Energy Audit Report 2022 – 23

K S SCHOOL OF ENGINEERING AND MANAGEMENT

15, Mallasandra, Off.Kanakapura Road,
Bengaluru-560109, Karnataka, INDIA.

FORWARD

Energy has grown in importance in today's complicated world, and it is becoming more widely acknowledged that energy conservation will enable sustainable development. In this sense, a modest but focused effort at the local level will assist in bringing about the required transformation and benefit all living things on the planet.

KSSEM is dedicated to protecting the environment and its resources, being an academic institution that produces many young people who will go on to improve their country. In this sense, KSSEM has put into practice environmentally friendly projects like water recycling, rainwater collection, solar water heaters, and other green campus projects. Energy auditing is one of the steps that KSSEM has taken to document, analyse, and report on patterns of energy consumption and to put energy-saving measures into place. It will assist us in managing our resources so that we can change up the current activities. Putting energy conservation opportunities into practice will help us create a sustainable campus and give us an opportunity to make the most of our resources for future growth.

It gives me great pleasure to write the forward for energy audit report 2022-23 of K S School of Engineering and Management, Bangalore. I am very happy to acknowledge the honest efforts of energy audit committee members for their effort in preparing the report. I do hope that the energy audit report 2022-23 will guide all the stakeholders of the institute to define themselves in their future activities and will motivate to put a sustainable campus ahead in future.

PRINCIPAL

Acknowledgement

K S School of Engineering and Management (KSSEM) has been in the forefront of efforts to bring about social transformation from the date of its estabilishment. In this regard activities such as workshops, environmental campaigns, and other extension programs have been carried out. KSSEM is aware of the societal responsiblity for the need of energy conservation and for the sustainable growth of the campus.

As part of its commitment to excellence, KSSEM has acknowledged the need to preserve its distinct, pristine ecosystem and conserve energy for the benefit of upcoming generations of students as well as all campus residents. In order to create a sustainable campus, KSSEM wants to step up energy conservation initiatives at all levels. In an attempt to address the energy problems, a faculty member-led body known as the Energy Audit committee was established to gather baseline information on the campus's energy parameters. The Energy Audit Committee has made an effort to determine the pattern of current energy usage and offer the required energy-saving solutions. The results of our inquiry into the patterns of energy usage in KSSEM are documented in these energy audit reports for the years 2022–2023.

This report is the result of the combined efforts of all members of the Energy Audit Committee, who conducted this audit in order to obtain data on all aspects of energy consumption. They then compiled and analyzed the data in order to identify any problems and identify opportunities for ongoing improvement in our energy consumption performance. It is anticipated that all parties involved would give this report enough thought so that we may pursue a bottom-up strategy that will enable us to effectively address the problems improving the energy conservation oppurtunities.

In this regard, the members of the Energy Audit committee would like to convey their heartfelt gratitude to Dr. K. Rama Narasimha, Principal of the K. S. School of Engineering and Management, for his kind encouragement and administrative assistance during the course of this study. We owe a debt of gratitude to the HoDs, Teachers, staff, and residents of KSSEM campus for their assistance in gathering information for the report. Finally, the members of the Energy Audit Committee would like to extend their sincere gratitude to the Kammavari Sangam Trust members and the Kammavari Sangam Group of Institutions management for all of their generous support in this endeavor.

Energy Audit Committee members

Energy Audit Committee members 2022-23

Dr. B Balaji
Professor & Head,
Department of Mechanical Engineering

Dr. Arun Kumar M
Associate Professor,
Department of Electronics and Communication Engineering

Mr. Manohar Kumar K N
Assistant Professor,
Department of Basic Sciences

Dr. Kokila Kulkarni
Assistant Professor
Department of MBA

Mr. Nischitha A H
Assistant Professor,
Department of Mechanical Engineering

Ms. Pallavi M
Assistant Professor
Department of Civil Engineering

Ms. Prasanna N
Assistant Professor
Department of Computer Science & Engineering

Mrs. Jayashree G R
Assistant Professor
Department of Electronics and Communication Engineering

Table of Contents

Energy Audit

INTRODUCTION

K S School of Engineering and Management (KSSEM) has developed and grown to represent an exceptional sense of pride in offering the excellant engineering and management education in India.

Today, the institution is proudly recognized as one among the top Ranked Engineering Colleges in Bangalore. It has a climate that fosters innovative research and development initiatives in the quest of engineering and managerial excellence in a highly competitive environment.

Established in 2010, K S School of Engineering and Management, Bengaluru, located off Kanakapura Road, provides high level of teaching, research and extension activities in the field of Artificial Intelligence and Data Science, Computer Science, Civil, Electronics and Communication, Mechanical, and Management education.

KSSEM, one of the top-ranked engineering colleges in Bengaluru, offers an abundant green campus, top-notch infrastructure, and a steadfast dedication to academic success. The school offers top-notch sports facilities, a library, research centers, labs, and a basketball court to support students in achieving the highest standards in academics, research, and professional performance.

KSSEM Mission

KSSEM has focused on its mission:

- Establish state-of-art infrastructure to facilitate effective dissemination of technical and Managerial knowledge.
- Provide comprehensive educational experience through a combination of curricular and experiential learning, strengthened by industry-institute-interaction.
- Pursue socially relevant research and disseminate knowledge.
- Inculcate leadership skills and foster entrepreneurial spirit among students.

KSSEM Vision

The vision of KSSEM is

"*To impart quality education in engineering and management to meet technological, business and societal needs through holistic education and research*"

KSSEM Objectives

The objectives of KSSEM are

- To provide world class education in the field of engineering and management.
- To train students to face challenges in corporate and industries.
- To inculcate the attitude of research in engineering and management students.
- To bridge gap between institutions and industries through research and consultancy programmes.

Courses offered

Courses offered in K S School of Engineering and Management are

UG Courses

- Artificial Intelligence and Data Science
- Civil Engineering
- Computer Science & Engineering
- Computer Science & Business Systems
- Electronics & Communication Engineering
- Mechanical Engineering

PG Courses

- M.Tech - Structural Engineering
- MBA – Master of Business Administration.

HOSTEL

With the quality of education drawing students from distant places, KSSEM provides residential facilities for both Boys & Girls students. Boy's hostel is in the KSSEM campus itself whereas the girl's hostel is near the KSIT college. Reading room, recreation centre, Wi-Fi facility, weekend movies, celebrating festivals etc all make the stay enjoyable. The Hostels are also provided with solar heater and good Cooking accessories. There is a warden appointed to look after the day-to-day working of the Hostel and the discipline of boarders. They will work under the general guidelines of the Director/Principal, who has the discretion to refuse admission to any student, if they are not satisfied with the conduct and progress of the particular student. The number of students in boy's hostel is listed below.

Facility	No. Of Rooms	No. Of Students
Boys Hostel	110	370

ENERGY CONSERVATION GROUP

KSSEM is green and very environment conscious. Keeping in view of environment policy and need to conserve energy it has set up energy conservation group. The main role of energy conservation group is to conduct energy audit and suggest suitable measures to conserve energy and promote the use of renewable energy.

WALK THROUGH ENERGY AUDIT

Walk through energy audit was carried out to understand the electrical energy usage in different parts of the KSSEM. The campus consists of 7 acres and houses K S School of Engineering and Management, K S School of Architecture and K S Boys Hostel. K S School of Engineering and Management consist of two block namely Main block and Visveswaraya block (New block). Walk through energy audit is carried out for KSSEM, Boys hostel and Estate. It consist of Principal and administrative office, Department of Civil Engineering, Department of Computer Sciences and Engineering, Department of Electrical and Electronics Engineering, Department of Mechanical Engineering, Department of Business administration, Department of Basic Sciences, associated labs, class rooms and library. Amenities include canteen, basketball court, indoor badminton courts and parking area. To carry out energy auditing following points where decided to be considered

1. Identification of various departments.

2. To identify different types of loads.

3. Collection of data relating to the loads in various departments.

4. Tabulation of collected information department wise.

5. Computation of connected loads and energy consumed department wise.

6. To understand Electric energy usage pattern by analysing electricity bills for the period August 2022 and July 2023.

7. Identification of energy conservation opportunities.

8. Suggestions and recommendations.

Departments

For the purpose of energy auditing following departments are identified

1. Principal office – Office of the principal.

2. Admin Section – This includes accounts, exam section and admissions.

3. Basic Sciences – This includes HOD chamber, staff rooms, class rooms and labs

4. Department of Civil Engineering – This includes HOD chamber, staff rooms, class rooms and labs

5. Department of Computer Science and Engineering - This includes HOD chamber, staff rooms, class rooms and labs.

6. Department of Artificial Intelligence and Data Science - This includes HOD chamber, staff rooms, class rooms and labs.

7. Department of Electronics and Communication Engineering - This includes HOD chamber, staff rooms, class rooms and labs.

8. Department of Mechanical Engineering - This includes HOD chamber, staff rooms, class rooms and labs.

9. Department of MBA - This includes HOD chamber, staff rooms, class rooms and labs.

10. Boys Hostel

11. Canteen

12. Estate

Types of Electrical Loads

To compute department- wise connected load, the load where classified into following categories.

1. Illumination: This includes all type of lighting fixtures

2. HVAC: This includes all fans and ACs.

3. Computer and peripherals: This includes CPU, monitor, printer and projector.

4. Electronic devices and Lab equipments: This includes all electronics lab equipments like CROs, function generator, power supplies, trainer kits, different types of motors used in different labs and campus

Table 1 Major types of Loads in campus

Sl No.	Type of Load	Ratings
1	Tubelight	40 W, 36 W, 20W
2	LED	15 W
3	Computer with LCD monitor	100 W
4	Ceiling fan	75 W
5	Water pumps	15 hp, 7.5 hp, 5hp
6	Lab equipments	Various ratings

Type of power supply

There are two sources of power for the campus 1) BESCOM Supply and 2) Captive Diesel Generator Unit.

The BESCOM power comes to substation situated between Main block and Visveswaraya block. It consists of step down transformer 11KV/415V. This is also the metering point for the BESCOM.

The captive diesel generator plant is also situated near the substation. Its capacity is 3-phase, 415 V, 200 kVA, 160KW. These generator is used when BESCOM supply is not available.

Collection of Data

Table 2 Collected data from different departments of KSSEM

Sl. No	Department	Illumination (Load in kW)	HVAC (Load in kW)	Computers &Peripherals (Load in kW)	Lab equipments (Load in kW)	Total load in kWh (for 1 hr)
1	AI&DS	6.6	4.95	1.5	167	180.05
2	ECE	3.48	5.4	2.7	3.4	14.98
3	CSE	3.92	6.82	17.6	1.5	29.84
4	Civil	14.2	11.17	2.1	50	77.47
5	Mechanical	8.48	8.55	10	105	132.03
6	Basic Science	2.4	4.28	0.7	3	10.38
7	MBA	1.4	1	3		5.4
8	Boys hostel				30	30
9	Library	4	4	2		10
10	Principal office	0.1	0.1	0.2		0.4
11	Admin Office	0.6	0.6	3		4.2
13	Estate	2.5			30	32.5
14	Lift				45	45
	Total	47.68	46.87	42.8	434.9	572.25

Energy consumption analysis in various departments

The major connected loads in KSSEM Campus are classified into 5 major categories namely illumination, HVAC, Computers and peripherals and Lab equipments as shown in fig 1.
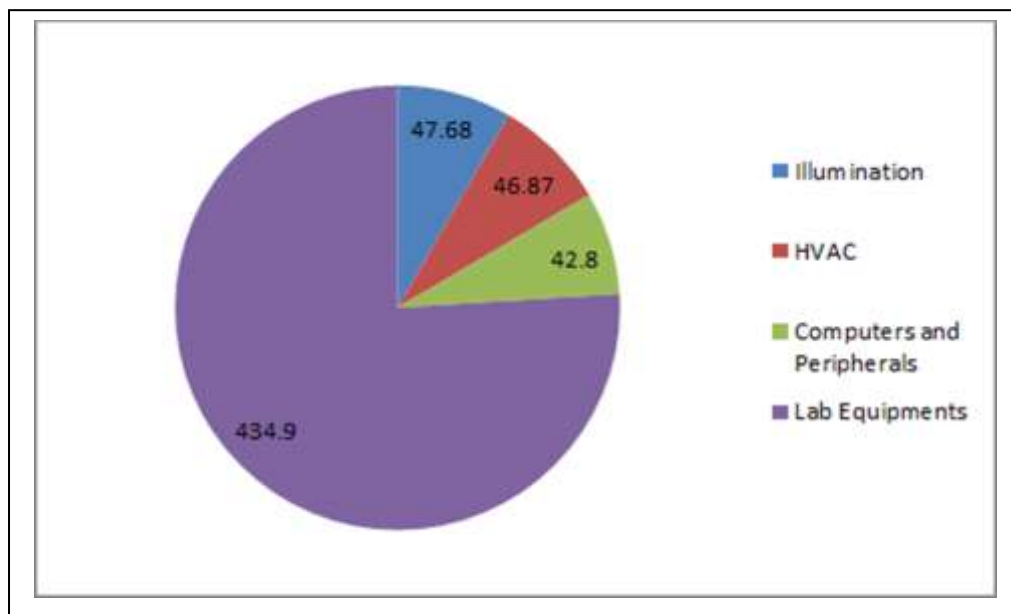
Fig: 1 Pictorial representations of loads connected in different departments

Principal Office

Table 3: Energy consumed by various loads in **Principals office**

Sl No.	Type of load	Connected Load in kW	Duration of use in hours	Energy Consumed in KWh	Number of days of Usage in a month	Energy Consumed per month in KWh
1	Illumination	0.1	6	0.6	23	13.8
2	HVAC	0.1	4	0.4	23	9.2
3	Computers and Peripherals	0.2	6	1.2	23	27.6
4	Lab equipments	-			23	0
	Total	0.4		2.2	23	50.6

Admin Section

Table 4: Energy consumed by various loads in **Admin section**

Sl No.	Type of load	Connected Load in kW	Duration of use in hours per day	Energy Consumed in KWh	Number of days of Usage in a month	Energy Consumed per month in KWh
1	Illumination	0.6	3	1.8	23	41.4
2	HVAC	0.6	5	3	23	69
3	Computers and Peripherals	1.2	7	8.4	23	193.2
4	Lab equipments			0	23	0
	Total	4.2		13.2	23	303.6

Department of Artificial Intelligence and Data Sciences

Table 5: Energy consumed by various loads in **Department of AI&DS**

Sl No.	Type of load	Connected Load in kW	Duration of use in hours per day	Energy Consumed in KWh	Number of days of Usage in a month	Energy Consumed per month in KWh
1	Illumination	6.6	3	19.8	23	455.4
2	HVAC	5	5	25	23	575
3	Computers and Peripherals	29.8	4	119.2	15	1788
4	Lab equipments	3.9	2	7.8	5	39
	Total			171.8		2857.4

Department of Electronics and Communication Engineering

Table 6: Energy consumed by various loads in **Department of ECE**

Sl No.	Type of load	Connected Load in kW	Duration of use in hours per day	Energy Consumed in KWh	Number of days of Usage in a month	Energy Consumed per month in KWh
1	Illumination	3.5	3	10.5	23	241.5
2	HVAC	5.4	5	27	23	621
3	Computers and Peripherals	2.7	6	16.2	23	372.6
4	Lab equipments	4.5	5	22.5	23	517.5
	Total	14.98		76.2		1752.6

Department of Computer Science and Engineering

Table 7: Energy consumed by various loads in **Department of CSE**

Sl No.	Type of load	Connected Load in kW	Duration of use in hours per day	Energy Consumed in KWh	Number of days of Usage in a month	Energy Consumed per month in KWh
1	Illumination	4	4	16	23	368
2	HVAC	7	5	35	23	805
3	Computers and Peripherals	29.8	6	178.8	23	4112.4
4	Lab equipments	3	5	15	23	345
	Total			244.8		5630.4

Department of Civil Engineering

Table 8: Energy consumed by various loads in **Department of Civil Engineering**

Sl No.	Type of load	Connected Load in kW	Duration of use in hours per day	Energy Consumed in KWh	Number of days of Usage in a month	Energy Consumed per month in KWh
1	Illumination	14.2	4	56.8	23	1306.4
2	HVAC	11.2	5	56	23	1288
3	Computers and Peripherals	4.8	5	24	15	360
4	Lab equipments	50	2	100	5	500
	Total	77.5		236.8		3454.4

Department of Mechanical Engineering

Table 9: Energy consumed by various loads in **Department of ME**

Sl No.	Type of load	Connected Load in kW	Duration of use in hours per day	Energy Consumed in KWh	Number of days of Usage in a month	Energy Consumed per month in KWh
1	Illumination	8.5	3	25.5	23	586.5
2	HVAC	8.6	5	43	23	989
3	Computers and Peripherals	4	4	16	15	240
4	Lab equipments	105	2	210	5	1050
	Total	132.1		294.5		2865.5

Department of Basic Science

Table 10: Energy consumed by various loads in **Department of BS**

Sl No.	Type of load	Connected Load in kW	Duration of use in hours per day	Energy Consumed in KWh	Number of days of Usage in a month	Energy Consumed per month in KWh
1	Illumination	2.4	3	7.2	23	165.6
2	HVAC	4.3	5	21.5	23	494.5
3	Computers and Peripherals	0.9	5	4.5	23	103.5
4	Lab equipments	3	5	15	23	345
	Total	10.4		48.2		1108.6

Department of Master of Business Administration

Table 11: Energy consumed by various loads in **Department of MBA**

Sl No.	Type of load	Connected Load in kW	Duration of use in hours per day	Energy Consumed in KWh	Number of days of Usage in a month	Energy Consumed per month in KWh
1	Illumination	1.4	4	5.6	23	128.8
2	HVAC	1	6	6	23	138
3	Computers and Peripherals	3	4	12	23	276
4	Lab equipments			0	23	0
	Total	5.4		23.6		542.8

Hostel

Table 12: Energy consumed by various loads in **Hostel**

Sl No.	Type of load	Connected Load in kW	Duration of use in hours per day	Energy Consumed in KWh	Number of days of Usage in a month	Energy Consumed per month in KWh
1	Illumination	2.5	6	15	30	450
2	HVAC	5.4	7	37.8	30	1134
3	Computers and Peripherals	10	5	50	30	1500
4	Kitchen equipments	25	6	150	30	4500
	Total	42.9		252.8		7584

Estate

Table 13: Energy consumed by various loads in **Estate**

Sl No.	Type of load	Connected Load in kW	Duration of use in hours per day	Energy Consumed in KWh	Number of days of Usage in a month	Energy Consumed per month in KWh
1	Illumination	2.5	10	25	30	750
2	HVAC			0	30	0
3	Computers and Peripherals			0	30	0
4	Water Pump motors	13	5	65	30	1950
	Total			90	120	2700

Canteen

Table 14: Energy Consumed by various loads in Canteen

Sl No.	Type of load	Connected Load in kW	Duration of use in hours per day	Energy Consumed in KWh	Number of days of Usage in a month	Energy Consumed per month in KWh
1	Illumination	3	7	21	25	525
2	HVAC	10	5	50	25	1250
3	Computers and Peripherals			0		0
4	Kitchen Equipments	17	6	102	25	2550
	Total	30		173		4325

Consolidated Energy consumption

Table 15: Consolidated Energy Consumed for the month of March 2023

Sl No.	Department	Illumination load in KWh	HVAC load in KWh	Computers and Peripherals KWh	Lab equipments load in KWh	Total load in KWh
1	Principal Office	13.8	9.2	27.6	0	50.6
2	Admin Section	41.4	69	193.2	0	303.6
3	Department of AI&DS	455.4	575	1788	39	2857.4
4	Department of ECE	241.5	621	372.6	517.5	1752.6
5	Department of CSE	368	805	4112.4	345	5630.4
6	Department of CV	1306.4	1288	360	500	3454.4
7	Department of ME	586.5	989	240	1050	2865.5
8	Department of BS	165.6	494.5	103.5	345	1108.6
9	Department of MBA	128.8	138	276	0	542.8
10	Hostel	450	1134	1500	4500	7584
11	Estate	750	0	0	1950	2700
12	Canteen	525	1250	0	2550	4325
	Total	5032.4	7372.7	8973.3	11796.5	33174.9

Considering 23 working days in a month the energy consumed in various departments are shown in Table 3 to Table 14. Table 15 gives the consolidated statement of the energy consumed from the various departments. Figures 2 to 7 gives the load distribution in various departments.
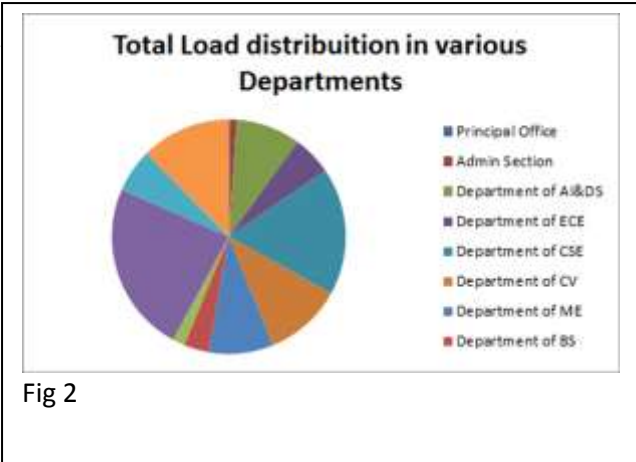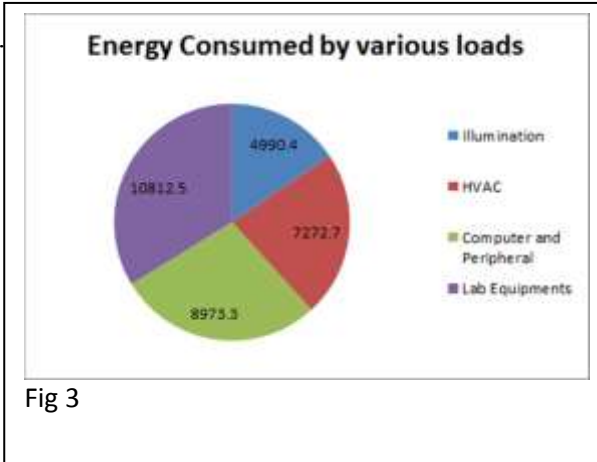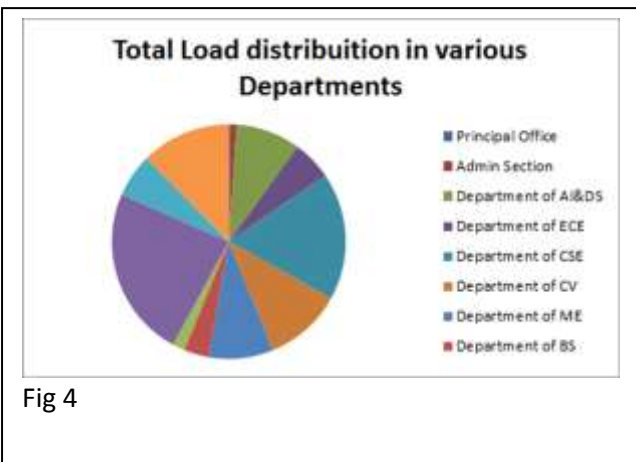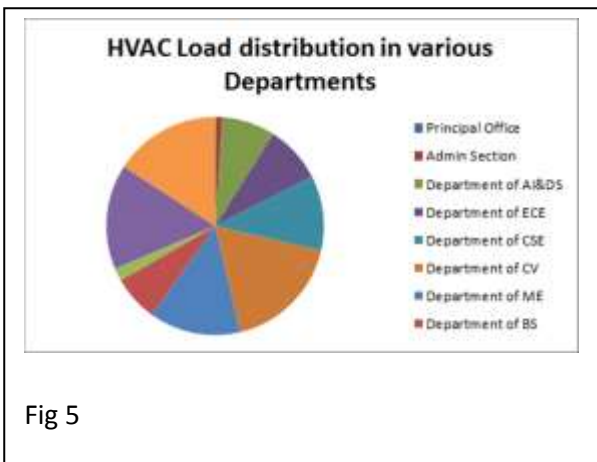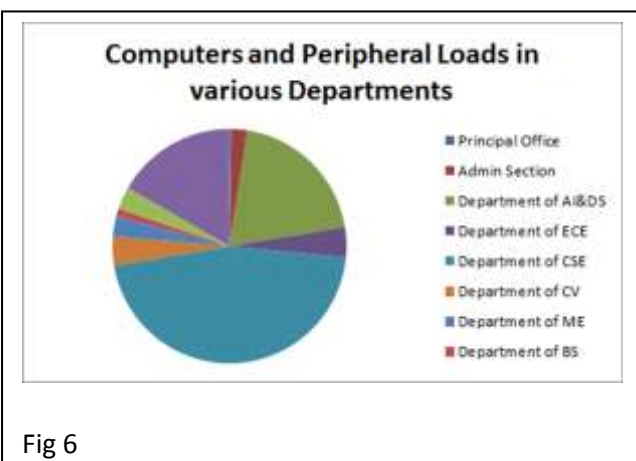

Fig 2

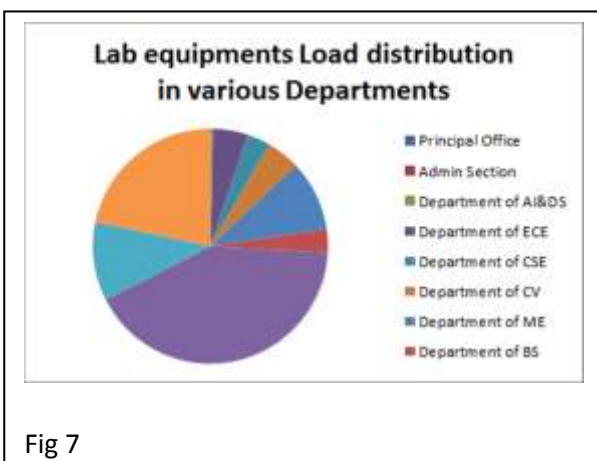Fig 3
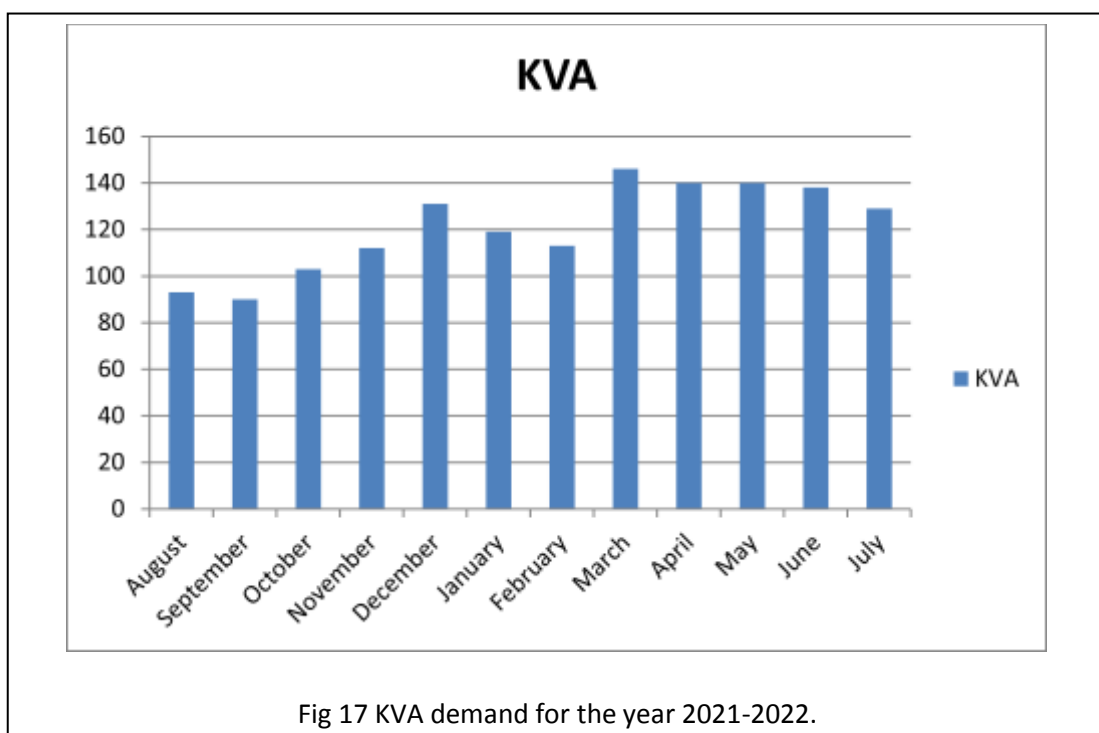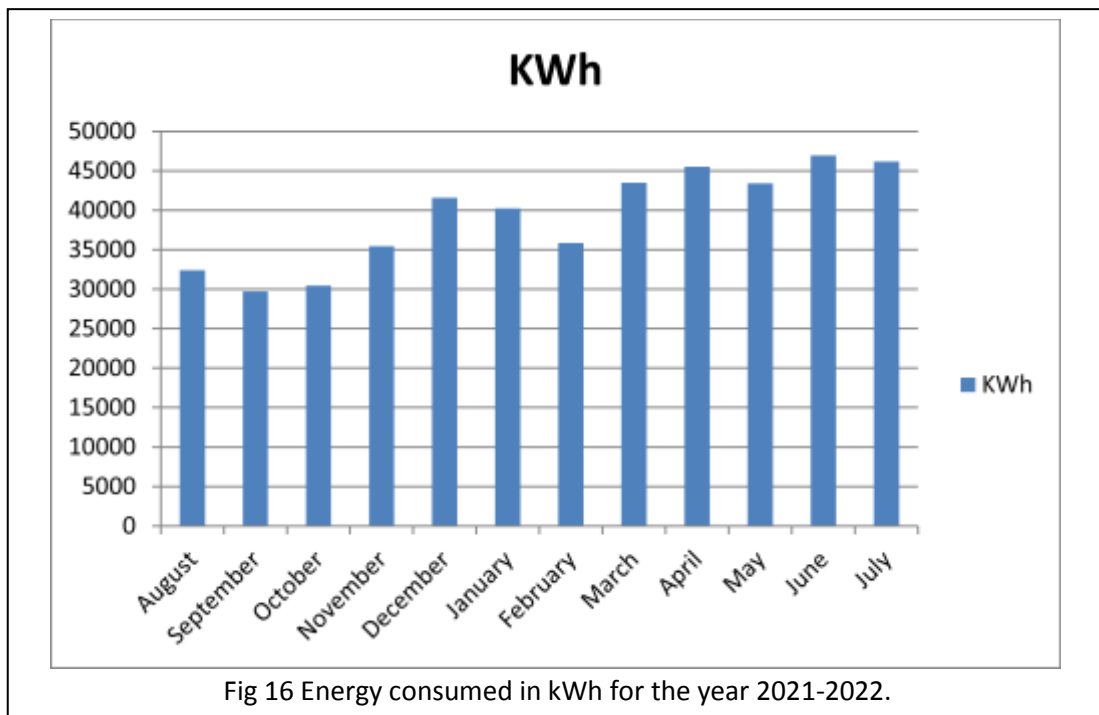

Fig 4

Fig 5

Fig 6

Fig 7

Electricity billing data and analysis

Table 15: Electricity billing data for the year 2022-23

Sl No.	Billing Period	Month	Demand in KVA incurred	Demand Charges per KVA in Rs.	Recorded KVA	Total Demand Charges in Rs.	Energy Consumed in kWh	Energy charges per kWh in Rs.	Total Energy charges in Rs.	Power factor pf	Pf Surcharge	Total amount including tax in Rs.
1	1-08-2022 to 01-09-2022	August	128	265	93	33920	32380.50	8.25	267139.13	0.93	0	335240
2	1-09-2022 to 1-10-2022	September	128	265	90	33920	29724.75	8.25	245,299.19	0.94	0	323316
3	1-10-2022 to 1-11-2022	October	128	265	103	33920	30459.00	8.25	251286.75	0.94	0	330462
4	1-11-2022 to 1-12-2022	November	128	265	112	33920	35451.75	8.25	292476.94	0.95	0	379054
5	1-12-2021 to 1-01-2023	December	128	265	131	34715	41562.00	8.25	342866.50	0.96	0	411055
6	1-01-2023 to 1-02-2023	January	128	265	119	33920	40256.00	8.25	332112.00	0.97	0	398437
7	1-02-2023 to 1-03-2023	February	128	265	113	33920	35835.75	8.25	295644.00	0.96	0	358423
8	1-03-2023 to 1-04-2023	March	128	265	146	38690	43484.25	8.25	358745.06	0.96	0	429822
9	1-04-2023 to 1-05-2023	April	128	265	140	37100	45521.25	8.25	375550.31	0.97	0	449281
10	1-05-2023 to 1-06-2023	May	128	350	140	49000	43416.21	8.50	369037.79	0.97	0	507397
11	1-06-2023 to 1-07-2023	June	128	350	138	48300	46944.00	8.50	399024.00	0.98	0	586551
12	1-07-2023 to 1-08-2023	July	128	350	129	45150	46187.25	8.50	392591.63	0.98	0	567859

As per the electricity billed by BESCOM for the year 2022-23 given in table 15, the contract demand is 150 KVA. The base demand for billing is 85% of the contract demand which is 128 KVA. It is observed that the energy consumption has never exceeded the base demand. For the month of August 2022 to April 2024 demand charges is Rs. 265/KVA. For the month of May 2023 to July 2023 the demand charges is Rs. 350/KVA. The energy charges for the month of August 2022 to April 2024 are Rs. 8.25 and for the month of May 2023 to July 2023 is Rs. 8.50. The pattern of energy consumed for the year 2022-23 is shown in fig 16.

Fig 16 Energy consumed in kWh for the year 2021-2022.

Fig 17 KVA demand for the year 2021-2022.

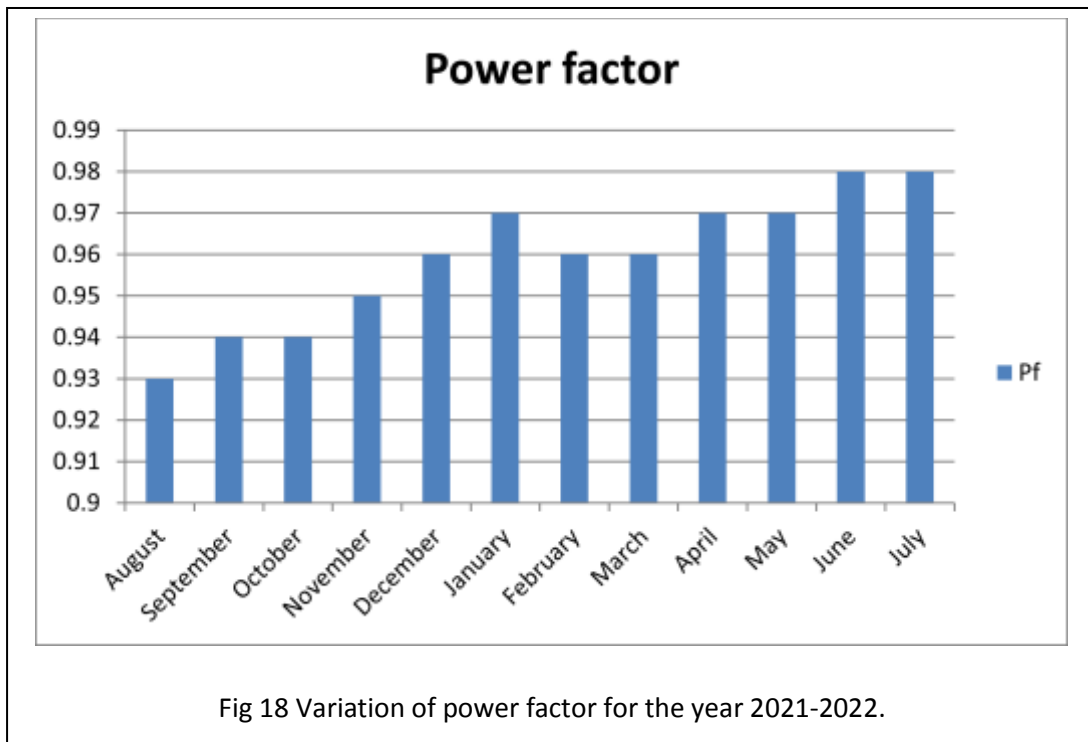Fig 18 Variation of power factor for the year 2021-2022.

Figure 17 and 18 gives the variation of KVA and power factor for the year 2022 to 2023.

Energy Conservation Opportunities.

Lights

- Replace fluorescent bulbs with ENERGY STAR®LED bulbs.
- Use windows or skylights for daylight, with ways to control excessive light and/or glare.
- Turn lights off when you're not around, and let windows provide light where possible.
- Reduce the use of over head lighting where possible and use task lighting instead.
- Install occupancy sensors to shut off lights when rooms are not in use.

HVAC (Heating ventilating & Air Conditioning)

- Make sure doors and windows have tight seals. Keep them closed when running your air conditioning system.
- Turn off fans when the room is unoccupied.
- Check equipment regularly (burners, coils, air filters, duct, etc.) for proper operation and maintenance needs.
- Use ENERGY STAR qualified roofing material with high reflectance.
- When replacing heating or cooling systems, choose ENERGY STAR equipment.

Equipment/ Devices

- Turn off printers, copiers, and coffee makers, etc., at the end of the day, and turn off desk lamps when not in use.
- Activate "sleep" mode on computers and monitors.
- An ENERGY STAR labelled laptop or desktop computer uses as much as 65% less electricity than computers without the ENERGY STAR label.

Motors & Pumps

- Energy-saving ENERGY STAR qualified commercial equipment is available for all types of motors & pumps appliances used for water pumping & Labs. The initial investment will typically be returned in savings quickly.

Suggestions and Recommendations.

- It is widely and commonly suggested to use **Star Rated or BEE** rated electrical equipments.
- **Advanced Power Strips**-When your electronics are off, they may still use power. And you pay for it. An Advanced Power Strip (APS) shuts off the power for you.
- **Sealing & Insulation**-Sealing and insulating the building is often the most cost effective way to improve energy efficiency and comfort in building.
- **Data Centres & IT**-Server rooms and classroom computer stations consume energy, even when not in use. Make a **smart switch** to energy-efficient options and state-of-the-art cooling methods to save on these "hidden costs".
- **Solar-Parking Area**- Solar Panels are used as a roof for the vehicles parking and the power generated by the solar panels can be used for outdoor lightings, by which we can reduce the maximum amount of lighting charges.
- **Solar Power Generation unit** can be made on the rooftops of the building; approximately around 250 KW of power can be generated by the usable roof space on the buildings. Further that power can be used for building load and the excess power can be fed back to the GRID/ BESCOM using NET Metering.
- **Solar Water Pumps -** Installation or Replacement of water pumps to solar water pumps for water pumping and other necessities.
- **Solar Street Lights** can be used for outdoor illuminations.
- UPS usage should be limited to Computers & peripherals only.

- For single phase load **off-line UPS** has to be used. Whereas, for three phase load **on-line UPS** should be preferred**.**

The Smart Energy Living® Pyramid

"A Country's progress is adjudged based on the per capita Consumption of Renewable Energy"