SANT BABA BHAG SINGH UNIVERSITY

ENERGY AUDIT REPORT

PREPARED BY
EHS ALLIANCE SERVICES

EHS alliance

CERTIFICATE No. EHSAC2121

CERTIFICATE

M/s Sant Baba Bhag Singh University

Village Khiala, Padhiana, Punjab 144030

Has been assessed by us for the comprehensive study of Energy Audit on institutional working framework to fulfill the requirement of

Energy Audit

The energy saving initiatives carried out by the college has been verified on the report submitted and was found to be satisfactory.

The efforts taken by management and faculty towards all type of energy used in college and sustainability are highly appreciated and noteworthy

Date of Audit: 02 Mar, 2022

BEE No - EM7059

Manoj Kumar
For EHS Alliance Services

EHS ALLIANCE SERVICES

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1.0 Acknowledgement

EHS Alliance Services audit team thanks the management of Sant Baba Bhag Singh University for assigning this important work of Environment Audit. We appreciate the co-operation to our team for completion of study.

Our special thanks are due to:

- Dr. Dharmjit Singh Parmar - *Vice-Chancellor*
- Dr. Vijay Dhir - *Director*
- Dr. Vikrant Jaryan - *In-charge NAAC criterion 7*

We are also thankful to the staff members for giving us necessary inputs to carry out this very vital exercise of Environment Audit, who were actively involved while collecting the data and conducting field measurements.

2.0 Disclaimer

EHS Alliance Services Energy Audit Team has prepared this report for Sant Baba Bhag Singh University based on input data submitted by the representatives of University complemented with the best judgment capacity of the expert team.

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

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

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BEE No - EM7059

EHS ALLIANCE SERVICES GURGAON

Manoj Kumar
BEE Certified & Lead Energy Auditor

Dr. Uday Pratap
Energy & Lead Auditor EMS

EHS ALLIANCE SERVICES GURGAON

2.1 Context and Concept

The National Assessment and Accreditation Council, New Delhi (NAAC) has made it mandatory from the academic year 2019–20 onwards that all Higher Educational Institutions should submit an annual Green, Environment and Energy Audit Report. Moreover, it is part of Corporate Social Responsibility of the Higher Educational Institutions to ensure that they contribute towards the reduction of global warming through Carbon Footprint reduction measures.

Management of, Sant Baba Bhag Singh University decided to conduct an environmental audit. Dr. Vijay Dhir, Director, Sant Baba Bhag Singh University coordinated with the auditor's team and provided necessary data and information for the audit.

The term 'Environmental audit' or 'Green audit' means differently to different people. Terms like 'assessment', 'survey' and 'review' are also used to describe similar activities. Furthermore, some organizations believe that an 'environmental audit' addresses only environmental matters, whereas others use the term to mean an audit of health, safety and environment-related matters. Although there is no universal definition of Green Audit, many leading companies/institutions follow the basic philosophy and approach summarized by the broad definition adopted by the International Chambers of Commerce (ICC) in its publication of Environmental Auditing (1989).

The ICC defines Environmental Auditing as:

"A management tool comprising a systematic, documented, periodic and objective evaluation of how well environmental organization, management and equipment are performing with the aim of safeguarding the environment and natural resources in its operations/projects."

The outcome of audit should be established with concrete evidence that the measures undertaken and facilities in the institution under green auditing. This audit focuses on the Green Campus, Waste Management, Water Management, Air Pollution, Energy Management & Carbon Footprint etc. being implemented by the institution. The concepts, structure, objectives, methodology, tools of analysis, objectives of the audit are discussed below.

2.2 Introduction

Nature is very precious gift for all life forms. Disturbance in the nature causes environmental problems increasing day by day due to development of urbanization and industrialization on earth. Due to unplanned utilization of resources, the planet is facing tremendous pressure resulting increase in global temperature. Therefore, there is an urgent need to plan the consumption of the resources in sustainable manner to conserve natural resources for future generation.

Sustainable development is becoming popular in the world for saving the earth. Utilizing resources in judicially can save the earth's precious resources. Measurement of environmental components is the most effective step to conserve and protect natural resources.

Environmental auditing had begun in the early 1970s with provision of civil lawsuits for non-compliance with environmental regulations. Environment auditing involves on site visit, collection of samples, performing analyses, and report results to competent authorities. Industry, the corporate world is initiating auditing for saving natural resources. Academic institutions also can contribute to the preservation and conservation of resources within their premises.

In thin "Environment Audit" report would help everyone to think about preserving resources, show willingness to learn their importance, adopt steps to minimize resource use and set an example for others to follow the path of eco-friendly practices to achieve the goal of sustainable development. Effective implementation of environmental auditing helps in minimization of environmental risks at low cost.

2.3 Overview of University

Sant Baba Bhag Singh Memorial Charitable Society, under the dynamic leadership of Sant Baba Malkit Singh ji, has been providing basic infrastructure facilities to the people living in the areas of the vicinity of Dera Sant Pura Jabbar, near Adampur Doaba, Dist. Jalandhar, by constructing bridges and roads, providing street lights to villages, etc. The Society started providing formal education by setting up SBBS Institute of Engineering & Technology in 2003, followed by the setting up of SBBS International School in 2004, SBBS Institute of Education (2005), SBBS Institute of Nursing (2005), SBBS Research & Development Centre (2010), SBBS Post Graduate College (2011), SBBS Public School, Binjon (2011). Rural Healthcare is being provided through Guru Nanak Sadh Sangat Charitable Hospital, Kalra, since 2003.

In pursuance of the vision: "To encourage each and every child to get educated, acquire knowledge and wisdom so dias to learn the art of leading a happy, successful and meaningful life," all these institutions established their presence in the field of education, leading to their flowering into Sant Baba Bhag Singh University, established vide the Sant Baba Bhag Singh University Act, 2014.

The institutions have made significant contributions in the field of education, which is visible in excellent results and placement records. With state of the art infrastructure catering to the needs of students, a pollution and drug free campus, focus on excellence in teaching, active involvement of students & faculty in co-curricular and extracurricular

activities, including NCC & NSS, industrial visits and a remarkable presence in the field of sports amongst educational institutions, along with a culture of imbibing ethical values, Sant Baba Bhag Singh University is an ideal place to be in to choose for quality education.

The University offers opportunities for students to get education & knowledge in below listed departments

UG Courses	PG Courses	Ph.D.
✓ B.A.	✓ M.Com	✓ *Ph.D Mechanical Engineering*
✓ B.Com	✓ M.Ed	✓ *Ph.D (Applied Science- Chemistry)*
✓ B.Com (Hons.)	✓ M.Ped	✓ *Ph.D (Applied Science- Mathematics)*
✓ B.Ed	✓ M.Sc(Chemistry)	✓ *Ph.D (Applied Science- Physics)*
✓ B.Lib.	✓ M.Sc(IT)	✓ *Ph.D (Commerce)*
✓ B.Ped	✓ M.Sc(Mathematics)	✓ *Ph.D (Education)*
✓ B.Sc (Non-Medical)	✓ M.Tech Civil Engineeri	✓ *Ph.D (English)*
✓ B.Sc. (Agriculture)	✓ M.Tech Computer Science & Engineering	✓ *Ph.D (Hindi)*
✓ B.Sc. (IT)	✓ M.Tech Mechanical Engineering	✓ *Ph.D (Music)*
✓ B.Sc. (Medical)	✓ MBA	✓ *Ph.D (Physical Education)*
✓ B.Sc. (MLS)	✓ MCA	✓ *Ph.D (Punjabi)*
✓ B.Tech Civil Engineering	✓ PGDCA	✓ *Ph.D(Economics)*
✓ B.Tech Computer Scienc Engineering		✓ *Ph.D(History)*
✓ B.Tech Electrical Engineering		✓ *Ph.D. Civil Engineering*
✓ B.Tech Mechanical Engineering		✓ *Ph.D. Computer Science & Engineering*
✓ BBA		✓ *Ph.D. Electrical Engineering*
✓ BCA		✓ *Ph.D. Electronics & Communication Engineering*
		✓ *Ph.D. Library Sciences*
		✓ *Ph.D. Management Studies*

*SBBSU also provides various vocational and certificate courses.

Sant Baba Bhag Singh University

Mission | Vision | Objectives

MISSION

To achieve the best possible academic standard by exposing every student to a holistic educational experience in an active and dynamic environment. To develop self-expression, self-reliance, confidence, self-esteem and eventually endorse self-directed learning which is befitting the life in the rapidly changing world of the new millennium.

VISION

To encourage learners to be educated, acquire knowledge and wisdom so as to live a happy, successful and meaningful life

OBJECTIVE

- To address the educational needs of the society through participatory mechanisms.
- To develop curriculum addressing challenges of the stakeholders for finding appropriate technology options to promote a just and equitable economic and social development.
- To develop a pool of researchers and academicians across the disciplines interested in and working for rural communities leveraging academic inputs for higher education.
- To train manpower to meet with the scientific and industrial needs- locally and globally.
- To pay special attention to the improvement of the social and economic conditions and welfare of the people of the region.
- To inculcate entrepreneurial spirit among the girls belonging to rural areas.

2.4 Sant Baba Bhag Singh University Location

Geo Coordinates from Google maps: 31.4220953, 75.808947

Objectives

The broad aims/benefits of the eco-auditing system would be

- To systematically identify the environmental aspects & components in the campus
- To quantify, record and analyse the identified aspects and components of environmental diversity of the campus.
- To deduce the impact of the environmental practices caused within and outside of the concerned campus.
- To establish baseline data or compare the past trends and predict future impacts
- To recommend possible measures for improvement and highlight best practices

Audit Participants

On behalf of University/University:

Name	Position/Department
Dr. Dharmjit Singh Parmar	Vice Chancellor of SBBS University
Dr. Vijay Dhir	Director
Dr. Anju Sood	Dy. Director, IQAC
Dr. Vikrant Jaryan	In-charge NAAC Criteria 7/ Head of Department of Botany
Er. Mandip Singh	Assistant Professor (EE)
Er. Neha Kapila	Assistant Professor (EE)

On behalf of EHS Alliance Services:

Name	Position	Qualification
Mr. Manoj Kumar	Lead Auditor	BEE Energy Auditor OHSAS 18001:2007, BEE Energy Auditor
Dr. Uday Pratap	Co- Auditor	Ph.D , Energy Auditor, QCI – WASH, Lead Auditor ISO 14001:20

Executive Summary

The purpose of this Energy Audit was to seek opportunities to improve the energy efficiency of the Sant Baba Bhag Singh University. Reducing the energy consumption despite improving the human comfort, health and safety were of primary concern.

Beyond just identifying the energy consumption pattern, this audit sought to detect and categorize the most energy efficient appliances. Additionally, some daily practices relating common appliances have been shared which may help reducing the energy consumption. Data collection for energy audit of the university was carried out by the EHS Alliance Team. The Energy Audit Report accounts for the energy consumption patterns of the university on actual survey and detailed analysis during the audit.

The work comprehends the area wise consumption traced using suitable equipment. The analysis was carried out by our team with the support of the staff members from SBBS University. The report provides a list of possible actions to preserve and efficiently access the available source, resources and their saving potential was also identified. We look forward towards optimization that the authorities, students and staff members would follow the recommendations in the best possible way. The report is based on certain generalizations including the approximations wherever necessary. The views conveyed may not reveal the general opinion. They merely represent the opinion of the team guided by the interviews of clients. We are happy to submit this Energy audit report to the SBBSU.

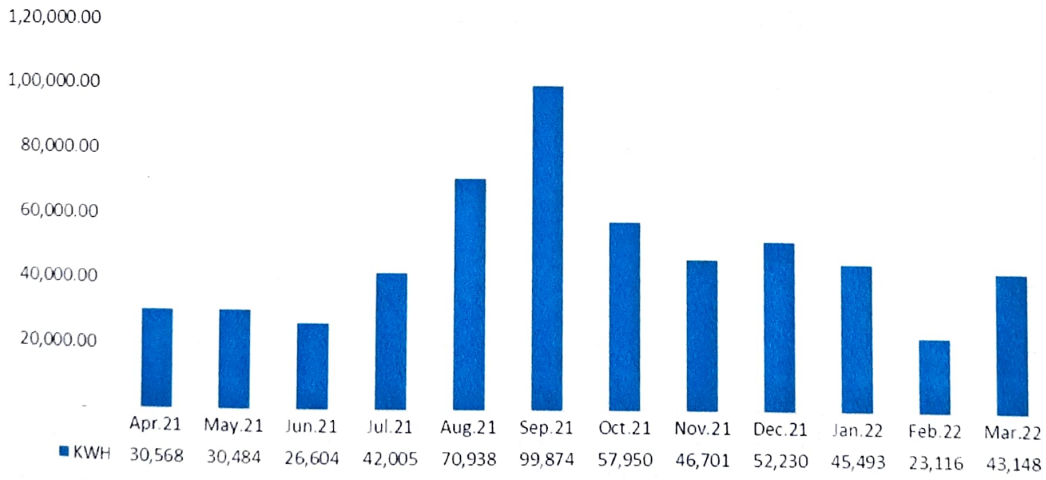
3.0 Review of Electricity Bills and Diesel Consumption

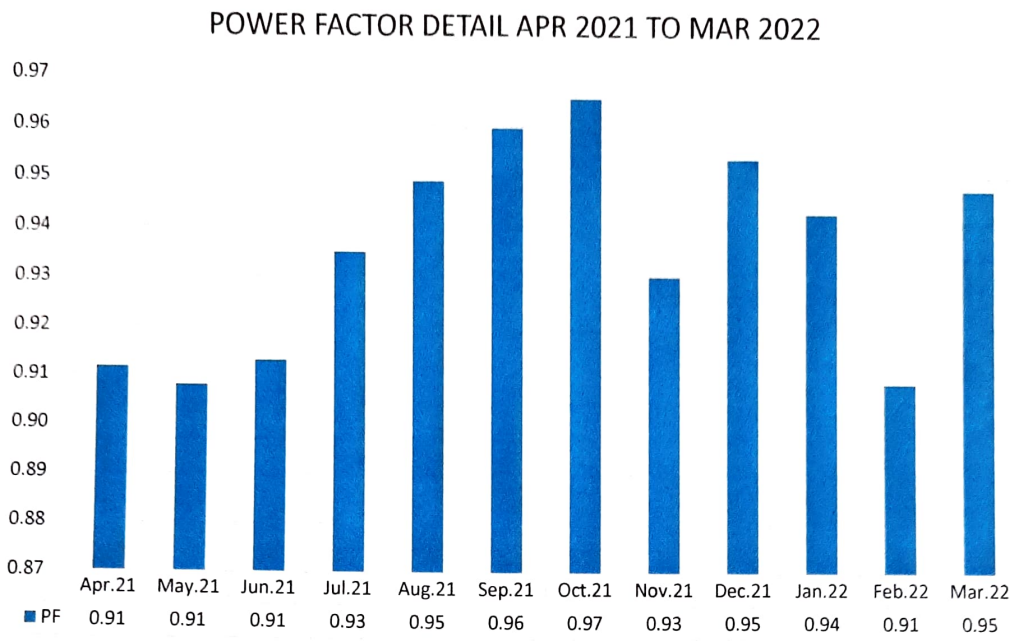
3.1 Summary of Monthly Electricity Consumption and Total Bill Amount

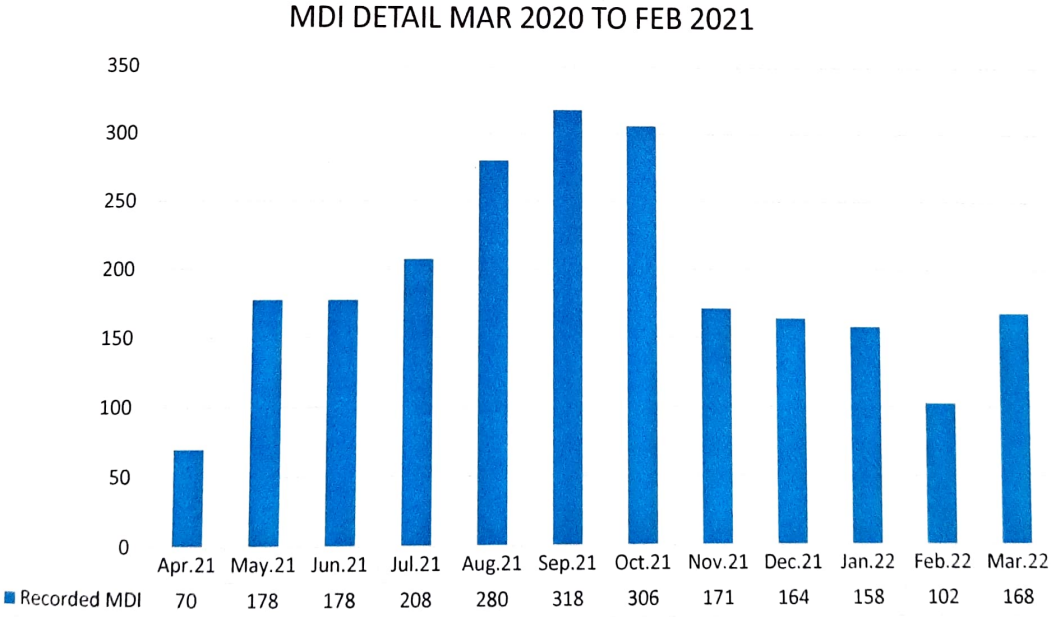
To understand the Energy consumption trend and for developing the baseline parameter we have collected monthly energy bill for the last available 12 month i.e. from Apr 21 to Mar 22.

MONTH WISE ELECTRICITY BILL APR 2021 TO MAR 2022						
SR. No.	Period	kWh	kVAh	PF	Contract Demand-kVA	Recorded MDI-kVA
1	Apr.21	30,568.00	33,532.00	0.91	324	69.92
2	May.21	30,484.00	33,572.00	0.91	324	177.68
3	Jun.21	26,604.00	29,139.00	0.91	324	177.68
4	Jul.21	42,005.00	44,937.00	0.93	324	207.68
5	Aug.21	70,938.00	74,760.00	0.95	324	280.24
6	Sep.21	99,874.00	1,04,090.00	0.96	324	317.84
7	Oct.21	57,950.00	60,023.00	0.97	324	306.08
8	Nov.21	46,701.00	50,225.00	0.93	324	171
9	Dec.21	52,230.00	54,780.00	0.95	324	164
10	Jan.22	45,493.00	48,268.00	0.94	324	158
11	Feb.22	23,116.00	25,448.00	0.91	324	102.3
12	Mar.22	43,148.00	45,544.00	0.95	324	168.24
Total		**5,69,111.00**	**6,04,318.00**			

MONTHWISE ENERGY CONSUMPTION IN KWH APR 2021 TO MAR 2022

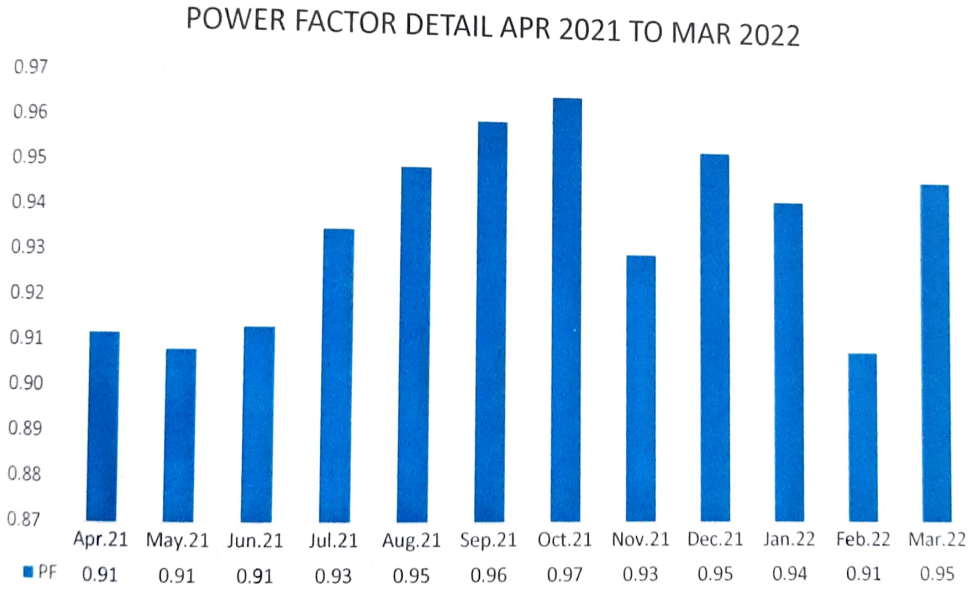



POWER FACTOR DETAIL APR 2021 TO MAR 2022
0.97
0.96
0.95
0.94
0.93
0.92
0.91
0.90
0.89
0.88
0.87
Apr.21 May.21 Jun.21 Jul.21 Aug.21 Sep.21 Oct.21 Nov.21 Dec.21 Jan.22 Feb.22 Mar.22
PF 0.91 0.91 0.91 0.93 0.95 0.96 0.97 0.93 0.95 0.94 0.91 0.95


MDI DETAIL MAR 2020 TO FEB 2021
350
300
250
200
150
100
50
0
Apr.21 May.21 Jun.21 Jul.21 Aug.21 Sep.21 Oct.21 Nov.21 Dec.21 Jan.22 Feb.22 Mar.22
Recorded MDI 70 178 178 208 280 318 306 171 164 158 102 168

3.2 Power Factor Analysis

SR. No.	Period	PF
1	Apr.21	0.91
2	May.21	0.91
3	Jun.21	0.91
4	Jul.21	0.93
5	Aug.21	0.95
6	Sep.21	0.96
7	Oct.21	0.97
8	Nov.21	0.93
9	Dec.21	0.95
10	Jan.22	0.94
11	Feb.22	0.91
12	Mar.22	0.95
Avg.		0.94
Min.		0.91
Max.		0.97



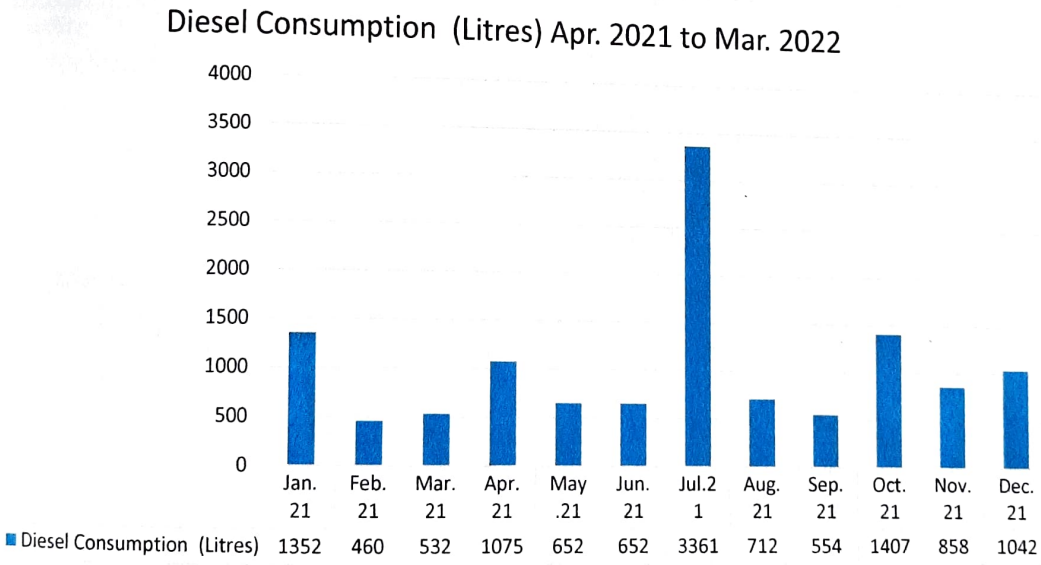
Observation and Recommendation: - We have analyzed electricity bills and found that average Power Factor throughout the year is 0.94 that is not good. We can improve Power Factor upto 0.99 by installing 370 kVAR APFC Panel by doing this we can get rebate in electricity bill.

ECRM-1 Energy saving by installing APFC panel

Average Units/month	=	50359.83	kVAh
Average saved Units/month	=	2517.99	kVAh
Saving/Month INR	=	16492.85	INR
Annual saving INR	=	197914.15	INR
Investment	=	375000	INR
Payback Period in Months	=	22.74	Months

3.3 Diesel Consumption

Total Diesel Consumption (Litres) Apr 2021 To Mar 2022	
Period	Diesel Consumption (Litres)
Jan.21	1352
Feb.21	460
Mar.21	532
Apr.21	1075
May.21	652
Jun.21	652
Jul.21	3361
Aug.21	712
Sep.21	554
Oct.21	1407
Nov.21	858
Dec.21	1042
Total	**12657**



4.0 ANALYSIS OF DG SETS

SBBSU is having two Diesel Generator (DG) sets for its electrical power needs in case of PSPCL power failure. Total installed DG sets capacity is 125 kVA.

- DG-1 :- 500 kVA
- DG-2 :- 250 kVA

During the energy audit study, performance of DG Sets has been carried out which detail is given below:

4.1 Performance of 500KVA DG Set

DG Set Performance

Description	Unit	DG
Design details:		
Rated capacity	kVA	500
Hz		50
Volts	Volts	415
PF		0.8
Phase		3
RPM		1500
Operating details:		
Operating hours during testing	Hours	0.50
% Loading	%	68.38
Energy Generation	kWh	135.13
Load	kVA	341.9
Fuel consumption during testing	Litres	44.00
Specific energy generation	kWh/litre	3.07

Observation and Suggestions:- As per the trial taken during the energy audit the percentage loading of DG set is 68.38% which is ok and specific energy consumption of DG Sets 3.07 kWh/Liter which is satisfactory because as per manufacturer recommendation, best practices for SEC in DG sets range from 3.0 to 3.5 kWh/litre and above.

4.2 Performance of 250 kVA DG Set

DG Set Performance		
Description	**Unit**	**DG**
Design details:		
Rated capacity	kVA	**250**
Hz		**50**
Volts	Volts	415
PF		0.8
Phase		3
RPM		1500
Operating details:		
Operating hours during testing	Hours	0.50
% Loading	%	71.58
Energy Generation	kWh	70.73
Load	KVA	179.0
Fuel consumption during testing	Liters	23.00
Specific energy generation	kWh/liter	**3.08**

Observation and Suggestions:- As per the trial taken during the energy audit the percentage loading of DG set is 71.58% which is ok and specific energy consumption of DG Sets 3.08 KWH/Liter which is satisfactory because as per manufacturer recommendation, best practices for SEC in DG sets range from 3.0 to 3.5 kWh/litre and above.

5.0 AC SYSTEM

There are Split ACs installed in SBBSU College Offices in various areas of various capacity which detail is given below:-

Energy Efficiency Ratio (EER):

Performance of smaller chillers and rooftop units is frequently measured in EER rather than kW/ton. EER is calculated by dividing a chiller's cooling
Capacity (in Btu/h) by its power input (in watts) at full-load conditions. The higher the EER, the More efficient the unit.

The cooling effect produced is quantified as tons of refrigeration. (TR)

**The above TR is also called as air-conditioning tonnage.

Sl.	Type of AC	Rated capacity (TR)	Room Temp. (°C)	AC-Tout (°C)	AC-Tin (°C)	Room-RH (%)	Area (m2)	Air velocity (m/s)	Enthalpy Hout	Enthalpy Hin	Heat Load in TR	KW supplied	(Eff.)Power per Ton (KW/TON)	EER
1	Split-1	1.5	24	11	20	52	0.03	2.2	22	38	0.39	0.63	1.61	2.18
2	Split-2	1.5	24	12	20	52	0.03	2.2	25	38	0.32	0.55	1.72	2.04
3	Split-3	1.5	24	11	19	52	0.03	2.6	24	37	0.38	0.57	1.52	2.31
4	Split-4	1.5	24	10	18	52	0.03	2.4	24	37	0.35	0.53	1.53	2.30
5	Split-5	1.5	23	12	20	52	0.03	2.3	25	38	0.33	0.55	1.67	2.11
6	Split-6	1.5	23	11	19	52	0.03	2	22	37	0.33	0.58	1.74	2.02
7	Split-7	1.5	23	13	20	52	0.03	2.3	26	38	0.31	0.53	1.74	2.02
8	Split-8	1.5	23	12	20	52	0.03	2.2	25	38	0.32	0.55	1.74	2.03
9	Split-9	1.5	23	12	19	52	0.03	2.3	24	37	0.33	0.58	1.74	2.02
10	Split-10	1.5	24	11	20	52	0.03	2.3	22	38	0.38	0.65	1.69	2.08
11	Split-11	1.5	24	12	20	53	0.03	2.5	25	38	0.34	0.60	1.79	1.97
12	Split-12	1.5	24	12	20	53	0.03	2.4	25	38	0.33	0.58	1.78	1.98
13	Split-13	1.5	23	12	20	52	0.03	2.5	25	38	0.34	0.63	1.86	1.89
14	Split-14	1.5	23	13	20	52	0.03	2.5	26	38	0.31	0.59	1.87	1.88
15	Split-15	1.5	23	12	20	52	0.03	2.5	25	38	0.34	0.63	1.87	1.88
16	Window-1	1.5	23	11	19	53	0.03	2.4	22	38	0.40	0.81	2.02	1.74
17	Window-2	1.5	22	11.5	22	52	0.03	2.1	23	43	0.44	0.77	1.77	1.99
18	Window-3	1.5	23	11	21	52	0.03	2.4	24	40	0.40	0.72	1.80	1.95
19	Window-4	1.5	22	10	19	52	0.03	2.2	20	37	0.39	0.78	1.99	1.77
20	Window-5	1.5	23	11	21	53	0.03	2.5	24	40	0.42	0.74	1.77	1.99
21	Window-6	1.5	22	12	20	52	0.03	2.6	25	38	0.35	0.71	2.02	1.74
22	Window-7	1.5	23	12	22	53	0.03	2.3	24	43	0.46	0.74	1.62	2.17
23	Window-8	1.5	23	12	20	53	0.03	2.7	25	38	0.37	0.65	1.78	1.98
24	Window-9	1.5	23	12	22	53	0.03	2.2	24	43	0.44	0.73	1.67	2.11
25	Window-10	1.5	23	12	22	53	0.03	2.3	24	42	0.43	0.71	1.63	2.15
26	Window-11	1.5	23	12	22	52	0.03	2.3	24	43	0.46	0.76	1.67	2.11
27	Window-12	1.5	24	11	20	52	0.03	2.2	22	38	0.37	0.66	1.79	1.97
28	Window-13	1.5	24	11	20	52	0.03	2.3	22	38	0.38	0.68	1.77	1.98
29	Window-14	1.5	23	12	22	53	0.03	2.2	24	42	0.41	0.72	1.75	2.00
30	Window-15	1.5	23	12	20	53	0.03	2.6	25	38	0.35	0.67	1.90	1.85
31	Window-16	1.5	24	11	20	52	0.03	2.3	22	38	0.38	0.63	1.65	2.14
32	Window-17	1.5	24	12	20	53	0.03	2.3	24	39	0.36	0.64	1.79	1.96
33	Window-18	1.5	24	10	18	53	0.03	2.4	21	37	0.40	0.69	1.73	2.04
34	Window-19	1.5	23	12	22	52	0.03	2.1	24	43	0.42	0.72	1.74	2.02
35	Window-20	1.5	24	11	18	53	0.03	2.4	22	37	0.38	0.64	1.70	2.07
36	Window-21	1.5	24	11	18	53	0.03	2.5	22	37	0.39	0.67	1.72	2.05
37	Window-22	1.5	24	11	18	53	0.03	2.4	22	37	0.38	0.64	1.71	2.06
38	Window-23	1.5	24	12	20	53	0.03	2.4	24	39	0.38	0.66	1.76	1.99
39	Window-24	1.5	23	11	18	53	0.03	2.4	22	36	0.35	0.63	1.80	1.96
40	Window-25	1.5	23	11	18	52	0.03	2.2	22	36	0.32	0.59	1.83	1.92
41	Window-26	1.5	24	10	17	53	0.03	2.4	21	35	0.35	0.67	1.93	1.82
42	Window-27	1.5	23	12	18	52	0.03	2.1	24	36	0.26	0.59	2.26	1.56
43	Window-28	1.5	24	11	18	52	0.03	2.2	22	36	0.32	0.60	1.87	1.88
44	Window-29	1.5	24	11	20	52	0.03	2.1	22	38	0.35	0.63	1.80	1.96
45	Window-30	1.5	23	12	21	52	0.03	2.3	25	39	0.34	0.62	1.84	1.91
46	Window-31	1.5	23	12	18	52	0.03	2.3	24	37	0.31	0.61	1.94	1.81
47	Window-32	1.5	24	12	21	52	0.03	2.3	24	39	0.36	0.64	1.79	1.96
48	Window-33	1.5	24	11.5	19	52	0.03	2.2	23	38	0.34	0.64	1.86	1.90

49	Window-34	1.5	24	11	18	52	0.03	2.4	22	37	0.38	0.63	1.68	2.10
50	Window-35	1.5	23	12	18	52	0.03	2.4	24	37	0.33	0.61	1.88	1.87
51	Window-36	1.5	24	12	20	51	0.03	2.5	25	38	0.34	0.62	1.83	1.92
52	Window-37	1.5	24	12	21	52	0.03	2.1	24	42	0.39	0.71	1.79	1.96
53	Window-38	1.5	24	12	21	52	0.03	2.4	24	39	0.38	0.67	1.78	1.97
54	Window-39	1.5	24	11	18	53	0.03	2.4	22	37	0.38	0.68	1.82	1.93
55	Window-40	1.5	24	12	21	52	0.03	2.4	24	39	0.38	0.66	1.76	2.00
56	Window-41	1.5	24	11	18	53	0.03	2.5	22	37	0.39	0.67	1.70	2.07
57	Window-42	1.5	24	11	18	52	0.03	2.4	22	37	0.38	0.64	1.69	2.08
58	Window-43	1.5	24	12	21	52	0.03	2.4	24	39	0.38	0.62	1.65	2.13
59	Window-44	1.5	24	11.5	19	52	0.03	2.1	23	38	0.33	0.63	1.92	1.83
60	Window-45	1.5	24	12	19	53	0.03	2.5	24	38	0.36	0.66	1.81	1.95
61	Window-46	1.5	24	12	19	53	0.03	2.4	24	38	0.35	0.65	1.86	1.89
62	Window-47	1.5	24	11	18	53	0.03	2.4	22	37	0.38	0.67	1.78	1.97
63	Window-48	1.5	24	12	21	52	0.03	2.3	24	39	0.36	0.64	1.79	1.96
64	Window-49	1.5	24	11	18	53	0.03	2.4	22	37	0.38	0.63	1.68	2.09
65	Window-50	1.5	24	12	21	53	0.03	2.3	24	39	0.36	0.63	1.76	2.00
66	Window-51	1.5	24	11.5	19	53	0.03	2.2	23	38	0.34	0.63	1.83	1.92
67	Window-52	1.5	24	11	18	53	0.03	2.3	22	37	0.36	0.64	1.79	1.96
68	Window-53	1.5	24	11	18	53	0.03	2.4	22	37	0.38	0.66	1.76	1.99
69	Window-54	1.5	24	12	21	53	0.03	2.3	24	39	0.36	0.65	1.80	1.95
70	Window-55	1.5	24	11	18	53	0.03	2.3	22	37	0.36	0.65	1.81	1.94
71	Window-56	1.5	24	12	21	52	0.03	2.4	24	39	0.38	0.67	1.77	1.98
72	Window-57	1.5	24	12	19	53	0.03	2.3	24	38	0.34	0.64	1.90	1.85
73	Window-58	1.5	24	11	18	53	0.03	2.1	22	37	0.33	0.63	1.91	1.84
74	Window-59	1.5	24	12	19	53	0.03	2.4	24	38	0.35	0.65	1.85	1.90
75	Window-60	1.5	24	12	19	53	0.03	2.4	24	38	0.35	0.63	1.80	1.96
76	Window-61	1.5	24	11	18	53	0.03	2.3	22	37	0.36	0.64	1.78	1.97
77	Window-62	1.5	24	12	21	53	0.03	2.2	24	39	0.34	0.61	1.78	1.98
78	Window-63	1.5	24	12	21	53	0.03	2.3	24	39	0.36	0.65	1.80	1.95
79	Window-64	1.5	24	12	19	53	0.03	2.4	24	38	0.35	0.63	1.80	1.96
80	Window-65	1.5	24	11	18	53	0.03	2.3	22	37	0.36	0.62	1.72	2.05
81	Window-66	1.5	24	11	18	53	0.03	2.3	22	37	0.36	0.64	1.78	1.97
82	Window-67	1.5	24	12	21	53	0.03	2	24	41	0.35	0.62	1.74	2.02
83	Window-68	1.5	24	11.5	19	53	0.03	2.3	23	38	0.36	0.63	1.75	2.01
84	Window-69	1.5	24	11	19	53	0.03	2.2	22	38	0.37	0.66	1.79	1.97
85	Window-70	1.5	24	11.5	19	53	0.03	2.3	23	38	0.36	0.65	1.81	1.94
86	Window-71	1.5	24	11	20	53	0.03	2.2	22	39	0.39	0.65	1.67	2.11
87	Window-72	1.5	24	12	21	52	0.03	2.4	24	39	0.38	0.67	1.78	1.97
88	Window-73	1.5	24	11	18	53	0.03	2.4	22	37	0.38	0.68	1.82	1.93
89	Window-74	1.5	24	12	21	52	0.03	2.2	24	39	0.34	0.66	1.92	1.83
90	Window-75	1.5	24	11	18	53	0.03	2.5	22	37	0.39	0.67	1.70	2.07
91	Window-76	1.5	24	11	18	52	0.03	2.4	22	37	0.38	0.64	1.69	2.08
92	Window-77	1.5	24	12	21	52	0.03	2.4	24	39	0.38	0.62	1.65	2.13
93	Window-78	1.5	23	11	21	52	0.03	2.5	24	40	0.42	0.72	1.73	2.04
94	Window-79	1.5	22	10	19	52	0.03	2.2	20	37	0.39	0.78	1.99	1.77
95	Window-80	1.5	23	11	21	53	0.03	2.3	24	40	0.38	0.74	1.92	1.83
96	Window-81	1.5	22	12	20	52	0.03	2.6	25	38	0.35	0.71	2.02	1.74
97	Window-82	1.5	23	12	22	53	0.03	2.3	24	43	0.46	0.74	1.62	2.17
98	Window-83	1.5	23	12	20	53	0.03	2.6	25	38	0.35	0.65	1.85	1.91
99	Window-84	1.5	24	11	18	53	0.03	2.4	22	37	0.38	0.68	1.82	1.93

Remarks: - We have checked Energy Efficiency Ratio of all AC's and EER of all AC's is quite OK. But in future you can purchase 5-Star rated invertor based split AC's because power consumption of Inverter based BEE 5-Star rated AC's is less than non-star rated AC's.6.0

CEILLING FANS

In the SBBSU have 3101 nos. Ceiling Fans are installed and observation and suggestion are given below.

Sl. No.	Location/Identification	Ceiling Fan-70W
1	Boys Hostel	432
2	Block No. 8	15
3	Workshop	77
4	Block no.7	263
5	Block no.5	717
6	Block no.3	154
7	Auditorium	59
8	Gymnasium	12
9	Bhagatpura	177
10	Dispensary	7
11	Store	6
12	Canteen	8
13	Transport office	16
14	Society workshop	15
15	Treatment Plant	3
16	SBBSIN	177
17	SBBSIS	521
18	Girls Hostel	429
19	Girls Canteen	13
	Total	**3101**

Observation and Suggestions:-

In the SBBSU old ceiling fans of 70W are installed but BEE 5 Star Rated of 30W Ceiling Fans are present in the market. Therefore we are suggesting replacing BEE 5 Star rated fans of 30W.

ECRM-2-Energy saving by replacing 70W fans with energy efficient 30W ceiling fans

Total no of Ceiling Fans (70W)	=	3101	Nos.
Total wattage of 70W Ceiling Fans	=	217070	Watt
Total wattage of BEE 5 Star rated Fans (30W)	=	93030	Watt
Total saving in Wattage after replacement	=	124040	Watt
Operating hours per day	=	12	Hours
Operating days per annum	=	180	Days
Energy charges per unit in Rs.	=	6.55	Rs.
Saving in Rs./annum	=	4549787	INR
Investment INR	=	9303000	INR
Payback period:- Months	=	24.54	Months

Note:- Energy saving will increase or decrease if operating hours of machine /equipment will be increase or decrease and payback period will also increase or decrease if cost of investment(Cost of machine/equipment/accessories of machine) will increase or decrease because cost of investment is taken on tentative basis.

7.0 ANALYSIS OF LIGHTING SYSTEM

7.1 Brief description of existing system

For assessing energy efficiency of lighting system, Inventory of the Lighting System has been noted / collected, with the aid of a lux meter, measurement and documentation of the lux levels at various locations at working level has been done.

7.2 Inventory of Lighting

Sl. No.	Location/Identification	60W LED	18W LED Light	36W LED	100W-RGP Light	100W LED-Shine Board	Tube light (40 W)
1	Boys Hostel		578		5		406
2	Block No. 8		987		1		18
3	Workshop		31		1		36
4	Block no.7		220		4		14
5	Block no.5		292		1		347
6	Block no.3		121		2		96
7	Auditorium	4	8	5	2	4	-
8	Gymnasium		3		-		9
9	Bhagatpura		204		4		5
10	Dispensary		10		1		2
11	Store		12		-		
12	Canteen		13		1		13
13	Transport office		32		2		16
14	Society workshop	8	3	3	1		3
15	Treatment Plant	3	4		1		-
16	SBBSIN	6	117		1		67
17	SBBSIS		268		2		90
18	Girls Hostel	2	329		3		278
19	Girls Canteen			4	2		11
	Total	**23**	**3232**	**12**	**34**	**4**	**1411**

7.3 Lux Measurement

Description	Lux	Remark
Class Rooms	120 to 240	Acceptable
Offices	130 to 245	Acceptable
Corridors	35 to 90	Acceptable
Washrooms	45 to 76	Acceptable
Outdoor	36 to 95	Acceptable
Computer Lab	150 to 289	Acceptable
Parking area	45 to 94	Acceptable
Canteen	69 to 185	Acceptable
Auditorium	98 to 244	Acceptable
Gymnasium	80 to 200	Acceptable
Dispensary	90 to 180	Acceptable
Workshop	95 to 238	Acceptable
Treatment Plant	60 to 150	Acceptable

Analysis

It suggested replacing the existing lighting system with most energy efficient lighting solution of Light Emitting Diodes or LED. LED lighting is gaining in popularity and availability. LEDs are more efficient and provide higher quality than even FTLs and MH light. LEDs saves energy, the life span is much greater and emit virtually no heat. Table below shows the performance characteristics comparison of all luminaries.

Table 8.1 Luminous Performance Characteristics of Commonly Used Luminaries

Type of Lamp	Lumens / Watt		Colour Rendering Index	Typical Application	Typical Life (hours)
	Range	Avg.			
Incandescent	8-18	14	Excellent (100)	Homes, restaurants, general lighting, emergency lighting	1000
Fluorescent lamps	46-60	50	Good w.r.t. coating (67-77)	Offices, shops, hospitals, homes	5000
Compact fluorescent lamps (CFL)	40-70	60	Very good (85)	Hotels, shops, homes, offices	8000-10000
High pressure mercury (HPMV)	44-57	50	Fair (45)	General lighting in factories, garages, car parking, flood lighting	5000
Halogen lamps	18-24	20	Excellent (100)	Display, flood lighting, stadium exhibition grounds, construction areas	2000-4000
High pressure sodium (HPSV) SON	67-121	90	Fair (22)	General lighting in factories, ware houses, street lighting	6000-12000
Low pressure sodium (LPSV) SOX	101-175	150	Poor (10)	Roadways, tunnels, canals, street lighting	6000-12000
Metal halide lamps	75-125	100	Good (70)	Industrial bays, spot lighting, flood lighting, retail stores	8000
LED lamps	30-50	40	Good (70)	Reading lights, desk lamps, night lights, spotlights, security lights, signage lighting, etc.	40,000-1,00,000

Recommendation and Proposed System

LEDs in white light, general illumination applications are one of today's most energy-efficient and rapidly-developing technologies. While LEDs are more expensive at this early stage, they still save money because they last a long time and have very low energy use. The replacement economics of all the existing luminaries installed in the all plants with LED Lights is given below:

ECRM-3 REPLACEMENT 40 Watt TUBE LIGHT

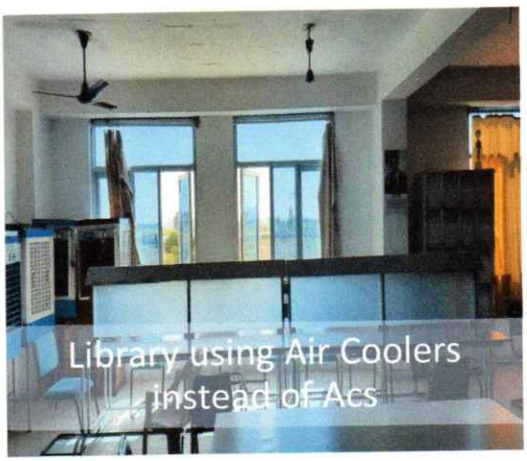
T12 40 W Tube Light		
A. Title Recommendation	:	Replace all the 40W T12 fixture with electronic ballast by 20W T8 LED Light
B. Description of Existing system	:	At present they are using 40W T12 fixture
C. Recommendation	:	It should be replace with 20W T8 LED Light
D. Energy Saving Calculation		
Average power consumption of 40 W T12 fixture	:	56 W
Average power consumption of 20 W T8 LED Light	:	22 W
Average power saving after replacement	:	34 W
Average working hour per day	:	12 hours
Average No. of working days	:	180 days
Approximate No. of fixture	:	1411
E. Cost Benefit Calculation		
Annual Energy Saving potential	:	103623.84 units
Power tariff	:	Rs. 6.55 per unit
Annual Cost Saving	:	678736.152
Cost of fitting	:	400 per fixture
Total investment cost	:	560400
Simple Payback Period	:	10 Months

RECOMMENDATIONS:

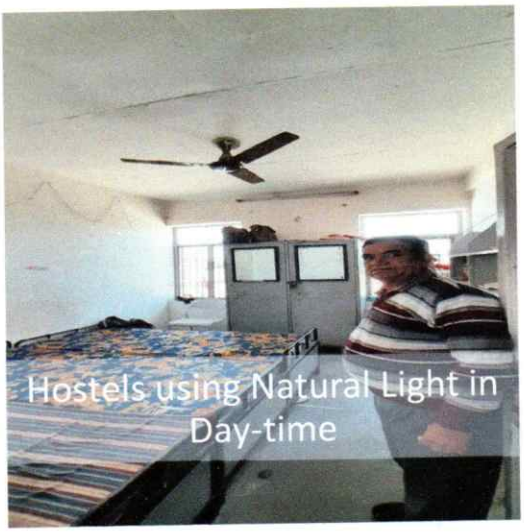
1. Traditional lighting system need to be replaced by latest technology like LED bulbs.
2. Street lights in campus can be solar powered with auto switch-on/off technology.
3. Old ceiling fans of 70W are installed but BEE 5 Star Rated of 30W Ceiling Fans are present in the market that can replace existing one.
4. At least 50% of the total power requirements should be fulfilled by solar energy in the university campus.
5. Sensor based lighting system should be installed in library and other offices to save energy also we should use natural light in day time.
6. Electricity consumptions need to be monitored and recorded with installation of separate electricity meters for School and Nursing College and other similar entities.
7. Lighting system should be according to the green building and should avoid excess light in the rooms.
8. ECBC compliance report is required for further building constructions and expansions.

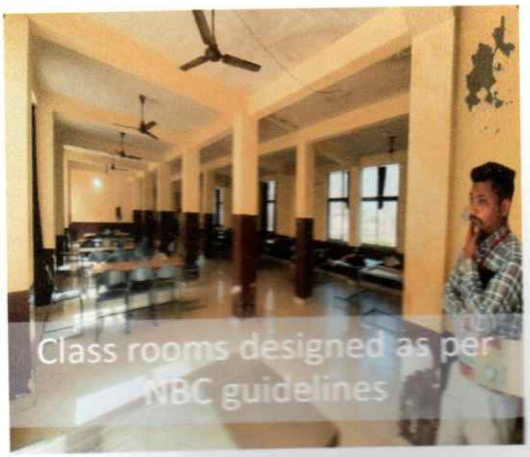
Annexure Photographs – Environmental Consciousness

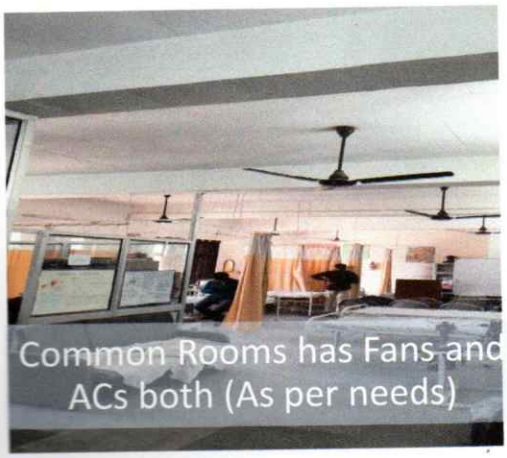

Library using natural lights


Library using Air Coolers instead of Acs


Dark Colour curtains to sheild the sunlight & Heat


Hostels using Natural Light in Day-time


Class rooms designed as per NBC guidelines


Common Rooms has Fans and ACs both (As per needs)