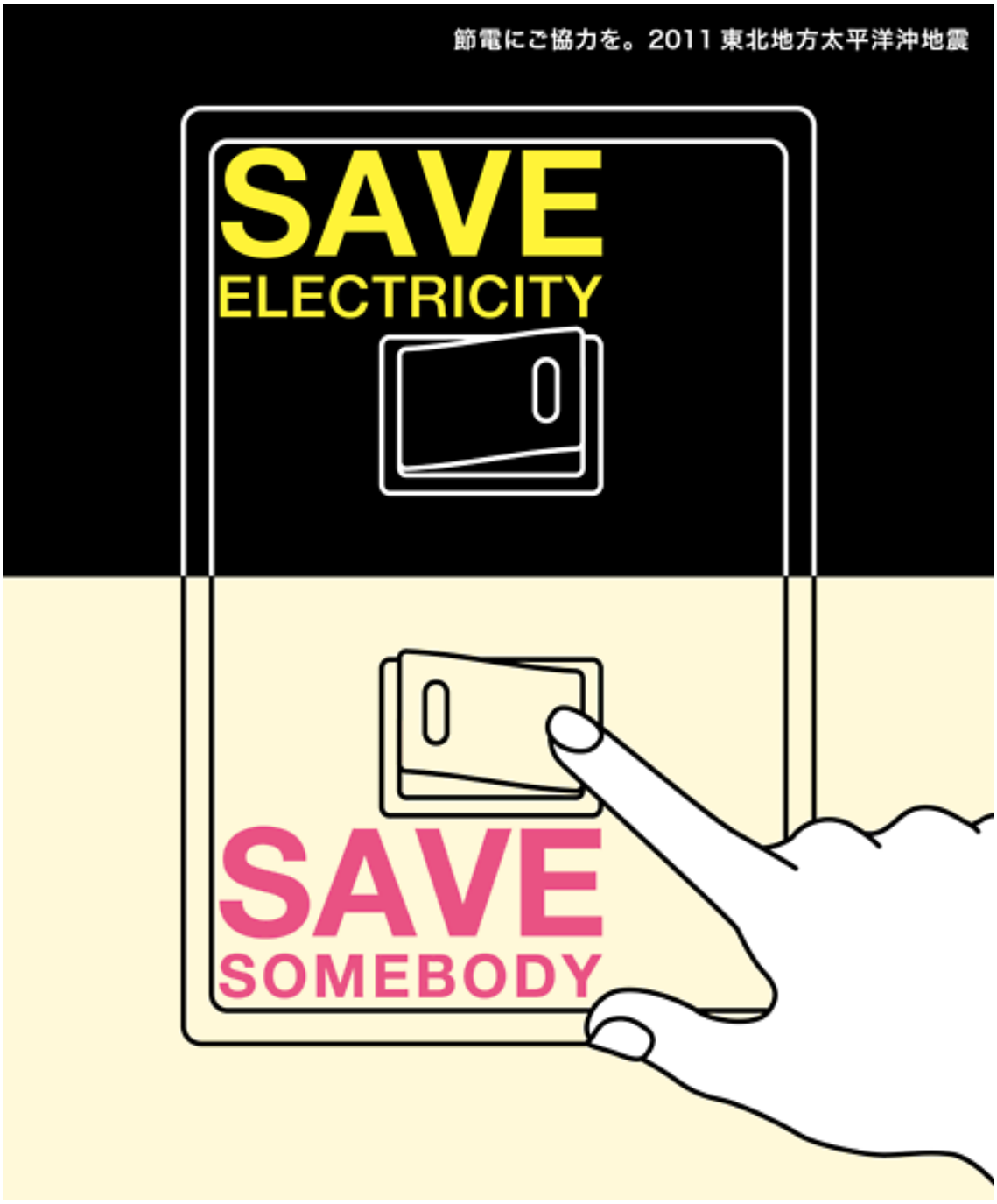


Electrical Data Logging

Measuring Lux Level

Field Survey

7. General Energy Conservation awareness posters to aware users


節電にご協力を。2011 東北地方太平洋沖地震
SAVE
ELECTRICITY
SAVE
SOMEBODY


STUDYMASTER.IN PRESENTS
Energy saved is equal to energy created
Save Today. Survive Tomorrow.
www.studymaster.in


STOP ENERGY
WASTE
Turn off the lights when leaving the room

Switch off, save more

We all deserve a rest, office equipment too! So when you're not using it, shut it down. A PC monitor left on overnight can waste enough electricity to laser print over 500 pages.

Simple ways to save a little more.

Clear business.

shutterstock.com · 1771962323

Load Profile of TR with Normal Load **Annexure1**

Date- 09-12-2021

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
12:38:58	255.8	222.2	258.4	19.31	0.55	18.95	0.71	0	0.74	5223.22	9958.67	0.52
12:38:59	255.7	222.2	258.3	19.28	0.56	18.92	1.43	0	1.47	5212.66	9939.88	0.52
12:39:00	255.8	222.2	258.3	19.28	0.55	18.93	2.14	0	2.21	5214.8	9944.94	0.52
12:39:01	255.7	222.1	258.3	19.3	0.56	18.95	2.85	0	2.94	5219.91	9952.53	0.52
12:39:02	255.8	221.9	258.5	19.27	0.56	18.93	3.56	0	3.68	5222.99	9946.8	0.521
12:39:03	256	220.8	259.3	19.24	0.6	18.9	4.28	0	4.42	5251.35	9960.91	0.526
12:39:04	256.1	220.8	259.4	19.24	0.64	18.91	5	0	5.16	5256.46	9974.94	0.527
12:39:05	256.2	220.8	259.1	19.25	0.6	18.91	5.72	0	5.9	5250.71	9963.12	0.525
12:39:06	256.5	220.9	258.5	19.28	0.56	18.92	6.44	0	6.64	5247.77	9958.62	0.521
12:39:07	256.3	220.8	259	19.32	0.56	18.97	7.16	0	7.38	5268.37	9989.47	0.524
12:39:08	256.1	221.2	258.6	19.31	0.56	18.96	7.88	0.01	8.12	5248.91	9973.51	0.521
12:39:09	255.9	222.1	258.3	19.31	0.56	18.96	8.59	0.01	8.86	5222.67	9960.85	0.519
12:39:10	255.9	222.1	258	19.31	0.56	18.96	9.3	0.01	9.6	5220.23	9958.26	0.518
12:39:11	255.9	222.2	257.9	19.32	0.57	18.97	10.01	0.01	10.34	5223.13	9962.7	0.518
12:39:12	256	222.2	257.9	19.28	0.61	18.94	10.72	0.01	11.08	5216.07	9958.59	0.519
12:39:13	256.5	219.9	259.1	21.23	0.57	20.88	11.52	0.01	11.89	5823.04	10979.63	0.528
12:39:14	256.7	217.7	260.7	22.58	0.58	22.1	12.38	0.01	12.77	6232.04	11687.78	0.534
12:39:15	256.6	216.8	261.3	23.55	0.58	22.77	13.26	0.01	13.66	6404.1	12120.41	0.524
12:39:16	256.1	217.7	261.1	22.84	0.57	21.93	14.08	0.01	14.53	6077.85	11698.19	0.507
12:39:17	256.8	218.5	260.4	21.7	0.57	21.36	14.91	0.01	15.37	6017.93	11258.89	0.537
12:39:18	256.7	218.7	260.1	21.4	0.56	21.06	15.73	0.01	16.2	5924.19	11094.94	0.536
12:39:19	256.5	219	259.7	21.73	0.56	21.39	16.56	0.01	17.03	5999.76	11251.01	0.534

12:39:20	256.3	219.7	259.3	21.82	0.56	21.47	17.39	0.01	17.87	6001.48	11284.78	0.532
12:39:21	256.4	219.4	259.4	22.06	0.56	21.72	18.23	0.01	18.72	6078.8	11412.16	0.534
12:39:22	256.2	219.7	259.2	21.79	0.56	21.44	19.05	0.01	19.56	5991.32	11265.79	0.533
12:39:23	256.3	219.8	259.2	21.61	0.56	21.26	19.87	0.01	20.39	5936.59	11169.81	0.532
12:39:24	256.5	219.3	259.7	21.41	0.56	21.06	20.68	0.01	21.22	5902.4	11083.56	0.534
12:39:25	256.8	218.3	260.3	21.8	0.56	21.45	21.52	0.02	22.06	6048.64	11303.72	0.538
12:39:26	256.8	218.3	260.1	21.71	0.56	21.36	22.35	0.02	22.9	6017.76	11253.69	0.537
12:39:27	256.8	218.5	260.2	21.62	0.56	21.28	23.18	0.02	23.73	5993.37	11213.75	0.537
12:39:28	256.7	218.9	260	21.17	0.56	20.83	23.99	0.02	24.55	5847.53	10976.04	0.534
12:39:29	256.8	219	260	21.08	0.57	20.74	24.79	0.02	25.36	5820.41	10931.69	0.534
12:39:30	256.9	219.7	259.1	21.62	0.57	21.28	25.61	0.02	26.2	5948.83	11191.54	0.53

Load Profile With Full Load & Pump

Date- 09-12-2021

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
12:59:01	256.7	224.7	259.8	2.85	2.57	2.73	1554.38	0.14	0.12	0.16	2017.11	0.771
12:59:02	256.7	224.6	259.7	2.85	2.57	2.74	1557.96	0.29	0.25	0.33	2020.09	0.772
12:59:03	256.8	224.7	259.7	2.84	2.56	2.72	1545.11	0.43	0.37	0.49	2010.1	0.77
12:59:04	256.7	224.6	259.6	2.84	2.56	2.73	1547.5	0.57	0.49	0.66	2011.71	0.77
12:59:05	256.8	224.6	259.6	2.83	2.55	2.72	1541.23	0.71	0.62	0.82	2006.6	0.769
12:59:06	256.8	224.6	259.7	2.84	2.55	2.72	1543.26	0.85	0.74	0.99	2008.49	0.769
12:59:07	256.8	224.6	259.7	2.84	2.56	2.72	1546.44	1	0.86	1.15	2011.05	0.77
12:59:08	256.8	224.7	259.8	2.83	2.56	2.72	1543.73	1.14	0.99	1.31	2009.17	0.769

12:59:09	257	224.7	259.2	2.84	2.56	2.72	1549.1	1.28	1.11	1.48	2012.11	0.771
12:59:10	256.8	224.7	259.5	2.83	2.55	2.72	1541.73	1.42	1.23	1.64	2006.48	0.769
12:59:11	257	224.7	259.2	2.85	2.57	2.73	1558.08	1.57	1.36	1.81	2019.2	0.772
12:59:12	256.9	224.7	259.3	2.84	2.57	2.73	1551.54	1.71	1.48	1.97	2014.03	0.771
12:59:13	257.2	224.8	258.8	2.85	2.58	2.73	1559	1.86	1.6	2.14	2019.32	0.773
12:59:14	256.9	224.6	259.4	2.85	2.57	2.73	1556.37	2	1.73	2.3	2017.44	0.772
12:59:15	257.1	224.8	259.2	2.86	2.58	2.74	1566.52	2.14	1.85	2.47	2025.83	0.774
12:59:16	257	224.8	259.2	2.84	2.56	2.72	1546.7	2.29	1.98	2.63	2010.65	0.77
12:59:17	256.8	224.8	259.7	2.83	2.55	2.71	1539.72	2.43	2.1	2.79	2005.62	0.769
12:59:18	256.8	224.6	259.8	2.84	2.55	2.72	1542.57	2.57	2.22	2.96	2007.56	0.769
12:59:19	256.8	224.6	259.7	2.84	2.56	2.72	1548.28	2.71	2.34	3.12	2011.67	0.771
12:59:20	256.9	225	259	2.84	2.57	2.72	1549.95	2.86	2.47	3.28	2012.22	0.771
12:59:21	256.8	224.6	259.7	2.83	2.56	2.72	1543.98	3	2.59	3.45	2008.36	0.77
12:59:22	256.8	224.7	259.7	2.86	2.58	2.75	1567.91	3.14	2.72	3.61	2027.12	0.774
12:59:23	256.9	224.8	259.7	2.84	2.56	2.73	1550.3	3.29	2.84	3.78	2014.15	0.771
12:59:24	256.9	224.8	259.7	2.85	2.57	2.73	1558.35	3.43	2.96	3.94	2020.11	0.772
12:59:25	257	224.8	259.5	2.86	2.58	2.74	1566.21	3.57	3.09	4.11	2025.84	0.774
12:59:26	257.1	224.9	259.3	2.85	2.58	2.74	1564.28	3.72	3.21	4.27	2023.92	0.774
12:59:27	257.2	225	259.4	2.85	2.58	2.73	1560.05	3.86	3.34	4.44	2021.76	0.773
12:59:28	257.2	225	259.4	2.85	2.58	2.73	1560.32	4.01	3.46	4.6	2021.95	0.773
12:59:29	257.3	225.1	259.4	2.85	2.57	2.72	1555.07	4.15	3.59	4.77	2018.1	0.771
12:59:30	257.2	225	259.7	2.87	2.59	2.75	1575.36	4.3	3.71	4.93	2033.92	0.776
12:59:31	257.1	225	259.8	2.88	2.6	2.76	1582.38	4.44	3.84	5.1	2040.18	0.776
12:59:32	257.2	225.1	259.8	2.87	2.59	2.74	1572.09	4.59	3.96	5.27	2032.17	0.774