



SREE NARAYANA COLLEGE, KOLLAM

Affiliated to the University of Kerala

ACCREDITED 'A' GRADE BY NAAC

ARIIA - All India Rank - II

Green Audit & Energy Audit



Nature's Green Guardians Foundation

Trivandrum 695 043 India

Green Audit – Environment Quality Certificate
Sree Narayana College, Kollam, 691 001 for AY 2021 - '22

Environment Audit for the academic year 2021 - '22 has been conducted at Sree Narayana College, Kollam, Kerala in accordance with the International Standards for ISO 14000 family of standards set by ISO TC 207 and its Sub-committees, Biological Diversity Act 2002, Environmental Protection Act 1986 (and amendments) of Government of India, and other relevant mandates for maintaining sustainable and healthy environment for education in the campus.

In our opinion, the Institution has presented true and up-to-date data on the various aspects of working of this education institution, and appropriate audit procedures have been completed by the audit team for issuing this Audit Certificate and Compliance Statement. The recommendations are based on verified data presented on the situation as they existed at the time of audit.

The audit methodology did combine physical inspection of the campus on several occasions, with analytical reviews of relevant documents and activities, as well as interviews with the Principal, selected Staff members and Students of the College.

Audit findings indicate that, of the 424.6 T CO₂ of carbon footprint of the institution for the year, the contribution from Transportation and mobility including public transport use is at 249.2 T CO₂ – with 75.9 T coming from the use of personal vehicles by staff and students, and that out of Wastes is at 69.2 T CO₂. The remedial activities contributed an overall relief of 70 T CO₂. The campus is maintained clean, and tidy, in the middle of the city corporation. Environmental Quality in the campus of nearly 4000 students appears satisfactory.

Prof. V K Damodaran

Ex-UNIDO International Energy Expert

For NGGFn Audit Team, dated 05 December 2022

I agree with the data presented in this report, as true, and further express my willingness to implement the recommendations of this audit report after internal review, even if any or many of them are in excess of the relevant mandates.

Prof. Dr. Nisha J Tharayil, Principal

Sree Narayana College, Kollam, Kerala

Date: 05 December 2022


Signature & Seal

Prof. (Dr.) Nisha J Tharayil
Principal
Sree Narayana College,
Kollam.





Nature's Green Guardians Foundation

Trivandrum 695 043 India

Energy Audit Certificate

Sree Narayana College, Kollam, Kerala for AY 2021 - '22

Energy Audit for the period of academic year 2021-'22 has been conducted for Sree Narayana College, Kollam, Kerala, in accordance with the International Standards for ISO 14000 family of standards set by ISO TC 207 and its Sub-committees, Bureau of Energy Efficiency Standards, and stipulations under the Energy Conservation Act 2021 of Government of India, and other relevant mandates for maintenance of sustainable and healthy environment for education in the campus.

In our opinion, the Institution has presented true and up-to-date data on relevant activities to the audit team, and appropriate audit procedures have been completed for issuing this Audit Certificate and the Compliance Statement. The recommendations are based on verified data presented as they existed at the time of audit.

The inspection methodology did combine physical inspection of the campus, with analytical reviews of relevant documents and activities, as well as interviews with the Principal, and selected members of Staff and Students of the College.

Audit findings indicate that, of the 424.6 T CO₂ of actual carbon footprint of the institution for the year, the contribution from direct use of electricity and firewood was limited to 79.2 T CO₂. Transportation including public transport use (outside the campus) is at 249.2 T CO₂ (or 59% of the total). Wastes contributed 69.2 T CO₂. Wastes to energy thro biogas has potential to be further strengthened as a remedial measure. Effective awareness and training programs were conducted during the year and are planned for the future as well, to make all stakeholders aware of the need for individual efforts.

Prof. V K Damodaran

*Ex-UNIDO International Energy Expert
For NGGFm Audit, dated 05 December 2022*

I agree with the data presented in this report, as true, and further express my willingness to implement the recommendations of this audit report after internal review, even if any or many of them are in excess of the relevant mandates.

Prof. Dr. Nisha J Tharayil, Principal

Sree Narayana College, Kollam, Kerala

Date: 05 December 2022

Signature & Seal

Prof. (Dr.) Nisha J Tharayil
Principal
Sree Narayana College,
Kollam.





Nature's Green Guardians Foundation

Trivandrum 695 043 India

Biodiversity - Green Audit Certificate

Sree Narayana College, Kollam, Kerala for AY 2021 - '22

This Green Audit including evaluation of Biodiversity conservation has been conducted for Sree Narayana College, Kollam, Kerala, in accordance with the International Standards for ISO 14000 family of standards set by ISO TC 207 and its sub-committees, and Biological Diversity Act, 2002 (Act No. 18 of 2003) of Government of India and other relevant mandates for promotion of sustainable living and education in a healthy environment.

In our opinion, the Institution has presented true and up-to-date data on the various aspects of working of this higher education institution before the audit team, and appropriate audit procedures have been completed for preparing this report. The assessments and recommendations are based on data presented before the team at the time of audit.

The audit methodology did combine physical inspection of the campus on several work days and holidays, with analytical reviews of relevant documents and activities, as well as interviews with the designated Staff and Students of the College.

This audit is conducted to ensure that a Green lifestyle is followed and implemented in the campus across all academic and non-academic departments, as well as the body of students undergoing studies in the College.

Green Audit 2021-'22 of Sree Narayana College, Kollam has found that the institution's per capita carbon footprint for the year is only 0.088 ton of CO₂ equivalent, a level well below the current 2021 national per capita average of 1.84 t CO₂, with **potential to develop early into a carbon neutral campus**. All efforts are taken to conserve, protect, and enrich the existing biodiversity and also to extend efforts even beyond the college boundary through outreach, and further by implementing the Green Protocol, and having a commitment to continue its green practices to positively impact the society at large.

Prof. V K Damodaran

Ex-UNEP Expert

For NGGFn Audit, dated 05 December 2022

I agree with the data presented in this report as true, and further express my willingness to implement the recommendations of this audit report after internal review, even if any or many of them are in excess of the relevant mandates.

Prof. Dr. Nisha J Tharayil, Principal

Sree Narayana College, Kollam, Kerala

Date: 05 December 2022

Signature & Seal



Prof. (Dr.) Nisha J Tharayil
Principal
Sree Narayana College,
Kollam.

**ENERGY AUDIT REPORT
FOR SREE NARAYANA COLLEGE, KOLLAM**



MARCH 2021

**JAHANGIR.M
(CERTIFIED ENERGY AUDITOR)**

ACKNOWLEDGEMENT

I thankfully acknowledge the guidance, support and co-operation extended by the Principal, HODs, professors, students and staffs of SN college, Kollam and especially entire physics department of SN college, without whose help this study would not have been completed.

I hereby concede my sincere gratefulness to Dr. R. Sunilkumar, Principal, Dr S Jayasree, NAAC coordinator, Associate Professor, HoD, Economics Department, Dr. Manoj S V, IQAC coordinator, Chemistry Department and Dr Dedhila Devadathan, Energy Audit Coordinator, Physics department for the valuable consensus, support and direction for conducting the Energy Audit of the esteemed institution.

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Energy auditor

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Kollam-691005

Energy Audit for M/s Sree Narayana college, Kollam

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This document has been prepared on the basis of findings of the study conducted by the Energy auditor and M/s Sree Narayana college, Kollam.

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LIST OF ABBREVIATIONS

DOL - Direct online

FTL - Fluorescent tube light

HT - High Tension

KSEBL - Kerala State Electricity Board Limited

kV- kilo Volt

kVA - kilo Volt Ampere

KVAr - kilo Volt Ampere reactive

MD—Maximum Demand

kW - kilo Watt

kWh - kilo Watt hour

LED - Light emitting diode

LT - Low tension

PF - Power Factor

VFD - Variable frequency drive

BLDC- Brushless Direct Current

SAC- Split air conditioner

CFL- Compact Fluorescent light

APFC-Automatic power factor controller

MDB- Main Distribution Board

SDB- Sub Distribution Board

TOD- Time of Day- Energy meter

CL-Connected Load

MD- Maximum Demand

CONTENTS

SI No.	Title	Page No.
	Executive summary	6-7
1.	Introduction	8
1.1	Methodology for Energy Audit	9
1.2	Instruments used for Measurements	9
1.3	Energy Audit Team	9
2	Brief Description of Electrical System	11
3.	Energy audit activities carried out	12
4.	Best Practices Implemented	12
5.	Electricity Bill Analysis	12
6.	Transformer	16
7.	Distribution of power	17
8.	Lighting system in the college	18
9.	Water pumps operations	18
10.	Library	19
11.	Canteen	20
12.	Labs	20
13.	Class Rooms	20
14.	List of Recommendations	23
	Annexure-A- Energy saving chart (3 pages)	
	Annexure-B- Catalogues (23 pages)	
	Annexure-C- Data sheets (76 pages) & Annex C part 2(17 pages)	
	Copy of auditor certificate & E-ID (2 pages)	

EXECUTIVE SUMMARY

M/s SNC entrusted the energy audit study of their institution to identify scope of energy conservation with necessary data collection and measurements wherever required. Accordingly, Auditor visited the college during month of January 2021 to March 2021 and guided the students of physics department to collect the data and sample data collection done by auditor along with teachers and students. All required data logged and prepared the audit report as per the prevailing guidelines.

1. Goals and objectives of the energy audit

The fundamental goal of energy management is to provide services with the least cost and least environmental adverse effect.

The objectives of energy management include:

- To achieve and maintain optimum energy procurement and utilization throughout the institution.
- To minimize energy costs/waste without affecting normal procedures and conducting curricula.
- To minimize environmental adverse effects.

2. Major challenges and goals for the impending years

With the implementation of various energy conservation measures, there will be steady decline of energy consumption of the institution. This will be expected to sustained efforts of all stakeholders of the institution to conserve energy with the implementation of various energy conservation measures & ideas to reduce the energy consumption.

However, there are certain major challenges as the main focus of institution for upcoming years and given below:

- Most of electrical gears/fittings are very old and not energy efficient.
- Energy consumption is more compared to standard energy efficient fixtures.

Major activities to meet above challenges are summarized below.

- Providing energy efficient fixtures.
- Imparting regular familiarisation training to stakeholders for the efficient use of energy.

The potential of energy saving identified for the institution is summarized below:

Sl.No	Particulars	Expected annual energy savings	
		Unit (KWH)	Rs.
1	Replacement of class room light fittings	6048	48384
2	Replacement of class room ceiling fans	13648	109190
3	Replacement of office rooms light fittings	11844	94752
4	Replacement of office rooms ceiling fans	14551	116409
5	Upgrading energy efficient Air conditioners in office rooms	6048	48384
6	Providing energy efficient electrical gears in labs	10507	84057
7	Providing energy efficient electrical gears in canteen	564	4512
8	Providing energy efficient electrical gears in library	2249	17990
9	Water pump replacement	448	3584
10	Power factor compensation	12000	96000*
11	Solar plants(proposed)	36000	288000

**Only considered disincentive of PF, there are benefits of PF incentive, regulation of voltage and reduction in unit consumption.*

1.0 INTRODUCTION

Sree Narayana College, Kollam is one of the earliest and the greatest centres of higher education in the whole state of Kerala. Affiliated to the University of Kerala, the College is managed by the Sree Narayana Trusts, Kollam. Bearing in letter and spirit the name of Sree Narayana Guru (1854-1928), the great saint philosopher, social reformer and mystic poet, the college was started in 1948 by S.N.D.P. Yogam and its able and inspiring leader R. Sankar (1909-1972) with 505 students at the Intermediate level. Next year it was upgraded to a Degree college and in 1957 it attained membership in the prestigious club of Postgraduate colleges. Today the college offers 18 undergraduate and 14 postgraduate courses. Nine of the Postgraduate Departments are approved research centres as well. Total number of courses is forty-one (41) inclusive of all programmes stated above. The institution further provides facilities (both infrastructure and faculty) for conducting contact classes of the correspondence courses of IGNOU coordinated by the IGNOU Study Centre. Now the college has intake strength of 4000 students approximately for different disciplines of curriculum. SNC entrusted energy auditor to carry out the energy audit, accordingly with full pledged cooperation of physics department and college principal / HODs/ professors/staffs/students. Auditor and teachers & students jointly visited and inspected the college facilities for data gathering from January 2021 to March 2021.

The major parts of the college are class rooms and besides office rooms, labs of concerned departments with instruments and equipment, library, canteen, water tanks, power distribution system with metering facility, light fixtures, ceiling fans, water pumps, air conditioners, street light fixtures, etc. Approximate facilities available are furnished below.

Total classrooms	--- 99 no's,
Staff rooms	--- 20 no's,
Office rooms & others	--- 107 no's,
Labs	--- 22 no's,
R&D facility	--- 04 no's,
Library	--- 1no
Canteen	--- 1no
Water Tanks	--- 6 no's

1.1 Methodology for Energy Audit

The methodology for carrying out energy audit study involved collection of relevant data through data collection format followed by the visit of auditor team for field measurement of electrical parameters with the help of portable measuring instruments, discussion with college officials and analysis of data for identifying potentials of energy saving in college facilities. The information /data regarding energy consumption of various sections and departments were collected during the inspection and visit of auditor and students.

1.2 Instruments used for Measurements

Power clamp on meter is used for all the electrical measurement and TOD meters readings, incomer ammeter and voltmeter readings of panels were recorded and utilised for all power calculations.

1.3 Energy Audit Team

1. Jahangir M Certified energy auditor
2. Dr S Sankar Assistant Professor and HoD
3. Mrs Asitha L R Assistant Professor
4. Mr Srijith S Assistant Professor
5. Mr Baiju V Assistant Professor
6. Dr M S Roxy Assistant Professor

7. Dr Dedhila Devadathan Assistant Professor
 8. Dr Vidya S Assistant Professor
 9. Mrs Rehna R Assistant Professor
 10. Mrs Saranya Babu Assistant Professor
 11. Dr Divya N K Assistant Professor
 12. Students of BSc (Physics) -final semester (Student's contribution is highly appreciable and data collection carried out scientifically and recorded in data sheet attached as annexure-C)
- The following students took part for the data collection and field survey of energy audit.

- 1)Aparna A P,
- 2)Aravind S Lal,
- 3)Bhamini Krishnaveni A G,
- 4)Reeja K George,
- 5)Akshay S Kumar,
- 6) Vishnu S,
- 7) Vishwajith S
- 8) Akash B S

I extend once again my sincere gratitude to whole physics department for the smooth conducting of energy audit at SNC Kollam.

Auditor

2. Brief Description of Electrical System

This college consists of main offices, classrooms, labs, library, etc. Power supply for the premises is tapped from 11KV of KSEBL and categorized under HT II (B) general tariff with average consumption of eighteen thousand units monthly. 100 KVA is the contract demand and the average MD is around 80 KVA & power factor very low at LT side. Metering is recorded at 11KV receiving end and power is stepped down through one transformer of 400 KVA capacity and LV supply is distributed through main DB located in a DB room near to chemistry department and fed to all colleges through SDBs, LDBs and feeder outlets. Load of each college measured and average load of SNC also recorded. However present consumption and MD were seen very low to average due to the present pandemic restrictions and rearrangement of classes. But the power distribution to other colleges is feeding from this transformer and common monthly electricity bill is available for all colleges together. There are five feeder outlets available to cater the power to the institutions. Two feeders are utilised for SNC. In order to get the consumption of individual feeders, energy meters are to be installed for this purpose. However, energy meters were provided in each college premises and readings recorded in every month to calculate the share of the electricity bill in each institution. It is better to provide the meters at Main DB and meter reading can be recorded every month from the feeding end. There are two feeders for SN college, as noticed, reading is taken from the DB located inside the building of southern side, power used for chemistry and physics departments is not able to record since there is no energy meter on that feeder. To know the total consumption of SNC for that two feeders reading are to be added. At least two meters are to be mounted exclusively for SNC reading at MDB located near the chemistry department.

3. Energy audit activities carried out

The following activities were carried out during the detailed energy audit.

Activities carried out:

- Study of power distribution system.
- Study of Contract Demand
- Detailed study of voltage at different locations.
- Loading and voltage profile of transformers.
- Study of power factor.
- Explored the options for improving the existing lighting system with energy efficient lighting.
- Water pumps usage and efficient usage recommendations.

4. Best Practices Implemented

- Installation of LED lamps for street lighting
- Solar light lanterns at entrance of the college
- CFL and LED lights some of the rooms and Labs.
- LED tube lights some office rooms.
- Natural lights utilised for most of class rooms which is highly appreciable.

5. Electricity Bill Analysis

Power consumption for the last year due to pandemic conditions, found to be very low and consumption pattern is not able to take for yearly analysis since the total requirement will be more as the institutions will work as normal. With the available data, the following data were furnished to know the details, these details belong to all intuitions powering from the existing transformer located in SNC

Contract Demand-----100KVA

Connected Load-----300KW (As calculated approximately 140KW for SNC, Kollam)

Average Consumption---18000KWH- Now about 8000KWH

Average Maximum Demand-80 KVA- Now about 30 KVA

Paying about Rs 20000 monthly as additional to cover the 75% contract demand. This may be due to pandemic situation.

Special attention may be given to find out the load pattern, accordingly application can be raised to reduce contract demand (To KSEBL), if the college works all facilities together, demand is crossing 75KVA, keep the demand as it is, however three months bill amount will be evaluated, right decision may be taken to avoid the excess charges paying in the head of contract demand charges.

It is also noticed that PF disincentive is paying in the tune of Rs8000/- monthly for the penalty, not keeping the power factor above .95, now the power factor is very low, capacitor banks (APFC panel) shall be installed in the LT side of distribution panel to avoid penalty charges. The details are furnished in the recommendations.

Because of these two additional charges unit rate is more than Rs10/KWH and this is highly above the normal rate.

Power measured at MDB

Date	25.03.2021		
Time	10.30 AM		
Load Details			
SNC	20A*	13	KW
SNW	45A	30	KW
School	10A	7	KW
Law college	17A	12	KW
Chemistry & Physics dept SNC	4A*	3	KW
*Low consumption due to classes suspended for college programmes			



Meters Reading at MDB showing current and voltage of LV side



TOD metering at HV side showing current

KERALA STATE ELECTRICITY BOARD LIMITED

Office of the Special Officer (Revenue), Payee, Thiruvananthapuram
DEMAND NOTICE for MAY 2020
 (As per PART B of KERALA ELECTRICITY SUPPLY CODE -2010)

Bill Code: 100000000			Bill Cycle: 04-May-2020			The Date: 19-May-2020			Ac No: 012801050000000		
Type: HT & 01 GENERAL			Last Issue: 27-May-2020			Category: 00000001			WFO No: 0102		
SN COLLEGE, KOLLAM SECRETARY, SN TRUST NO. LAM, Kollam, Mobile No- 0254789323 CCR: 236000						WFO Unit AC No/B'S Code: 010000010400000101000000 Consumer Code: 01-0000-03007-01-000000000000000000					

Contract (Demand Pt)				20% of UB (WPA)		100% of UB (WPA)		Contract Unit (WPA)		Average (WPA)		Power Factor		Phase	
0001				75.0		100.0		100.0		100.0		100.0		3-Phase	

Reading Details of meter 622Bq-Working (KVA, kWh, KVArh & PVAWh) for 04-2020

Date	1. Energy Consumption (kWh)			Meter	2. Energy Consumption (kVArh)			Lag cos	3. PVAWh (Last)		
	kWh	PF	WPA		kVArh	PF	WPA		PF	WPA	WPA
1	42196	0.8300	2300	622B	1	42000	0.83	2300	0	0	0
2	14449	0.8400	3381	622B	2	46001	0.84	3381	0	0	0
3	14449	0.8400	3381	622B	3	46001	0.84	3381	0	0	0
Total					Total				Total		

Date	4. Energy Consumption (kVArh)			Meter	kVArh (kVAr)	kVArh (kVAr)	kVArh (kVAr)
	kVArh	PF	WPA				
1	42196	0.8300	2300	622B	4111	2300	23.00
2	14449	0.8400	3381	622B	4111	3381	33.81
3	14449	0.8400	3381	622B	4111	3381	33.81
Total					Total		

INVOICE

Particulars	Unit	Rate (Rs)	Quantity (Qty)	Amount	Particulars	Unit	Rate (Rs)	Quantity (Qty)	Amount
1. Demand Charge - Max	Rs	440.00	1	440.00	4. Demand Charge - HT cost	Rs	140.00	1	140.00
2. Demand Charge - Min	Rs	450.00	1	450.00	5. Demand Charge - Meter	Rs	450.00	1	450.00
3. Demand Charge - HT cost	Rs	140.00	1	140.00	6. Demand Charge - Meter	Rs	450.00	1	450.00
4. Demand Charge - Meter	Rs	450.00	1	450.00	7. Demand Charge - Meter	Rs	450.00	1	450.00
5. Demand Charge - Meter	Rs	450.00	1	450.00	8. Demand Charge - Meter	Rs	450.00	1	450.00
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90. Demand Charge - Meter	Rs	450.00	1	450.00					
91. Demand Charge - Meter	Rs	450.00	1	450.00					
92. Demand Charge - Meter	Rs	450.00	1	450.00					
93. Demand Charge - Meter	Rs	450.00	1	450.00					
94. Demand Charge - Meter	Rs	450.00	1	450.00					
95. Demand Charge - Meter	Rs	450.00	1	450.00					
96. Demand Charge - Meter	Rs	450.00	1	450.00					
97. Demand Charge - Meter	Rs	450.00	1	450.00					
98. Demand Charge - Meter	Rs	450.00	1	450.00					
99. Demand Charge - Meter	Rs	450.00	1	450.00					
100. Demand Charge - Meter	Rs	450.00	1	450.00					

Sample electricity bill (highlighted portion for excess charges paying for low power factor)

Connected load of college premises calculated approximately with data available in annexure 3 and deailed in annex 3 part 2.

Connected load of college--Department wise	KW
DEPARTMENT OF BOTANY AND BIOTECH	10
DEPARTMENT OF CHEMISTRY	15
DEPARTMENT OF COMMERCE	3
DEPARTMENT OF ECONOMICS	10
DEPARTMENT OF ENGLISH	3
DEPARTMENT OF HISTORY	2
DEPARTMENT OF HINDI	3
LIBRARY & READING ROOM	12
DEPARTMENT OF MALAYALAM	2
DEPARTMENT OF MATHS	7
OFFICES AND OTHER	10
DEPARTMENT OF PHILOSOPHY	11
DEPARTMENT OF PHYSICS AND PCA	20
DEPARTMENT OF POLITICS	2
DEPARTMENT OF SANSKRIT	2
DEPARTMENT OF ZOOLOGY	23
Other facilities	5
Total (approximately)	140

6. Transformer

The college is operating with one transformer with design voltage of 11KV/433V and design capacity of 400KVA. Now the loading of the transformer is about 40% as per the TOD reading and current shown in the LT panel. Unbalanced load was found in the TOD meter as well as LT panel, this has to be corrected, balancing the load of each phase by transferring loads almost equal to each phase and voltage regulation will be improved, this will be beneficial to sophisticated instruments used in labs and consumption will be reduced if the almost balance loading is maintained.



Name plate details of transformer

7. Distribution of power

Power cables laid for each sub distribution boards from the main DB located near to the chemistry department, voltages shown in each phase differs, voltage drop of incoming cables of each feeder coming to the different area of the college and voltage drop shall be within 3% as per the norms of electrical inspectorate. This is to be verified and corrected. As checked in the SNC premises showed less especially in one phase and other premises are to be checked.

8. Lighting system in the college.

One of the major loads is lighting installations in the college and this will include all lighting fittings including ceiling fans in the class rooms, labs, office rooms, library, etc.

On visit of auditor along with students examined the lights and fans individually all the rooms and facilities, recorded the quantities and type of gears used in the college, this was done in a scientific way and tabulated in each category and total load anticipated for the survey of premises and facilities of the college. All data summarised and tabulated in chart for recommendation showing the existing power. Street lighting is comparatively less installation and there is no part time classes after evening. It is noticed that LED street light fittings were provided which are energy efficient installations. Most of the light fittings and ceiling fans were found to be normal electrical gears, these are to be replaced with energy efficient fittings.

9. Water pumps operations

Pumps were operated in throttled condition; energy is wasted through this type of switching of these pump sets. In order to stream line effective pumping of water to tanks, selection of pump set is required, it is better to install submersible pump set to reduce capacity of pump as well as pumping time can also be reduced, some places water is overflowing from the tank which is to be controlled, for this purpose automatic level controllers shall be installed, power can be saved by controlling the pump and wastage of water is minimised or avoided. Details are furnished in recommendations. Variable frequency drive (VFD) for water pump DOL starter is also suggested for 3% power reduction of total power consumption of water pump motor. Refer Annex-A for further details.



Name plate details of water pump set

10. Library

Library is maintained with adequate space and computers are provided with net facility. There are lights and fans are in place for the utility purpose when stakeholders came for library service. Fans and lights are to be replaced with energy efficient electrical gears. For the NET facility and computers, it is recommended to install 3KVA UPS centralised one to cater all computers and net facility, this will attract continuous reliable power to net and computers by avoiding 1KVA individual UPS for each system which consumed more power can be reduced to some extent and maintenance of total system can be reduced and availability of total system can be improved. This is also suggested

in main office and HOD offices to provide centralised UPS system for the all computers and laptops. {7.5KVA ups is required for this purpose or total computers consumption shall be counted for finding out the capacity of UPS (50% cushion may be added) in total required for the college.}.

11. Canteen

As examined canteen are provided with LED light fittings and ceiling fans are to be replaced with energy efficient one, however separate source of power is taken from KSEB with meter facility for the canteen.

There are five ceiling fans which can be replaced for with BLDC fans.

Power saving for providing BLDC fans- 564 units-Annual Power saving (@Rs8/KWH) is Rs4512/-

12. Labs

There are many labs and equipped with highly sophisticated instruments, most of the instruments are supported with voltage stabilised unit. The units which were used without stabilisers are to be tested regularly the required voltage are available in the outlet, if this voltage is not coming under the stipulated value, reliable source of power shall be arranged by means of UPS system, this will take care all abnormalities in the voltage and smooth trouble-free operation of instruments are guaranteed, this is applicable to other labs especially computer labs also. All the labs, lighting system and ceiling fans were examined, most of them are found as standard one, not energy efficient and included in the recommendation for replacement. Refer Annex-A for further details.

13. Class Rooms

Most of the class rooms are seen without lights, but natural lighting allowed and keeping the windows open, this is highly appreciable, this was in most of the upper stair class rooms. At the same time, ceiling fans were put for usage, these fans and light fitting available in the class

rooms found to be not energy efficient, all these electrical gears are to be replaced with phased manner. The major part of the college consists of class rooms; however, the quantities were counted and recommendations are given below.

Total classrooms	--- 99 no's,
LED/CFL provided	--- 85 no's,
Single tube lights	--- 69 no's,
Ceiling Fans	--- 121 no's,
Wall/pedestal fans	--- 3 no's,

Other facilities like projectors/ computers/ speakers are available in class rooms.

LED tube lights and CFL lights are energy efficient one, other fittings/gears were found as non-energy efficient.

It is recommended to replace all fluorescent tube lights with LED tube lights and all ceiling fans with energy efficient BLDC ceiling fans in a phased manner. Total saving is expected in a year about one and half lakh rupees and the payback period for light fittings is less than one year and BLDC fans are about two years, yearly saving of one BLDC fan is about 1000 rupees since operation hours is less than 8 hours. Initial investment for total replacement fans is more, then recommended to go for 30 pieces every year in class rooms category and faulty ceiling fans replacement shall be energy efficient BLDC type.

Please refer annexure A for more details of power saving by introducing energy efficient gears.

Sample calculation for LED tube fitting

Standard single tube light consumption---- 55Watts

Energy efficient single LED tube light consumption-20 Watts

Energy saving for the installation of one LED tube-35 Watts

Present cost of one LED tube fitting—Rs 300/-

Total working hours anticipated in a year- 2400 Hrs

Units saved for this period---- $(55-20) \times 2400/1000 = 84\text{KWH}$

Average cost of one unit—Rs 8/-

Saving in rupees---- Rs 672/-

Payback period--- $300/672 \times 12 =$ approximately five and half months.

Sample calculation for BLDC ceiling fan

Standard Ceiling Fans consumption---- 75Watts

Energy efficient BLDC ceiling fan consumption- 28 Watts

Energy saving for the installation of BLDC fan -47 Watts

Present cost of one BLDC fan —Rs 2500/-

Total working hours anticipated in a year - 2400 Hrs

Units saved for this period---- $(75-28) \times 2400/1000 = 112.8\text{KWH}$

Average cost of one unit—Rs 8/-

Saving in rupees---- Rs 902/-

Payback period--- $2500/902 \times 12 =$ approximately thirty-three months.

Class rooms wall and pedestal fan were mounted very less, further replacement or procurement shall be energy efficient category,

Saving calculation of wall fans/ pedestal fans are tabulated in energy saving chart and simple payback period is same as BLDC ceiling fans.

Note:

Catalogues of energy efficient fans are attached for ready reference in annexure B

14. List of Recommendations

1. Replace all fluorescent tube lights with chokes by LED tube lights. Approximate quantity: 305 nos', details in annex-A
2. Replace all ceiling fans by BLDC fans. Approximate quantity: 296 no's', details in annex-A
3. All air conditioners shall be procured star rated with consumption level will be low compared to normal SACs. Details in annex-A
4. Water pumps shall be obtained low-capacity submersible pump instead of three horse power pump set, it is better to go for two horse power pump set(submersible), it will be attracted 5% saving of power consumption. Auto operation of water pumps are to be made by providing water level switches at the tank as well as in the open well, for bore well, level switches can be mounted at water tanks and over flowing and unwanted pumping can be avoided. The details are furnished in energy data sheet annex-A
5. 50KVAR APFC panel is recommended for power factor compensation. This unit is to installed at MDB and total cost is about Rs 50000/-, Payback period will be 4 to 6 months, there is no need to pay pf disincentive since pf will be more than .95 always. PF incentive also will get keeping the power factor more than .95. Moreover, voltage regulation will be obtained and reduction in consumption is also an advantage (about 1%). There will be reduction demand charges if the load is availing above 75kVA, pf incentive will be around Rs40000/- yearly if maintain pf around .996 for the normal operation of the college. There will be reduction of Rs8000/- by month approximately in the bill by providing capacitor banks for excess charges for disincentive of PF and saving of Rs 96000/- yearly which is equivalent to 12000 KWH yearly.

APFC panel specification

Power Rating 50 kvar

Voltage Rating 415V AC, 50Hz, 3φ

Full Load Current 69 Amps.

Operating Ambient Up to 40°C

Steps 6

Each Step (kvar) 2, 3, 5, 10, 15, 15

Wall mounted or floor mounted

APFC panel technical specification is furnished above for the ready reference.

6. Solar recommendations, it is proposed to provide 5KWp solar plant at the top of chemistry department and 20KWp is proposed at top of main building. This proposal is the part of environmentally friendly power generation of avoiding fossil fuels and sticking on renewable energy.

On grid type solar plant is to be planned

20KWp --- KWH expected yearly-28800

Monthly production- 2400 KWH

Approximate cost of plant—Rs 10 lakhs

Simple payback period- 4.3 years

5KWp --- KWH expected yearly-7200

Monthly production- 600 KWH

Approximate cost of plant—Rs 2.5 lakhs

Simple payback period- 4.3 years

Certification

This is to certify that

The data collection has been carried out diligently and truthfully;

All data monitoring devices are in good working condition and have been calibrated or certified by approved agencies authorized and no tampering of such devices has occurred;

All reasonable professional skill, care and diligence had been taken in preparing the energy audit report and the contents thereof are a true representation of the facts;

Adequate training provided to personnel involved in daily operations after implementation of recommendations; and

The energy audit has been carried out in accordance with the Bureau of Energy Efficiency (Manner and Intervals of Time for the Conduct of Energy Audit) Regulations, 2010


(Jahangir M)



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