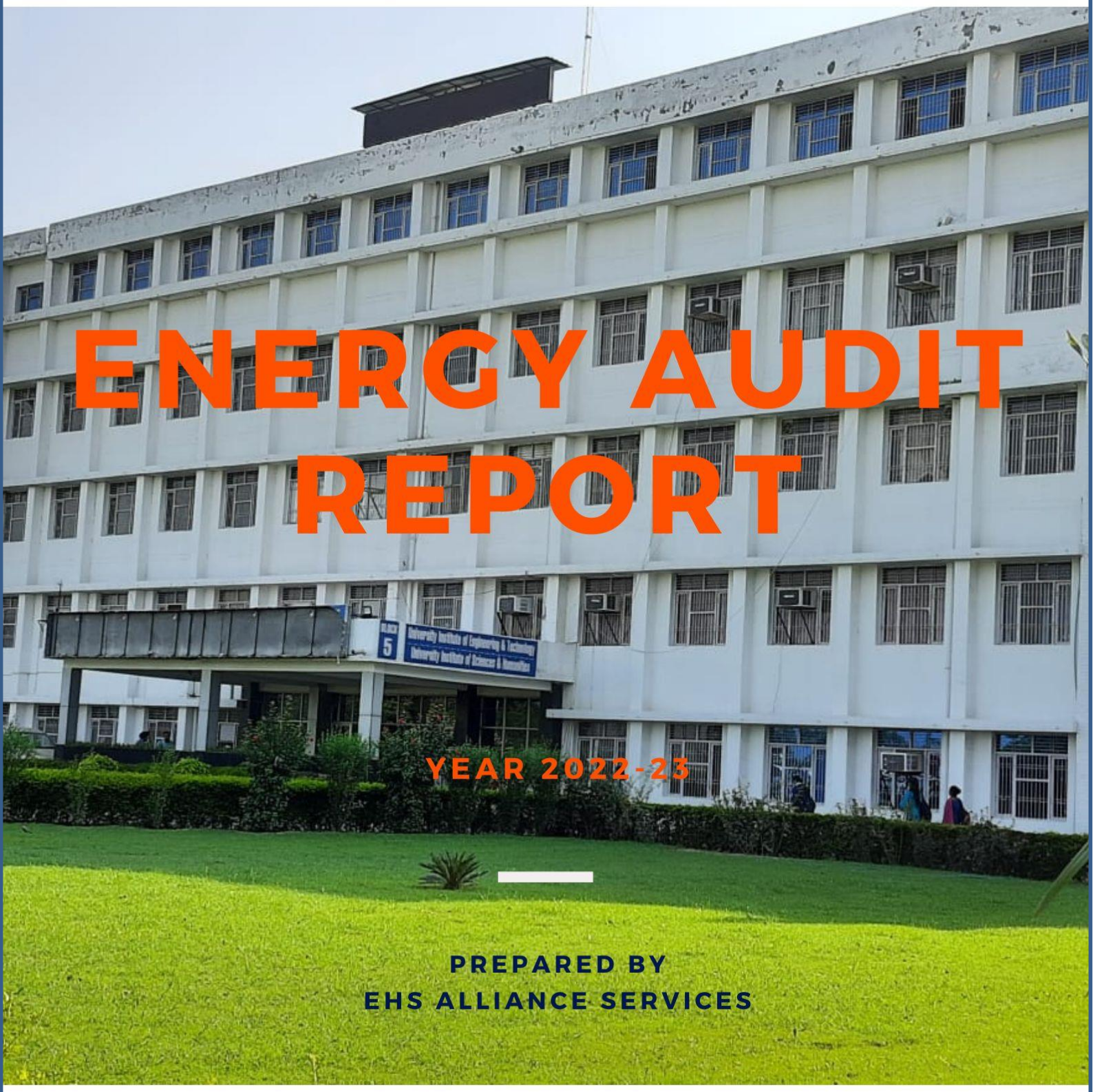
SANT BABA BHAG SINGH UNIVERSITY



ENERGY AUDIT REPORT

YEAR 2022-23

PREPARED BY

EHS ALLIANCE SERVICES

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Audit Certificate

EHS alliance

AUDIT CERTIFICATE

Sant Baba Bhag Singh University

Village Khiala, Padhiana, Punjab 144030

Has been assessed by us for the comprehensive study of energy management systems on the institutional working framework to fulfill the requirement of

Energy Audit

Academic year 2022-23

The energy-saving initiatives carried out by the college have been verified in the report submitted and were found to be satisfactory.

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

Date of Audit: 03 May, 2023

BEE No.-EM7059
Manoj Kumar
For EHS Alliance Services
EHS ALLIANCE SERVICES

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 - *Honorable Vice-Chancellor*
- Dr. Vikrant Jaryan - *Dept. of Botanical & Environmental Sciences*
- Dr. Neha Kapila – *Department of Electrical Engineering*

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.

If you wish to distribute copies of this report external to your organisation, then all pages must be included.

EHS Alliance, its staff and agents shall keep confidential all information relating to your organisation and shall not disclose any such information to any third party, except that in the public domain or required by law or relevant accreditation bodies. EHS Alliance staff, agents and accreditation bodies have signed individual confidentiality undertakings and will only receive confidential information on a 'need to know' basis.

Manoj Kumar
BEE Certified & Lead Energy Auditor

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. Harpreet Kaur, Director, (IQAC Team), 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 reso

In thin "Environme
help everyone to
preserving resource
willingness to learı
importance, adopt st
minimize resource
and set an example
others to follow tl
path of eco-friendly
practices to achiev
the goal of sustain
development. E
implementation
environmental audi
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. ✓ B.Com ✓ B.Com (Hons.) ✓ B.Ed ✓ B.Lib. ✓ B.Ped ✓ B.Sc (Non-Medical) ✓ B.Sc. (Agriculture) ✓ B.Sc. (IT) ✓ B.Sc. (Medical) ✓ B.Sc. (MLS) ✓ B.Tech Civil Engineering ✓ B.Tech Computer Science & Engineering ✓ B.Tech Electrical Engineering ✓ B.Tech Mechanical Engineering ✓ BBA ✓ BCA *BBSU also provides various vocational and certificate courses.	✓ M.Com ✓ M.Ed ✓ M.Ped ✓ M.Sc(Chemistry) ✓ M.Sc(IT) ✓ M.Sc(Mathematics) ✓ M.Tech Civil Engineering ✓ M.Tech Computer Science & Engineering ✓ M.Tech Mechanical Engineering ✓ MBA ✓ MCA ✓ PGDCA	✓ Ph. D Mechanical Engineering ✓ Ph.D (Applied Science-Chemistry) ✓ Ph.D (Applied Science-Mathematics) ✓ Ph.D (Applied Science-Physics) ✓ Ph.D (Commerce) ✓ Ph.D (Education) ✓ Ph.D (English) ✓ Ph.D (Hindi) ✓ Ph.D (Music) ✓ Ph.D (Physical Education) ✓ Ph.D (Punjabi) ✓ Ph.D(Economics) ✓ Ph.D(History) ✓ Ph.D. Civil Engineering ✓ Ph.D. Computer Science & Engineering ✓ Ph.D. Electrical Engineering ✓ Ph.D. Electronics & Communication Engineering ✓ Ph.D. Library Sciences ✓ Ph.D. Management Studies

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. Paramjit Singh Parmar	Vice Chancellor of SBBS University
Dr. Vikrant Jaryan	In-charge NAAC Criteria 7/ Head of Department of Botany
Dr. Neha Kapila	Assistant Professor (EE)
Mr. Arshdeep Singh	Assistant Professor (EE)
Mr. Mandeep Singh	Assistant Professor (EE)

On behalf of EHS Alliance Services:

Name	Position	Qualification
Manoj Kumar	Lead Auditor	BEE Energy Auditor OHSAS 18001:2007, BEE Energy Auditor
Dr. Uday Pratap	Co- Auditor	Ph.D , PDIS, QCI – WASH, Lead Auditor ISO 14001:2015

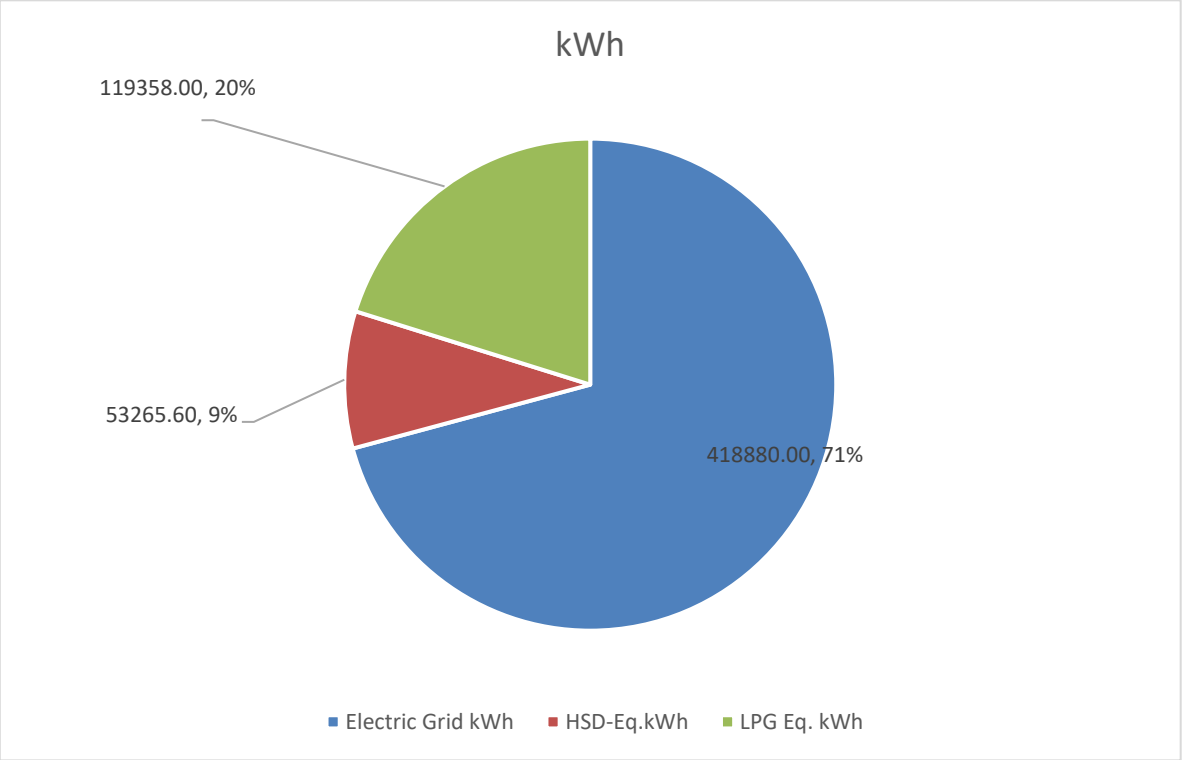
Executive Summary

Energy today has become a key factor in deciding the product cost at micro level as well as in dictating the inflation and the debt burden at the macro level. Energy cost is a significant factor in economic activity at par with factors of production like capital, land and labour. The imperatives of an energy shortage situation calls for energy conservation measure, which essentially mean using less energy for the same level of activity. Energy Audit attempts to balance the total energy inputs with its use and serves to identify all the energy streams in the systems and quantifies energy usage's according to its discrete function. Energy Audit helps in energy cost optimization, pollution control, safety aspects and suggests the methods to improve the operating & maintenance practices of the system. It is instrumental in coping with the situation of variation in energy cost availability, reliability of energy supply, decision on appropriate energy mix, decision on using improved energy conservation equipment's Instrumentation and technology.

Energy Audit is the key to a systematic approach for decision-making in the area of energy management. It attempts to balance the total energy inputs with its use, and serves to identify all the energy streams in a facility. It quantifies energy usage according to its discrete functions.

The Energy Audit would give a positive orientation to the energy cost reduction, preventive maintenance and quality control 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 appropriate energy mix, identify energy conservation technologies, retrofit for energy conservation equipment etc. The primary objective of Energy Audit is to determine ways to reduce energy consumption per unit of product output or to lower operating costs. The present report shows the energy audit of COER campus in terms of pre-audit phase, audit phase and post audit phase.

	kWh	Percentage
Electric Grid kWh	418880	70.82 %
HSD-Eq.kWh	53265.6	9.01 %
LPG Eq. kWh	119358	20.18 %
Total -kWh	456820	100 %

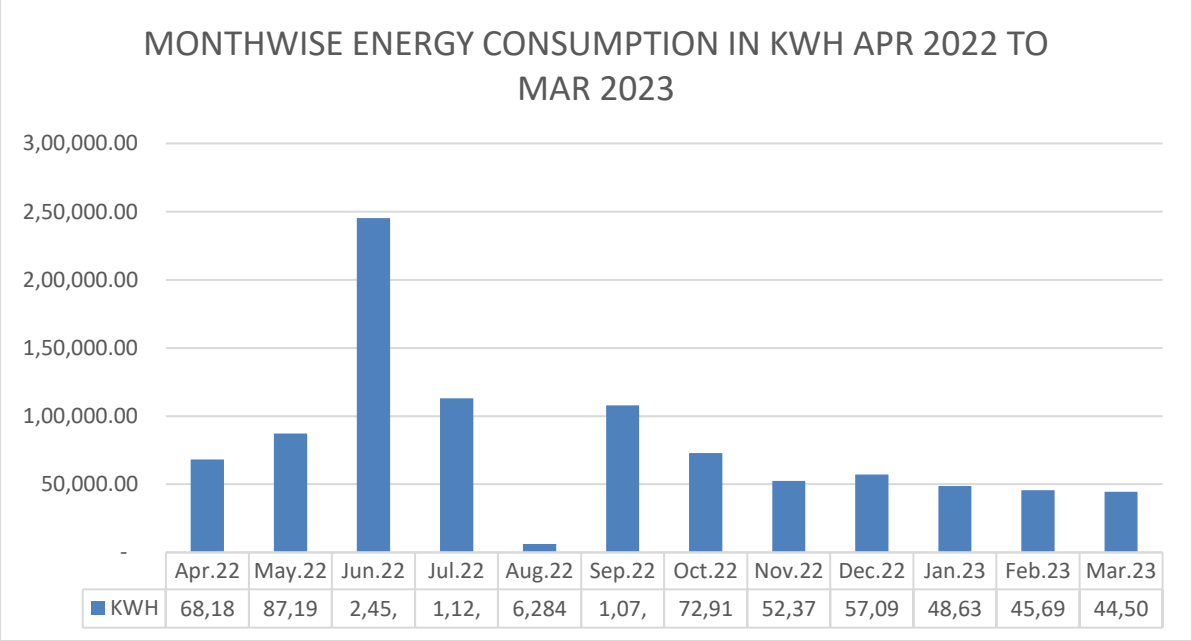


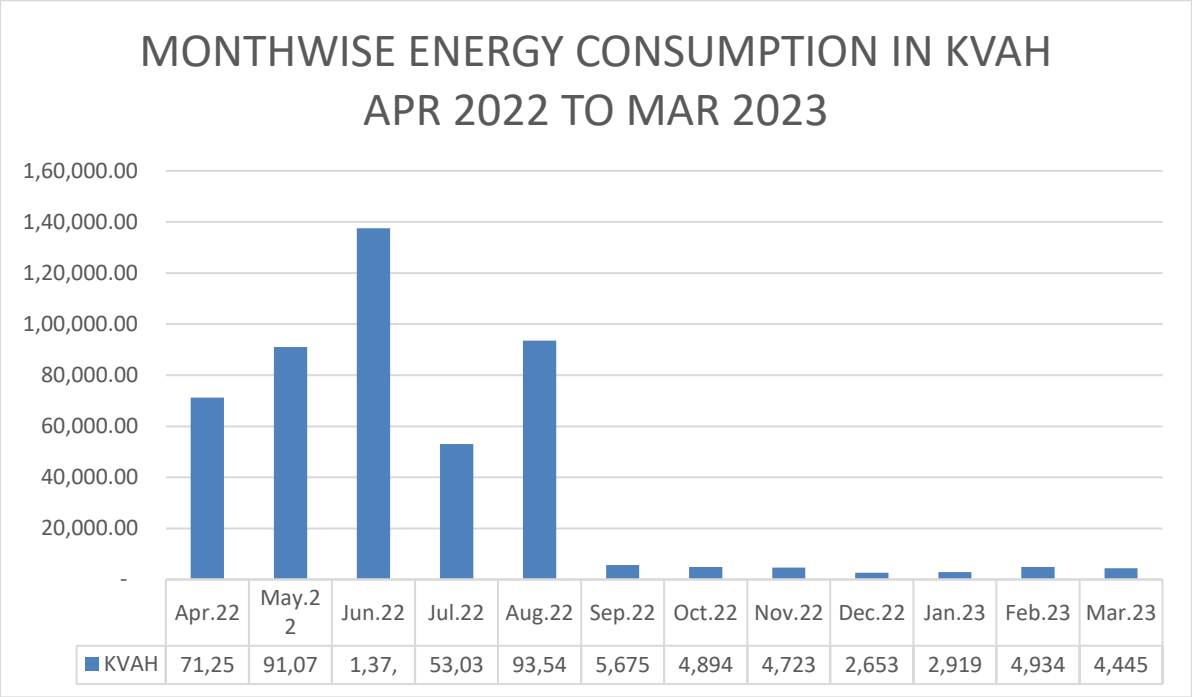
3.0 Review of Electricity Bills and Diesel Consumption

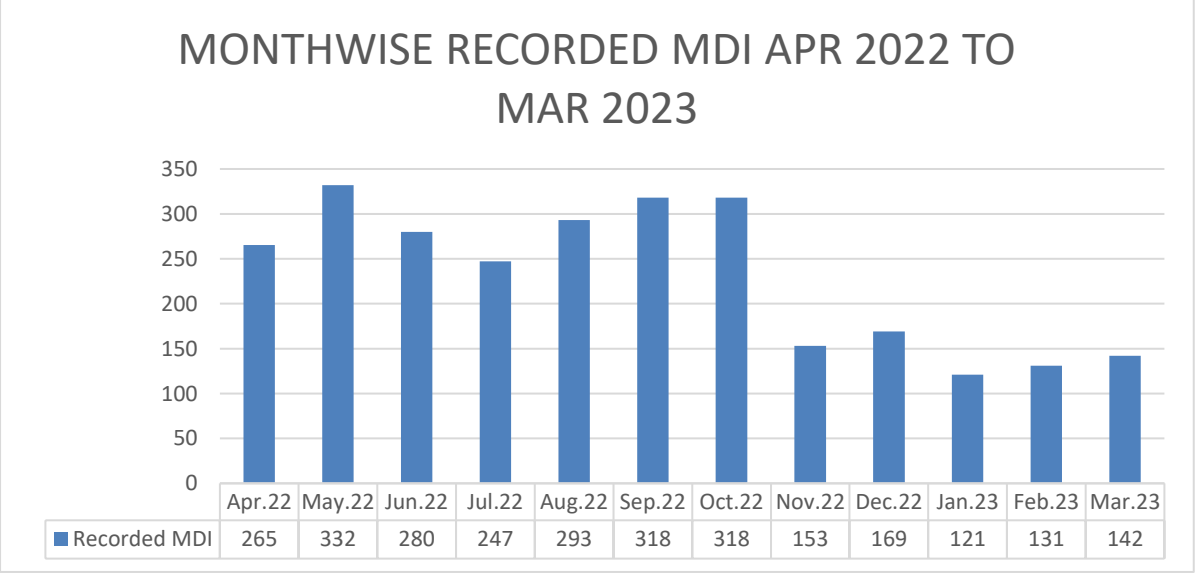
3.1 Summary of Monthly Electricity Consumption and Total Bill Amount

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 22 to Mar 23.

MONTH WISE ELECTRICITY BILL APR 2022 TO MAR 2023						
SR. No.	Period	KWH	KVAH	PF	Contract Demand-KVA	Recorded MDI-KVA
1	Apr.22	68,184.00	71,256.00	0.96	324	265.4
2	May.22	87,196.00	91,072.00	0.96	324	332.0
3	Jun.22	2,45,214.00	1,37,570.00	1.78	324	280.0
4	Jul.22	1,12,922.00	53,030.00	2.13	324	247.0
5	Aug.22	6,284.00	93,540.00	0.07	324	293.0
6	Sep.22	1,07,931.00	5,675.00	19.02	324	318.0
7	Oct.22	72,910.00	4,894.00	14.90	324	318.0
8	Nov.22	52,375.00	4,723.00	11.09	324	153.0
9	Dec.22	57,093.00	2,653.00	21.52	324	169.0
10	Jan.23	48,631.00	2,919.00	16.66	324	121.0
11	Feb.23	45,694.00	4,934.00	9.26	324	131.0
12	Mar.23	44,509.00	4,445.00	10.01	324	142.0
Total		**9,48,943.00**	**4,76,711.00**			

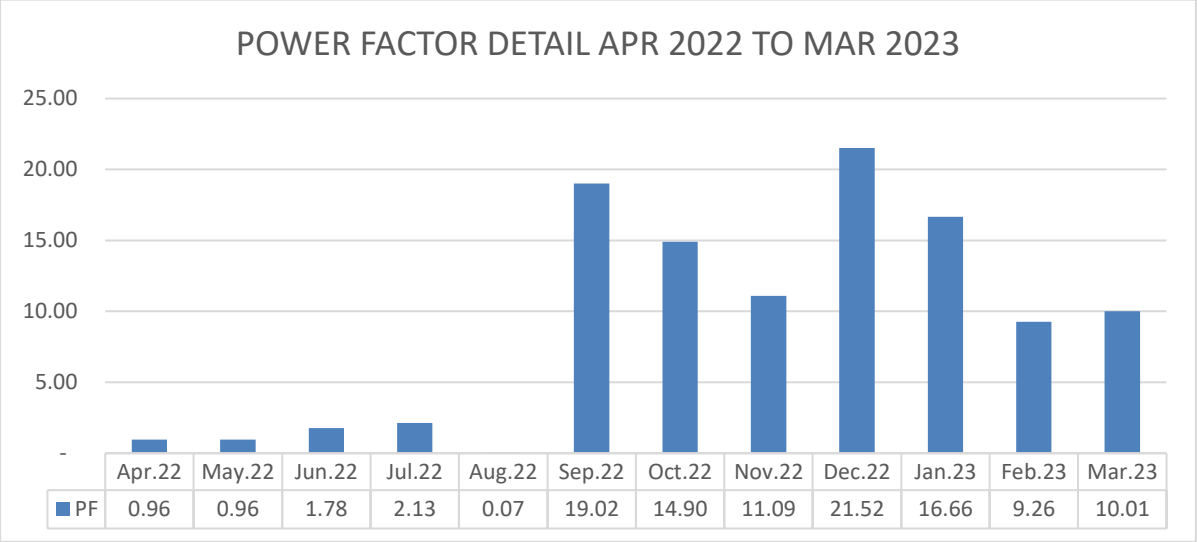



MONTHWISE ENERGY CONSUMPTION IN KVAH
APR 2022 TO MAR 2023
1,60,000.00
1,40,000.00
1,20,000.00
1,00,000.00
80,000.00
60,000.00
40,000.00
20,000.00
-
Apr.22
May.22
Jun.22
Jul.22
Aug.22
Sep.22
Oct.22
Nov.22
Dec.22
Jan.23
Feb.23
Mar.23
KVAH
71,25
91,07
1,37,
53,03
93,54
5,675
4,894
4,723
2,653
2,919
4,934
4,445


MONTHWISE RECORDED MDI APR 2022 TO MAR 2023
350
300
250
200
150
100
50
0
Apr.22
May.22
Jun.22
Jul.22
Aug.22
Sep.22
Oct.22
Nov.22
Dec.22
Jan.23
Feb.23
Mar.23
Recorded MDI
265
332
280
247
293
318
318
153
169
121
131
142

3.2 Power Factor Analysis

SR. No.	Period	PF
1	Apr.22	0.96
2	May.22	0.96
3	Jun.22	1.78
4	Jul.22	2.13
5	Aug.22	0.07
6	Sep.22	19.02
7	Oct.22	14.90
8	Nov.22	11.09
9	Dec.22	21.52
10	Jan.23	16.66
11	Feb.23	9.26
12	Mar.23	10.01
Avg.		8.91
Min.		0.07
Max.		21.52

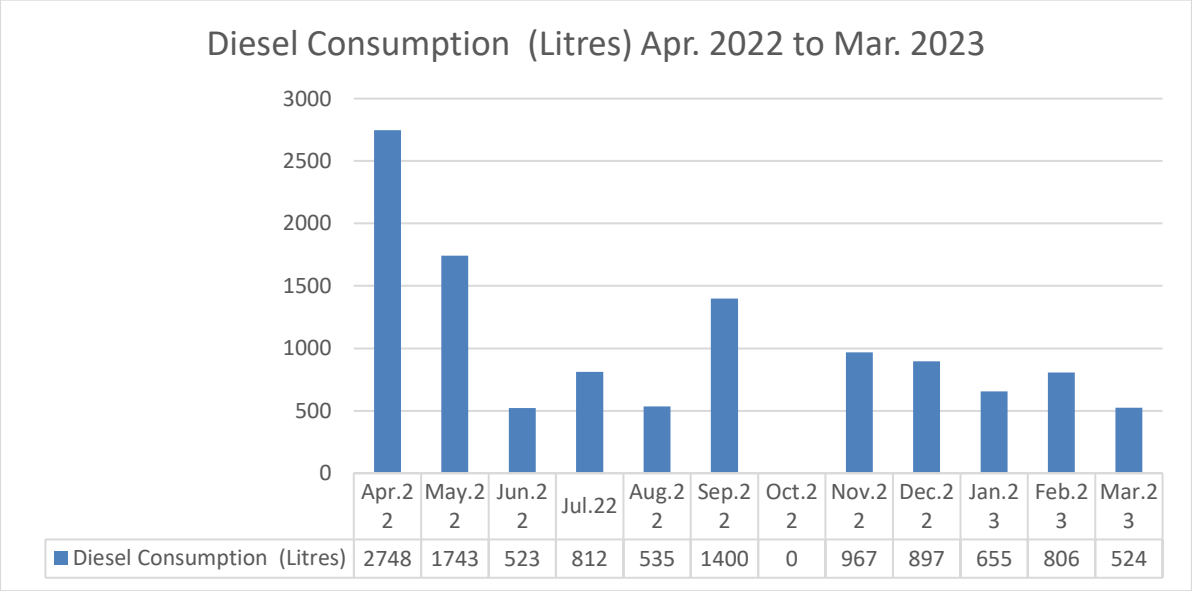


Observation and Recommendation: - We have analyse Electricity bills and Solar power generation and found the Reverse Energy Meter is not installed. Due to that; whenever the university is running/operational, solar power energy is used according to the university load, but if the university is not running/operational, then solar energy goes to the grid. Hence, due to non-availability of reverse meter; the energy meter reads the remaining solar power energy and the reading of the energy meter increases.

Hence, we are suggesting to installed reverse energy meter immediately by doing that electricity energy consumption can be reduced.

3.3 Diesel Consumption

Total Diesel Consumption (Litres) Apr 2022 To Mar 2023	
Period	**Diesel Consumption (Litres)**
Apr.22	2748
May.22	1743
Jun.22	523
Jul.22	812
Aug.22	535
Sep.22	1400
Oct.22	0
Nov.22	967
Dec.22	897
Jan.23	655
Feb.23	806
Mar.23	524
Total	**11610**



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 125KVA.

- 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	%	67.94
Energy Generation	kWh	134.27
Load	KVA	339.7
Fuel consumption during testing	Liters	43.40
Specific energy generation	kWh/liter	**3.09**

Observation and Suggestions:- As per the trial taken during the energy audit the percentage loading of DG set is 67.94% which is ok and specific energy consumption of DG Sets 3.09 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 250KVA 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	%	73.03
Energy Generation	kWh	72.17
Load	KVA	182.6
Fuel consumption during testing	Liters	23.00
Specific energy generation	kWh/liter	**3.14**

Observation and Suggestions:- As per the trial taken during the energy audit the percentage loading of DG set is 73.03% which is ok and specific energy consumption of DG Sets 3.14 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. No.	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	2.3	22	38	0.41	0.63	1.54	2.28
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	2.3	24	37	0.33	0.57	1.72	2.04
4	Split-4	1.5	24	10	18	52	0.03	2.3	24	37	0.33	0.53	1.59	2.21
5	Split-5	1.5	23	12	20	52	0.03	2.5	25	38	0.36	0.55	1.53	2.29
6	Split-6	1.5	23	11	19	52	0.03	2.4	22	37	0.40	0.58	1.45	2.42
7	Split-7	1.5	23	13	20	52	0.03	2.5	26	38	0.33	0.53	1.60	2.20
8	Split-8	1.5	23	12	20	53	0.03	2.5	25	38	0.36	0.55	1.53	2.30
9	Split-9	1.5	23	12	19	53	0.03	2.5	24	37	0.36	0.58	1.60	2.19
10	Split-10	1.5	24	11	20	52	0.03	2.4	22	38	0.40	0.65	1.62	2.17
11	Split-11	1.5	24	12	20	52	0.03	2.6	25	38	0.35	0.60	1.72	2.05
12	Split-12	1.5	24	12	20	52	0.03	2.4	25	38	0.33	0.58	1.78	1.98

13	Split-13	1.5	23	12	20	53	0.03	2.7	25	38	0.37	0.63	1.72	2.05
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	2.6	25	38	0.35	0.63	1.79	1.96
16	Window-1	1.5	23	11	19	52	0.03	2.6	22	38	0.43	0.81	1.86	1.89
17	Window-2	1.5	22	11.5	22	53	0.03	2.2	23	43	0.46	0.77	1.69	2.08
18	Window-3	1.5	23	11	21	52	0.03	2.5	24	40	0.42	0.72	1.73	2.04
19	Window-4	1.5	22	10	19	53	0.03	2.4	20	37	0.43	0.78	1.82	1.93
20	Window-5	1.5	23	11	21	53	0.03	2.4	24	40	0.40	0.74	1.84	1.91
21	Window-6	1.5	22	12	20	53	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	52	0.03	2.2	25	38	0.30	0.65	2.18	1.61
24	Window-9	1.5	23	12	22	53	0.03	2.6	24	43	0.51	0.73	1.41	2.49
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	2.4	22	38	0.40	0.66	1.64	2.15
28	Window-13	1.5	24	11	20	52	0.03	2.1	22	38	0.35	0.68	1.94	1.81
29	Window-14	1.5	23	12	22	53	0.03	2.4	24	42	0.45	0.72	1.61	2.19
30	Window-15	1.5	23	12	20	53	0.03	2.5	25	38	0.34	0.67	1.98	1.78
31	Window-16	1.5	24	11	20	52	0.03	2.4	22	38	0.40	0.63	1.58	2.23
32	Window-17	1.5	24	12	20	53	0.03	2.4	24	39	0.38	0.64	1.72	2.05
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	2.2	24	43	0.44	0.72	1.66	2.12
35	Window-20	1.5	24	11	18	53	0.03	2.5	22	37	0.39	0.64	1.63	2.15
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	2.5	24	39	0.39	0.66	1.69	2.08
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	2.3	22	36	0.34	0.59	1.75	2.01
41	Window-26	1.5	24	10	17	53	0.03	2.6	21	35	0.38	0.67	1.78	1.98
42	Window-27	1.5	23	12	18	52	0.03	2.7	24	36	0.34	0.59	1.76	2.00
43	Window-28	1.5	24	11	18	52	0.03	2.4	22	36	0.35	0.60	1.72	2.05
44	Window-29	1.5	24	11	20	52	0.03	2.4	22	38	0.40	0.63	1.57	2.24
45	Window-30	1.5	23	12	21	52	0.03	2.5	25	39	0.36	0.62	1.70	2.07
46	Window-31	1.5	23	12	18	52	0.03	2.7	24	37	0.37	0.61	1.65	2.12
47	Window-32	1.5	24	12	21	52	0.03	2.4	24	39	0.38	0.64	1.72	2.05
48	Window-33	1.5	24	11.5	19	52	0.03	2.4	23	38	0.38	0.64	1.70	2.07
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	2.5	24	37	0.34	0.61	1.80	1.95
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	2.4	24	42	0.45	0.71	1.57	2.25
53	Window-38	1.5	24	12	21	52	0.03	2.6	24	39	0.41	0.67	1.64	2.14
54	Window-39	1.5	24	11	18	53	0.03	2.5	22	37	0.39	0.68	1.75	2.01
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	2.4	22	37	0.38	0.67	1.77	1.98
57	Window-42	1.5	24	11	18	52	0.03	2.3	22	37	0.36	0.64	1.77	1.99
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	2.3	23	38	0.36	0.63	1.76	2.00
60	Window-45	1.5	24	12	19	53	0.03	2.7	24	38	0.39	0.66	1.67	2.10
61	Window-46	1.5	24	12	19	53	0.03	2.6	24	38	0.38	0.65	1.71	2.05
62	Window-47	1.5	24	11	18	53	0.03	2.6	22	37	0.41	0.67	1.64	2.14
63	Window-48	1.5	24	12	21	52	0.03	2.4	24	39	0.38	0.64	1.72	2.05
64	Window-49	1.5	24	11	18	53	0.03	2.3	22	37	0.36	0.63	1.76	2.00

65	Window-50	1.5	24	12	21	53	0.03	2.4	24	39	0.38	0.63	1.68	2.09
66	Window-51	1.5	24	11.5	19	53	0.03	2.3	23	38	0.36	0.63	1.75	2.01
67	Window-52	1.5	24	11	18	53	0.03	2.6	22	37	0.41	0.64	1.58	2.22
68	Window-53	1.5	24	11	18	53	0.03	2.5	22	37	0.39	0.66	1.69	2.08
69	Window-54	1.5	24	12	21	53	0.03	2.4	24	39	0.38	0.65	1.72	2.04
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	2.3	24	39	0.36	0.67	1.85	1.90
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	2.5	22	37	0.39	0.63	1.60	2.19
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	52	0.03	2.5	24	38	0.36	0.63	1.72	2.04
76	Window-61	1.5	24	11	18	53	0.03	2.5	22	37	0.39	0.64	1.64	2.14
77	Window-62	1.5	24	12	21	53	0.03	2.5	24	39	0.39	0.61	1.56	2.25
78	Window-63	1.5	24	12	21	53	0.03	2.4	24	39	0.38	0.65	1.72	2.04
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	2.4	22	37	0.38	0.62	1.65	2.14
81	Window-66	1.5	24	11	18	53	0.03	2.2	22	37	0.34	0.64	1.86	1.89
82	Window-67	1.5	24	12	21	53	0.03	2.5	24	41	0.44	0.62	1.39	2.53
83	Window-68	1.5	24	11.5	19	52	0.03	2.6	23	38	0.41	0.63	1.55	2.27
84	Window-69	1.5	24	11	19	53	0.03	2.3	22	38	0.38	0.66	1.71	2.05
85	Window-70	1.5	24	11.5	19	53	0.03	2.7	23	38	0.42	0.65	1.55	2.27
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	2.5	24	39	0.39	0.67	1.71	2.06
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	2.5	24	39	0.39	0.66	1.69	2.08
90	Window-75	1.5	24	11	18	52	0.03	2.4	22	37	0.38	0.67	1.77	1.98
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	2.2	24	39	0.34	0.62	1.80	1.95
93	Window-78	1.5	23	11	21	53	0.03	2.5	24	40	0.42	0.72	1.73	2.04
94	Window-79	1.5	22	10	19	53	0.03	2.6	20	37	0.46	0.78	1.68	2.09
95	Window-80	1.5	23	11	21	52	0.03	2.5	24	40	0.42	0.74	1.77	1.99
96	Window-81	1.5	22	12	20	52	0.03	3	25	38	0.41	0.71	1.75	2.01
97	Window-82	1.5	23	12	22	52	0.03	2.2	24	43	0.44	0.74	1.69	2.08
98	Window-83	1.5	23	12	20	53	0.03	2.8	25	38	0.38	0.65	1.71	2.05
99	Window-84	1.5	24	11	18	52	0.03	2.5	22	37	0.39	0.68	1.75	2.01

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** 3119 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	735
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	**3119**

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 to replace BEE 5 Star rated fans of 30W.

ECRM-1-Energy saving by replacing 70W fans with energy efficient 30W ceiling fans

Total no of Ceiling Fans (70W)	=	**3119**	**Nos.**
Total wattage of 70W Ceiling Fans	=	**218330**	**Watt**
Total wattage of BEE 5 Star rated Fans (30W)	=	**93570**	**Watt**
Total saving in Wattage after replacement	=	**124760**	**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	=	**1765104**	**INR**
Investment INR	=	**9357000**	**INR**
Payback period:- Months	=	**63.61**	**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	20W LED	100W -RGP Light	100 W LED-Shine Board	Tube light (40 w)
1	Boys Hostel		782		**5**	5		200
2	Block No. 8		1027			1		18
3	Workshop		31			1		36
4	Block no.7		270		50			14
5	Block no.5		402		60			347
6	Block no.3		154		18			50
7	Auditorium	4	8	5			4	-
8	Gymnasium		3					9
9	Bhagatpura		204					5
10	Dispensary		10					2
11	Store		12					
12	Canteen		13					13
13	Transport office		32					16
14	Society workshop	8	3	3				3
15	Treatment Plant	3	4					-
16	SBBSIN	6	117					67
17	SBBSIS		268					90
18	Girls Hostel	2	425		**60**			200
19	Girls Canteen			4				11
20	Mechanical Workshop		14		35			
21	Administration block		50					
22	Main Road		25					
23	Boys Hostel		506		50			
		23.00	**4,360.00**	**12.00**	**278.00**	**7.00**	**4.00**	**1,081.00**

7.3 Lux Measurement

Description	Lux	Remark
Class Rooms	122 to 239	Acceptable
Offices	129 to 248	Acceptable
Corridors	34 to 92	Acceptable
Washrooms	42 to 75	Acceptable
Outdoor	34 to 97	Acceptable
Computer Lab	153 to 288	Acceptable

Parking area	42 to 93	Acceptable
Canteen	70 to 184	Acceptable
Auditorium	96 to 243	Acceptable
Gymnasium	75 to 201	Acceptable
Dispensary	92 to 182	Acceptable
Workshop	91 to 233	Acceptable
Treatment Plant	55 to 152	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 - Luminous Performance Characteristics of Commonly Used Luminaries					
Type of Lamp	Lumens/Watt		Colour Rendering Index	Typical Application	Typical Life
	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, and car parking. floodlighting	5000
Halogen lamps	18-24	22	Excellent (100)	Display, flood lightening, stadium exhibition grounds, construction areas	2000 - 4000
High-pressure sodium (HPSV) SON	67-121	90	Fair (22)	General lighting in warehouses, factories, 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, spotlighting, floodlighting, retail stores	8000

LED Lamps	30-50	40	Good (70)	Reading lights, desk lamps, night lights, spotlights, security lights, signage lights, etc.	40000 - 100000

REPLACEMENT 40 W 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 20W T8 LED Light	:	22 W
Average power saving after replacement	:	34 W
Average working hour per day	:	12 hrs.
Average No. of working days	:	180 days
Approximate No. of fixture	:	1081
E. Cost Benefit Calculation		
Annual Energy Saving potential	:	79388.64 units
Power tariff	:	Rs. 6.55 per unit
Annual Cost Saving	:	Rs. 519995.592
Cost of fitting	:	Rs. 400 per fixture
Total investment cost	:	Rs. 432400
Simple Payback Period	:	10.0 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.

********** END OF THE REPORT **********