Swami Vivekanand College of Engineering
(Approved by: AICTE, New Delhi • Affiliated to RGPV, Bhopal and DAVV, Indore• Recognised by : DTE Govt. of MP)
Campus : Khandwa Road, Indore-452020 (M.P.) Phone : +91- 07324-405000
• Email : info@svceindore.ac.in • Website : www.svce.vivekanandgroup.com

Declaration

Metric 7.1.3

I declare that all the data, pictures, reports and other information enclosed in the criteria are authentic to the best of my knowledge.

Criteria In-charge

Mr. Vishal Wankhade

Index

Energy Audit Report

ENERGY AUDIT REPORT

CONSULTATION REPORT

Swami Vivekanand College of Engineering

Khandwa Road, Indore
Pin-452009
Madhya Pradesh, India

PREPARED BY

EMPIRICAL EXERGY PRIVATE LIMITED

Flat No. 201, OM Apartment, 214 Indrapuri Colon,
Bhawarkuan, Indore – 452 001 (M. P.), India
0731-4948831, 7869327256
Email ID:eempirical18@gmail.com
www.eeplgroups.com

(2022-23)

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CONTENT

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ACKNOWLEDGEMENT

Empirical Exergy Private Limited (EEPL), Indore (M.P) takes this opportunity to appreciate & thank the management of **Swami Vivekanand College of Engineering, Indore** for allowing us to conduct an Energy Audit for the institute.

We are indeed touched by the helpful attitude and co-operation of all faculties and technical staff, who rendered their valuable assistance and co-operation during the audit.

Rajesh Kumar Singadiya

(Director)

M.Tech (Energy Management), PhD (Research Scholar)
Accredited Energy Auditor [AEA-0284]
Certified Energy Auditor [CEA-7271]
(BEE, Ministry of Power, Govt. of India)
Empanelled Energy Auditor with MPUVN, Bhopal M.P.
Lead Auditor ISO50001:2011 [EnMS] from FICCI, Delhi
Certified Water Auditor (NPC, Govt of India)
Charted Engineer [M-1699118], The Institution of Engineers (India)
Member of ISHRAE [58150]

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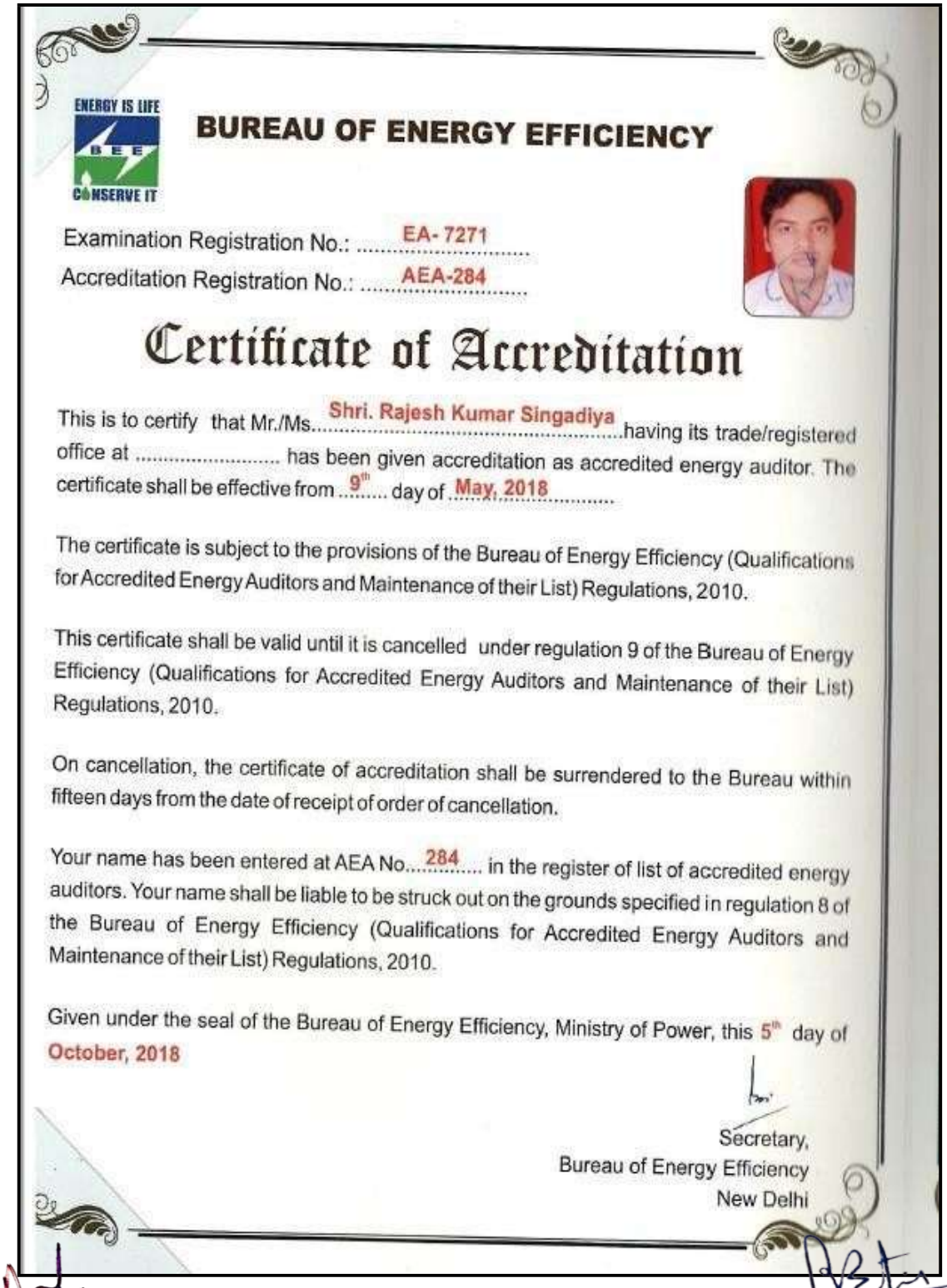
Certificate of Accreditation



ENERGY IS LIFE
BEE
CONSERVE IT

BUREAU OF ENERGY EFFICIENCY

Examination Registration No.: EA- 7271

Accreditation Registration No.: AEA-284

Certificate of Accreditation

This is to certify that Mr./Ms. Shri. Rajesh Kumar Singadiya having its trade/registered office at ..... has been given accreditation as accredited energy auditor. The certificate shall be effective from 9th day of May, 2018

The certificate is subject to the provisions of the Bureau of Energy Efficiency (Qualifications for Accredited Energy Auditors and Maintenance of their List) Regulations, 2010.

This certificate shall be valid until it is cancelled under regulation 9 of the Bureau of Energy Efficiency (Qualifications for Accredited Energy Auditors and Maintenance of their List) Regulations, 2010.

On cancellation, the certificate of accreditation shall be surrendered to the Bureau within fifteen days from the date of receipt of order of cancellation.

Your name has been entered at AEA No. 284 in the register of list of accredited energy auditors. Your name shall be liable to be struck out on the grounds specified in regulation 8 of the Bureau of Energy Efficiency (Qualifications for Accredited Energy Auditors and Maintenance of their List) Regulations, 2010.

Given under the seal of the Bureau of Energy Efficiency, Ministry of Power, this 5th day of October, 2018

Secretary,
Bureau of Energy Efficiency
New Delhi

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Energy Audit Team

The study team constituted of the following senior technical executives from **Empirical Exergy Private Limited,**

- **Mr. Rajesh Kumar Singadiya** [Director & Accredited Energy Auditor AEA-0284]
- **Mr. Rakesh Pathak**, [Director & Electrical Expert]
- **Mrs. Laxmi Raikwar Singadiya** [Chemical Engineer]
- **Mr. Charchit Pathak** [Asst.Project Engineer]
- **Mr. Ajay Nahra,** [Sr. Accountant & admin]
- **Mr. Praveen Puniyasa** [Jr. Technician]

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EXECUTIVE SUMMARY

The executive summary of the Energy audit report furnished in this section briefly gives the identified Energy conservation measures and other recommendations during the project that can be implemented in a phased manner to conserve Energy and increase productivity inside the institute campus.

INICIATIVE TAKEN BY INSTITUTE

- Institute installed 129 LED bulbs for power saving- **It's Appreciable**
- Institute installed Grid connected rooftop Solar PV System of 50 KWp capacity & in year 2022-23 generated solar power around **38%** of consumption- **It's Appreciable**

ENERGY AUDIT RECOMMENDATION

POWER FACTOR IMPROVEMENT

APFC panel required to achieve near about the Unity Power Factor (PF 1) through Installation of **35 KVAR** rating Capacitor Bank for total section load (100 KVA) & for (Engg Block, MBA Block & Admin Block total load 38 KW) so APFC panel installation recommended for three main blocks around 25 KVAR rating capacitor bank. Current Average **Power Factor 0.79.**

CEILING FAN AND EXHAUST FAN

Replacement of 556 "Conventional Ceiling Fan (50 Watt)" by energy efficient star rated fan or BLDC based energy efficient fan (28 Watt) in class rooms, laboratories and faculties cabins" have great potential for energy saving.

TIMER CONTROLLED STREET LIGHTS

It is recommended to installation of "Timer control on-off street lighting" in institute campus. To save human efforts & power saving.

MOTION SENSOR

It is recommended to installation of motion sensor in faculty cabins, offices, toilets, Corridors and non-working areas to save energy.

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IoT BASED ENERGY MONITORING SYSTEM

Installation of "Cloud based (IoT based) energy monitoring system" including harmonic measurement (total voltage and current harmonic distortion %) in power house will be good initiate for energy monitoring as well as student demo project for management. expected energy saving potential about 5 to 6%.

- Installation of energy meters between transformer and main PCC panel with IoT systemwill monitor line losses of the system. It will give real time measurement of Power Factor and line losses from the cable.
- Installation of IoT based solar power generation system to track daily/monthly/yearly solar power generation

GROUND EARTHING

- Transformer area required 6 type proper Earthing of structure, fencing, double Earthing of transformer, fuse box Earthing, meter box.
- Proper installation of ground Earthing for Human & devices protection point of view.
- Maintenance required for cabling & wiring to reduce the power loss & decrease extra billing.
- Building wise Ground Earthing recommended for safety point of view.

ENERGY MANAGEMENT WORKSHOP AND TRAINING

Conduct awareness, training programs, seminars, workshops, exhibitions for faculties, management and nonteaching staff.

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CHAPTER-1
INTRODUCTION

1.1 About Institute

Swami Vivekanand College of Engineering, Indore has glorious history under Swami Vivekanand Group of Institutions. The Swami Vivekanand Group of Institutes is widely known for its commitment to excellence in preparing students to address the current and future needs of society, while performing with Intergrid, compassion, and competence.

SVCE started its journey in the year 2004 with the aim of providing education to students and empowering them so that they can be financially independent, socially conscious, morally upright and emotionally balanced. The Institute is best equipped with excellent infrastructure facilities, combined with the support of academicians, experts from the industry, and other fields to cater to the needs of the student's community. The Institute ensures that you get the best possible support, both academically and socially.

The Institute proudly announces the during past 19 years journey, it has been serving the society by providing excellent environment for education in area of Engineering & Management. It promotes the innovative teaching methodologies to help students gain practical knowledge and better insights about applying the theoretical knowledge. It believes in imparting education along with preparing students for corporate world. With a lush green campus spread over a large areas of located in the heart of the Indore city, the institute is well connected through all means of transport.

Figure 1.1: - Satellite image of SVCE, Indore from Google Map

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Vision

Swami Vivekanand College of Engineering (SVCE) aspires to create Center of Excellence for continuous learning by providing state-of-art Techno-Management Education to the students and learners, by enhancing the capabilities to be the Techno-Management Thought Leaders.

Mission

The mission of the Swami Vivekanand College of Engineering (SVCE)

1. To import human values and to promote leadership qualities among students.
2. To set up a suitable infrastructure and provide better resources to students and faculties.
3. To encourage academic excellence amongst faculties and students.
4. To impart education based on scientific, moral and value-based foundation to meet the challenges of the technologically advancing global environment.

1.2 Institute Build-up area

Total Buildup Area – 21,179 Sq. Mt.

Sr.no.	Location	Total Area Sq.mt.
1	Engineering Building	12,957
2	MBA Building	4331
3	Admin Building	2882
4	Canteen	1009
	Total	**21,179**

COLLEGE POPULATION

Total No. of Student	1500
Total No. of Teaching Faculty	80
Total No. of Non-Teaching Staff	36

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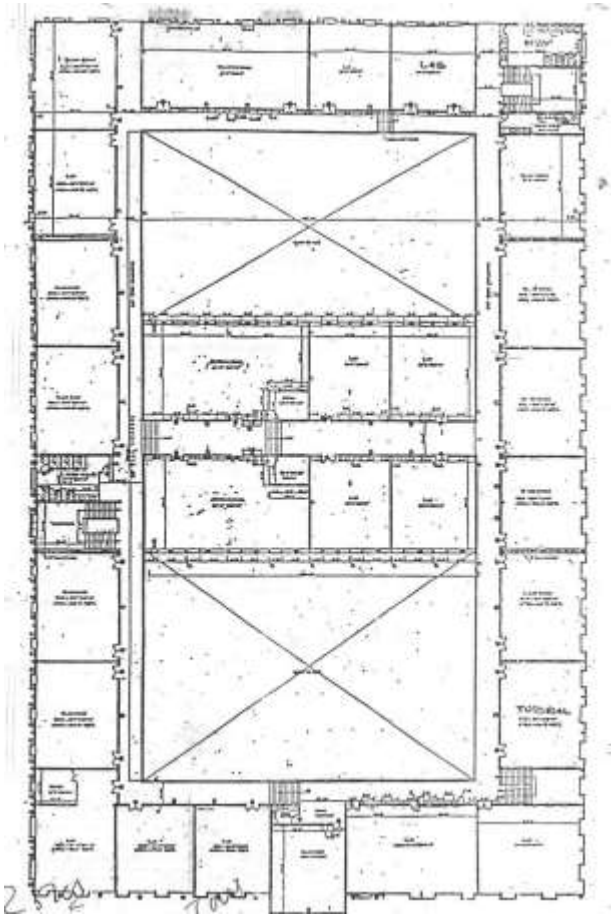
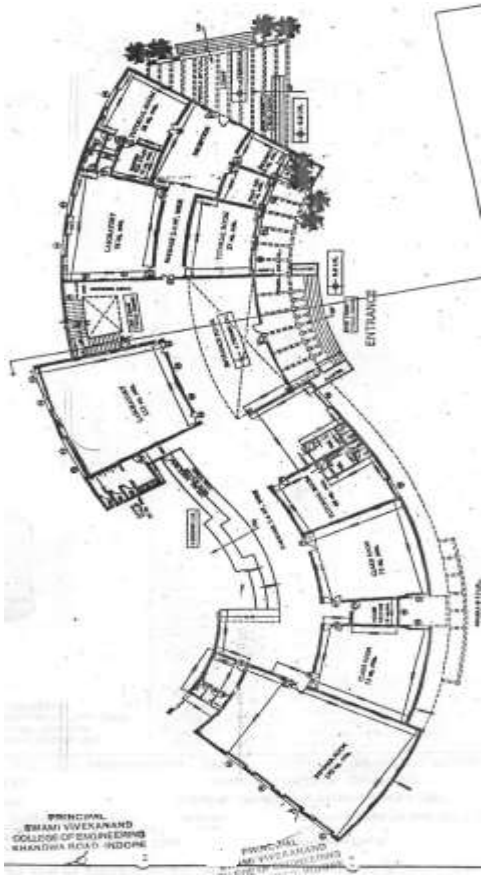
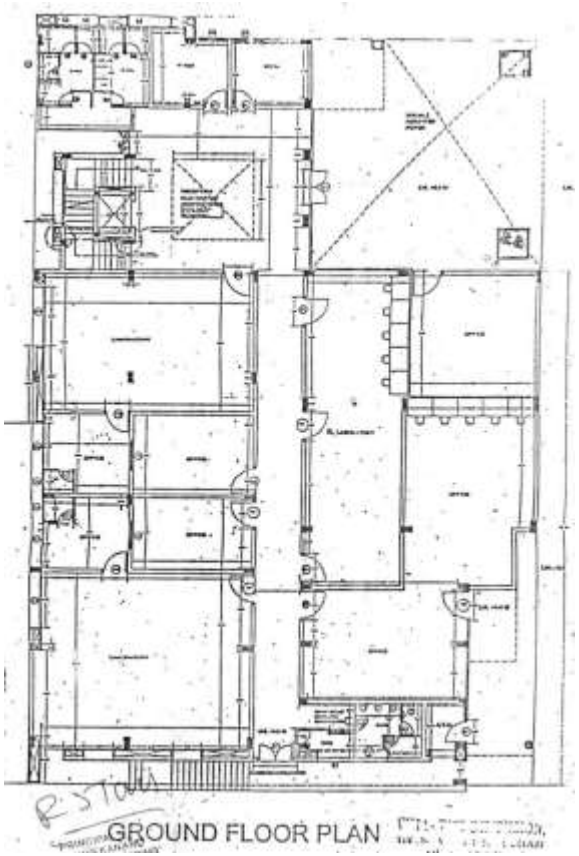
1.3 COLLEGE LAYOUT



ENGG Block



MBA Block



Admin Block

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1.4 About Energy Audit

An energy audit helps to understand more about the ways energy is used in any institute and helps in identifying areas where waste may occur and scope for improvement exists. The overall energy efficiency from generation to the final consumer becomes 50%. Hence one unit saved in the end user is equivalent to two units generated in the power plant.

An energy audit is the most efficient way to identify the strength and weaknesses of energy management practices and to find a way to solve problems. An energy audit is a professional approach to utilizing economic, financial, social, and natural resources responsibly. Energy audits "adds value" to management control and are a way of evaluating the system.

Empirical Exergy Private Limited (EEPL), Indore M.P. carried out the "Energy Audit" at the site to find gaps in the Energy consumption pattern for **Swami Vivekanand College of Engineering, Indore M.P**. A technical report is prepared as per the need and the requirement of the project.

1.5 Objectives of Energy Auditing

An energy audit provides a vital information base for an overall energy conservation program covering essentially energy utilization analysis and evaluation of energy conservation measures. It aims at:

- Identifying the quality and cost of various energy inputs.
- Assessing the present pattern of energy consumption in different cost centers of operations.
- Relating energy inputs and production output.
- Identifying potential areas of the thermal and electrical energy economy.
- Highlighting wastage in major areas.
- Fixing of energy-saving potential targets for individual cost centers.
- Implementation of measures for energy conservation & realization of savings.

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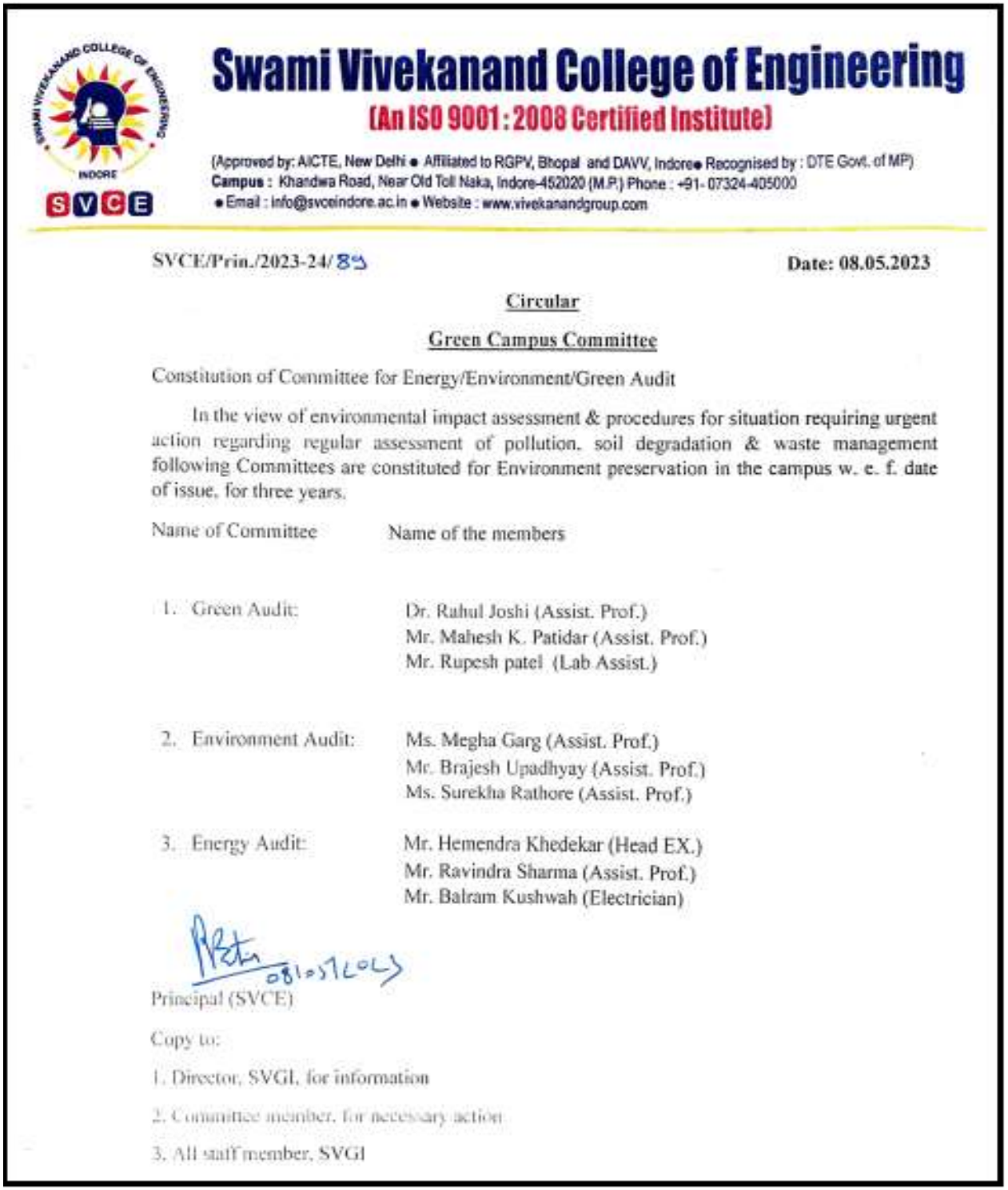
1.6 Green Monitoring Committee



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• Email : info@svceindore.ac.in • Website : www.vivekanandgroup.com

SVCE/Prin./2023-24/89 Date: 08.05.2023

Circular

Green Campus Committee

Constitution of Committee for Energy/Environment/Green Audit

In the view of environmental impact assessment & procedures for situation requiring urgent action regarding regular assessment of pollution, soil degradation & waste management following Committees are constituted for Environment preservation in the campus w. e. f. date of issue, for three years.

Name of Committee	Name of the members
1. Green Audit:	Dr. Rahul Joshi (Assist. Prof.) Mr. Mahesh K. Patidar (Assist. Prof.) Mr. Rupesh patel (Lab Assist.)
2. Environment Audit:	Ms. Megha Garg (Assist. Prof.) Mr. Brajesh Upadhyay (Assist. Prof.) Ms. Surekha Rathore (Assist. Prof.)
3. Energy Audit:	Mr. Hemendra Khedekar (Head EX.) Mr. Ravindra Sharma (Assist. Prof.) Mr. Balram Kushwah (Electrician)

08/05/2023

Principal (SVCE)

Copy to:

1. Director, SVGI, for information
2. Committee member, for necessary action
3. All staff member, SVGI

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1.7 Methodology

The methodology adopted for achieving the desired objectives viz.: Assessment of the Current operational status and energy savings includes the following.

- Discussions with the concerned officials for identification of major areas of focus and other related systems.
- A team of engineers visited the site and had discussions with the concerned officials/supervisors to collect data/information on the operations and load distribution within the plant and the same for the overall premises. The data were analyzed to arrive at a baseline Energy consumption pattern.
- Measurements and monitoring with the help of appropriate instruments including continuous and/or time-lapse recording, as appropriate and visual observations were made to identify the energy usage pattern and losses in the system.
- Trend analysis of costs and consumptions.
- Capacity and efficiency test of major utility equipment wherever applicable.
- Estimation of various losses
- Computation and in-depth analysis of the collected data, including utilization of computerized analysis and other techniques as appropriate, were done to draw inferences and to evolve suitable energy conservation plans for improvements/ reduction in specific Energy consumption.

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1.8 Present Energy Scenario

- The institute uses energy in the form of electricity purchased from MPPKVVCL grid. The institute has non industrial 33 kV Feeder with contract demand 100 KVA.

- Total billing amount of Swami Vivekanand College of Engineering, Indore is Rs. **12, 12,021/-** with respect to annual energy consumption 57,654 units from August-2022 to August-2023.

- Annual overall charges paid by institute are Rs. 21 per unit.

- Institute has also installed 50KWp rooftop solar system.

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CHAPTER- 2
POWER SUPPLY SYSTEM

2.1 Transformer Details.

The power supply for the **Swami Vivekanand College of Engineering, Indore** from MPPKVVCL with the help of 33 kV Feeders under Tariff HV-3.2.B Non-Industrial. There is single Transformer has capacity 200 KVA. Detail of the transformer is given in table 2.1

Table: 2.1 Technical details of transformer.

Sr. No.	Items	Technical Specification
1	Make	M.P. Transformers Pvt. Ltd.
2	Year	2014
3	Rating (kVA)	200
4	Voltage (HV/ LV)	33000/433
5	Current Rating (HV/ LV)	3.49/ 266.7
6	Frequency (Hz)	50
7	Vector group	Dyn-11
8	Type of cooling	ONAN

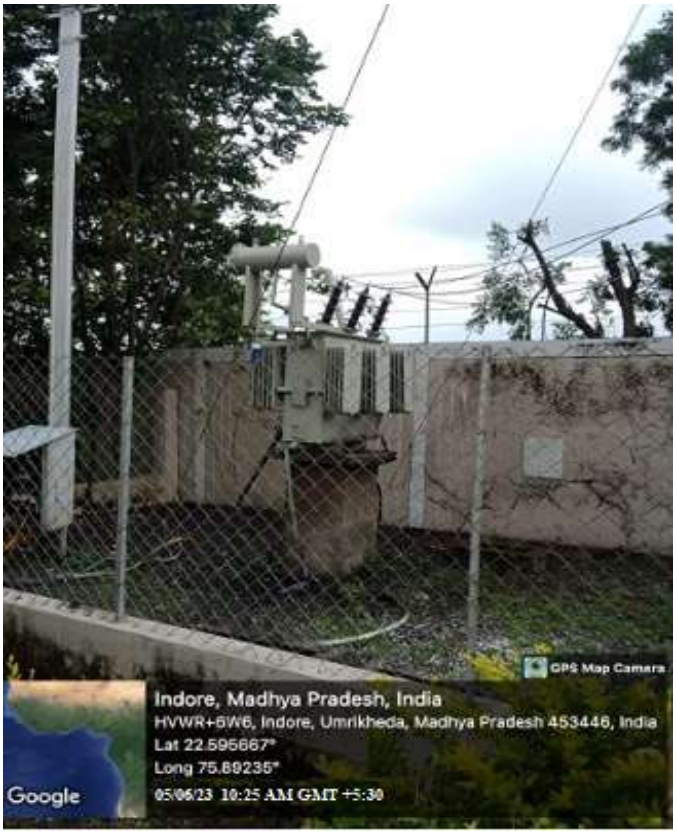

Figure 2.1:- 200 kVA Transformer in the campus

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Table 2.2: Calculated Transformer loading (%) based on Electricity bills year (2022-23)

Sr. No.	Month & Year	Transformer Capacity (KVA)	Maximum Demand (KVA)	TR loading (%)
1	Aug-22	200	53	26.5
2	Sep-22	200	50	25
3	Oct-22	200	27	13.5
4	Nov-22	200	30	15
5	Dec-22	200	25	12.5
6	Jan-23	200	27	13.5
7	Feb-23	200	17	8.5
8	March-23	200	39	19.5
9	April-23	200	60	30
10	May-23	200	70	35
11	June-23	200	56	28
12	July-23	200	54	27
13	Aug-23	200	48	24
			Average Transformer loading (%)	**21.38**
			Maximum Loading (%)	**35**

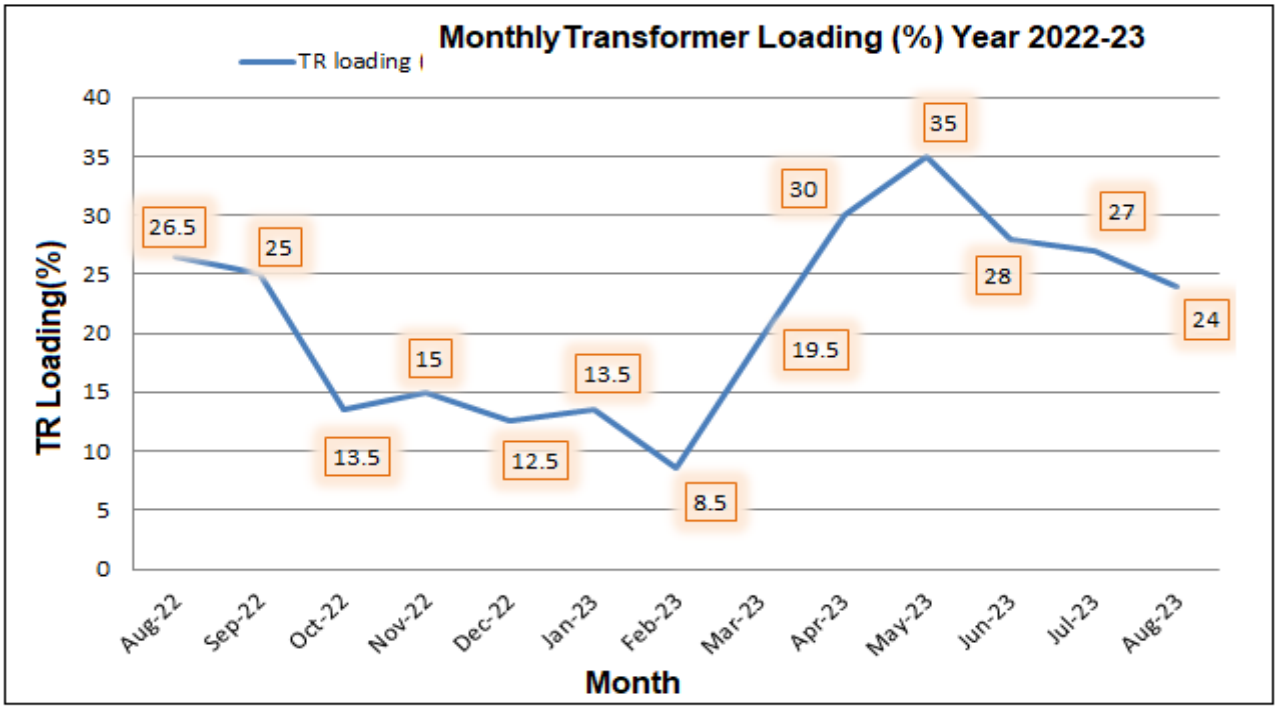

Figure 2.2:- Graphical presentation of TR loading percentage Year 2022-23

Observation: -

The average loading of the transformer is 21.38%. Maximum TR loading 35% Minimum TR loading 8.25%. **-It's acceptable**

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2.2 DG Set

There is one DG set in institute campus. Detail of the DG set is given below in table.

Table 2.4 Technical specifications for DG set

Sr. No.	Parameter	Technical Specification
1	Make	GMMCO LIMITED
2	Engine Sr. No	148/2009
3	Capacity (KVA)	62.5
4	Rated Voltage (V)	415
5	Full load current (A)	87
6	Frequency (Hz)	50
7	Power factor	0.8
8	Speed (RPM)	1500
9	Phase	3

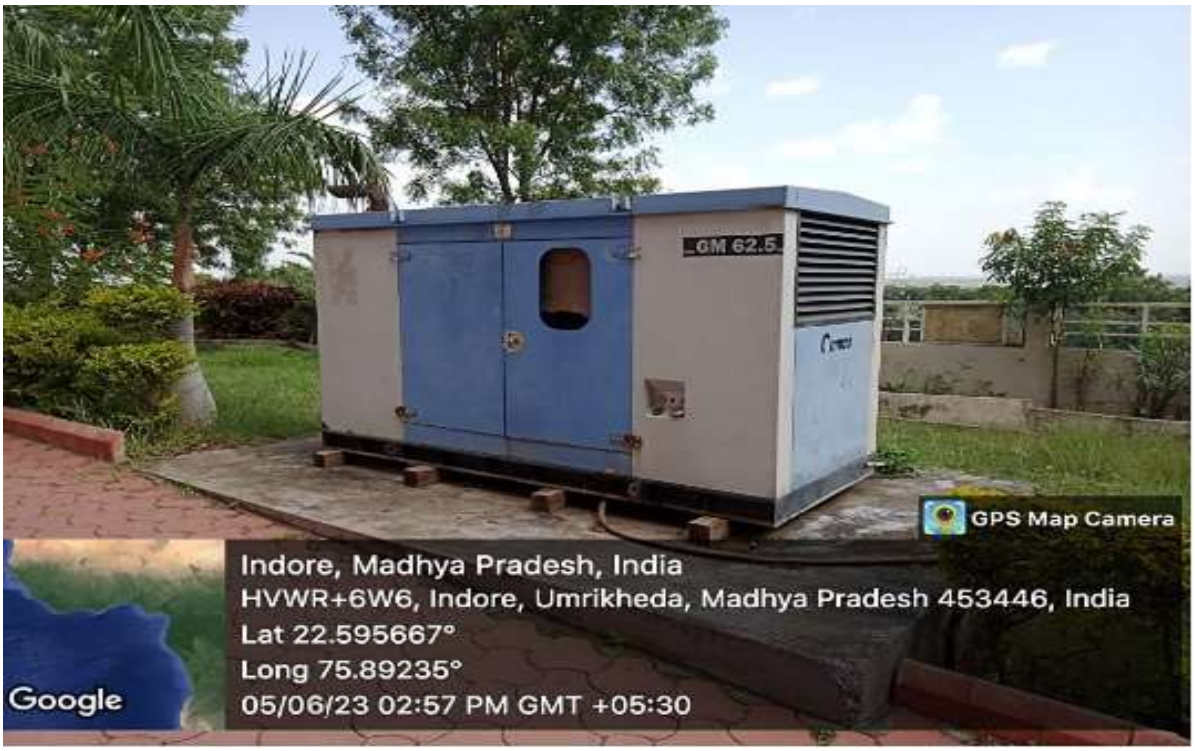

Figure 2.3:- DG set in the campus

Observation:

- DG set is used only in case of grid power failure.

Recommendation

- There is requirement of energy meter and fuel meter to find out specific fuel consumption (kWh/litter) of DG set.

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2.3 Single Line Diagram (SLD)

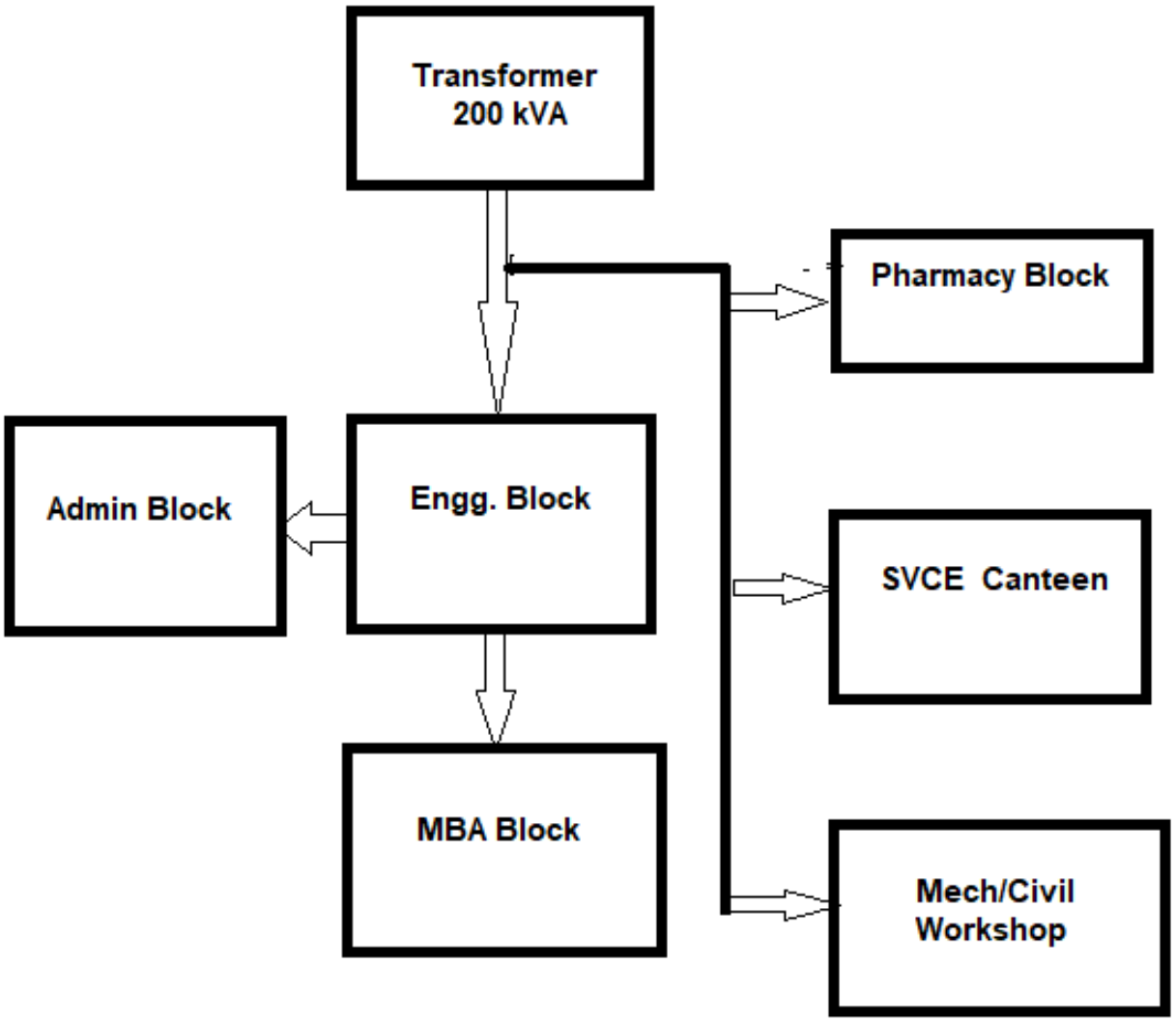

Fig. 2.4 Single Line Diagram of electricity supply in SVCE Campus

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CHAPTER- 3
ELECTRICITY BILL ANALYSIS

3.1 Monthly Electrical Energy Consumption 2022-23

Table 3.1 Energy consumption and billing amount (year 2022-23)

Sr. No.	Month & Year	Total Unit Consumption (kWh)	Total Amount (Rs.)	Per Unit Charges (Rs./kWh)
1	Aug-22	6237	105980	16.99
2	Sep-22	6432	103706	16.12
3	Oct-22	5963	97198	16.30
4	Nov-22	1863	59177	31.76
5	Dec-22	1826	60082	32.90
6	Jan-23	835	71742	85.92
7	Feb-23	794	84046	105.85
8	Mar-23	2184	84415	38.65
9	Apr-23	4871	88766	18.22
10	May-23	6245	103243	16.53
11	Jun-23	6560	111944	17.06
12	Jul-23	7047	118723	16.85
13	Aug-23	6797	122999	18.10
Total Unit		**57,654**	**12,12,021/-**	**Avg Rs. 21/-**

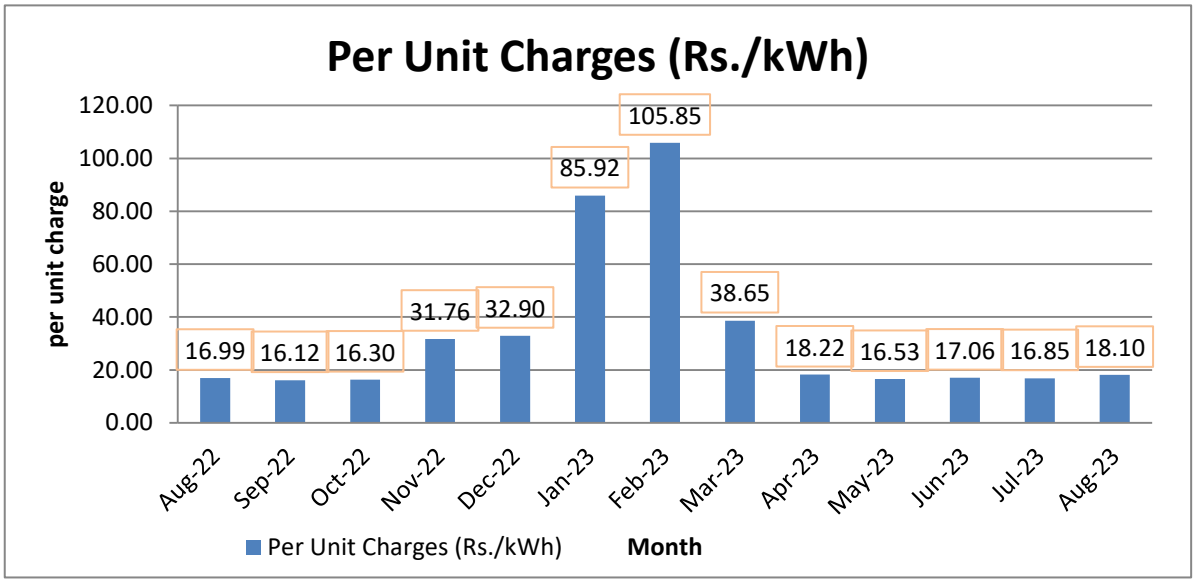

Figure 3.1:- Graphical presentation of actual per-unit charges for the year 2022-23

Observation:

The overall per unit charge is Rs 21/ kWh.

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3.2 Monthly Demand Analysis (2022-23): The monthly demand consumption for the institute is given in the table.3.2

Table 3.2:- Monthly demand analysis (KVA) consumption pattern year 2022-23

Sr. No.	Month & Year	Contract Demand (KVA)	Maximum Demand (KVA)	Billing Demand (KVA)
1	Aug-22	100	53	90
2	Sep-22	100	50	90
3	Oct-22	100	27	90
4	Nov-22	100	30	90
5	Dec-22	100	25	90
6	Jan-23	100	27	90
7	Feb-23	100	17	90
8	Mar-23	100	39	90
9	Apr-23	100	60	90
10	May-23	100	70	90
11	Jun-23	100	56	90
12	Jul-23	100	54	90
13	Aug-23	100	48	90
	Minimum Demand (KVA)		**17**	
	Maximum Demand (KVA)		**70**	
	Average Demand (KVA)		**43**	

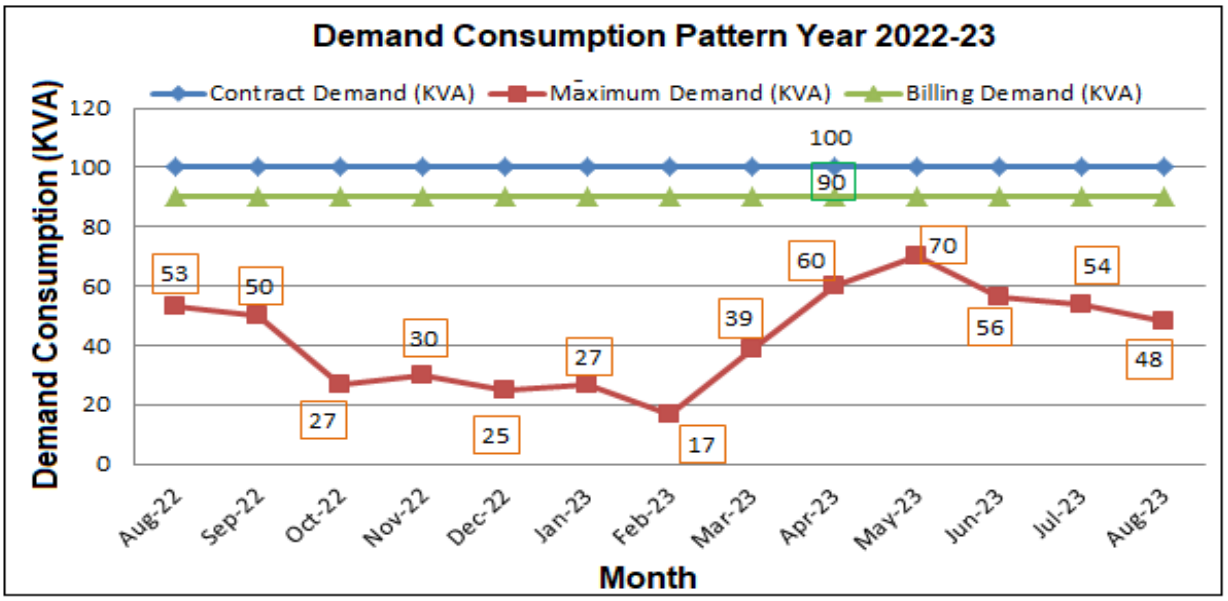

Figure 3.2:- Graphical presentation of demand consumption in the college year 2022-23

Observation: There are maximum demand **70 kVA** & minimum demand **17 KVA** in the Month of May-23 & Feb-23 respectively**.**

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3.3 Average Monthly Power Factor Analysis Year-2022-23: The monthly power Factor of the Institute is given in the following table. 3.3

Table 3.3:- Average Power Factor Analysis of the Institute year 2022-23

Sr. No.	Month & Year	Average Power Factor	PF Incentive loss @7% of Energy Charges (Rs.)	PF Penalty (Rs.)
1	Aug-22	0.79	3223	7931
2	Sep-22	0.84	3323	3368
3	Oct-22	0.83	3081	4068
4	Nov-22	0.81	963	1836
5	Dec-22	0.77	944	2907
6	Jan-23	0.73	432	1870
7	Feb-23	0.76	411	1410
8	Mar-23	0.77	1129	3541
9	Apr-23	0.87	2546	1141
10	May-23	0.87	3293	1482
11	Jun-23	0.82	3458	5891
12	Jul-23	0.78	3715	10704
13	Aug-23	0.62	3583	18478
	Average	**0.79**	**30,101/-**	**64,623/-**

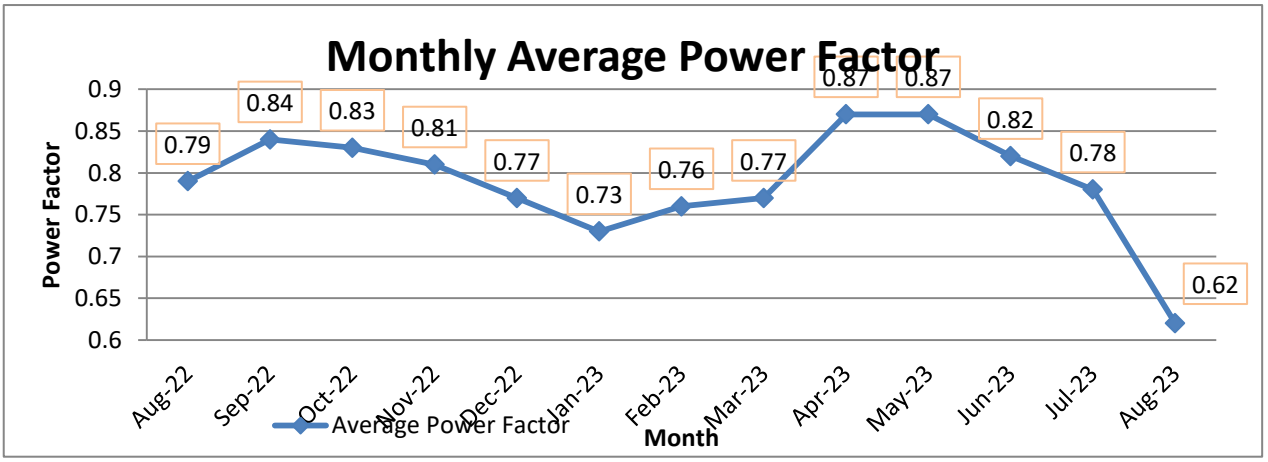

Figure 3.3:- Graphical presentation of average power Factor year 2022-23

Observation: The average power Factor from Aug-22 to Aug-23 is **0.79** & Power Factor Incentive loss is 7% of energy billing amount around **Rs. 30,101/-** for the year 2022-23. Due to low Power Factor **(0.62)** in the month of Aug-23 MPPKVVCL charge the penalty **Rs. 18,477/- &** in last one year institute paid the total penalty for low Power Factor is **Rs. 64,623/- - There is good potential (Rs. 94,724/-) to convert this loss into saving.**

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Recommendation:

- There is requirement of APFC panel to correct the low power Factor, observed that Capacitor banks are not present in control panel room.

- APFC (Automatic Power Factor Controller) panel correct the low Power Factor, due to low Power factor MPPKVVCL charge the penalty per month, APFC panel improve the power Factor & we can gain the PF Incentive per month up to 7% of energy bill charges.

3.4 On Site Power Measurement in Institute

Table 3.4 Power measurement details

Sr. No.	Location	Voltage (V)	Current (I)	Power Factor	Input Power (KW)
1	Transformer	411	49.6	0.85	30
2	Water Pump	420	15.2	0.84	3.7
3	Engg. Block	423	35	0.86	22
4	Admin Block	410	24	0.79	14
5	MBA Block	409	4	0.78	2
6	Canteen	230	5	0.72	1

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3.5 Monthly Load Factor Analysis Year-2022-23: The monthly load factor for the Institute is given in the following table. 3.4

Table 3.5 Load Factor of the Institute year 2022-23

Sr. No.	Month& Year	Avg. Load Factor (%)
1	Aug-22	9
2	Sep-22	9
3	Oct-22	9
4	Nov-22	2
5	Dec-22	2
6	Jan-23	1
7	Feb-23	1
8	Mar-23	3
9	Apr-23	7
10	May-23	9
11	Jun-23	9
12	Jul-23	10
13	Aug-23	9
	Maximum Load Factor	**10 %**
	Average Load Factor	**6.14 %**

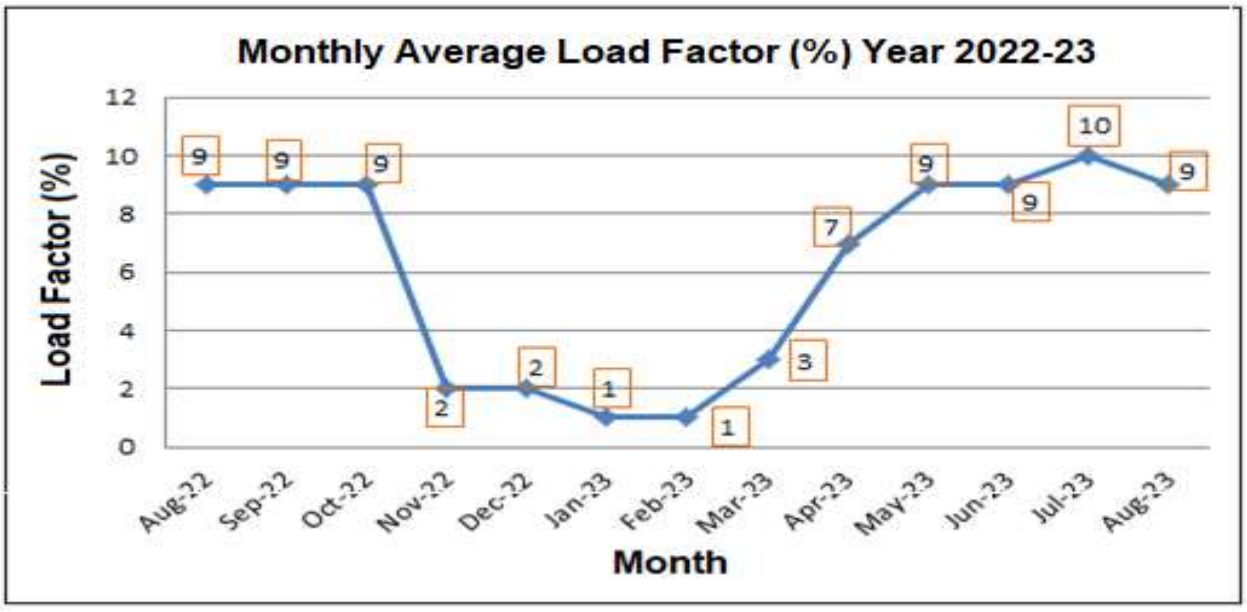

Figure 3.4:- Monthly Average Load Factor of the institute Year 2022-23

Observation:

The average Load factor was 6.04 for the year 2022-23 of the institute. **It's good.**

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3.6 Solar power generation percentage in year 2022-23

Table 3.6 Grid consumption & solar power generation details

Sr. No.	Month & Year	Grid Consumed unit	Solar power Export unit	Solar power Generation Unit
1	Aug-22	6237	410	1034
2	Sep-22	6432	0	879
3	Oct-22	5963	1311	1986
4	Nov-22	1863	1802	2145
5	Dec-22	1826	1430	1847
6	Jan-23	835	2054	2231
7	Feb-23	794	2076	2142
8	Mar-23	2184	1372	1784
9	Apr-23	4871	1204	1648
10	May-23	6245	762	1435
11	Jun-23	6560	668	1764
12	Jul-23	7047	135	1867
13	Aug-23	6797	175	1245
		57654	**13399**	**22007**

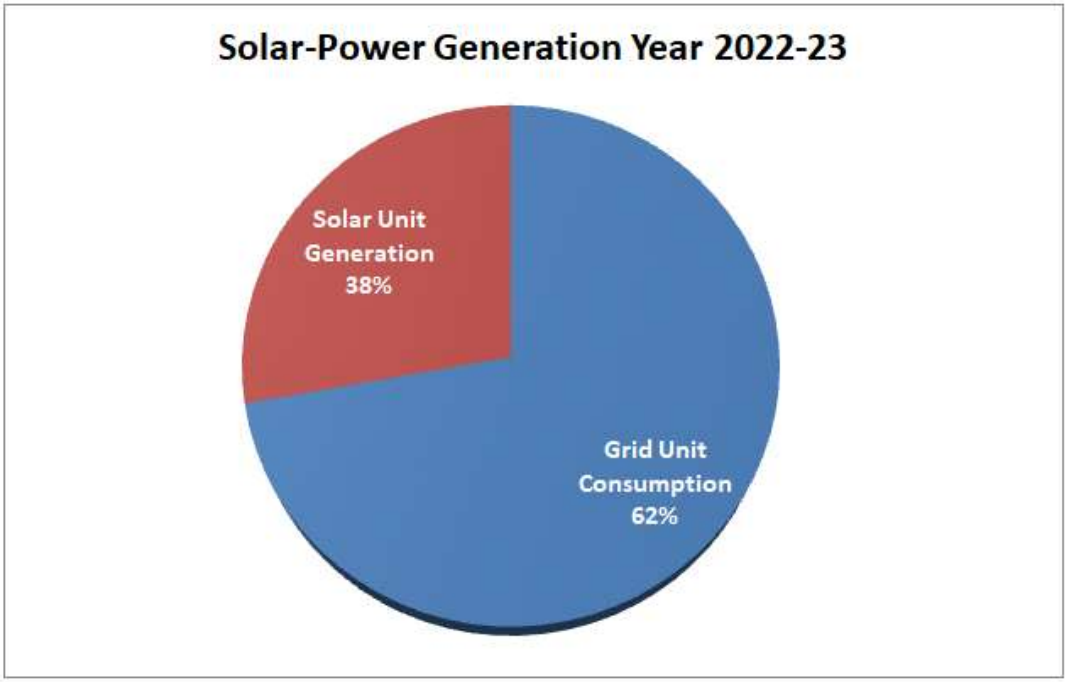

Figure 3.5:- Solar Power Generation percentage in Year 2022-23

Observation: It observe that college self-generated around 38% power by solar system-**Its appreciable**

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Chapter-4
CONNECTED LOAD

4.1 Engg. Block Ground Floor

Sr. No.	Location	Fan	Tube light (36W)	CFL Bulb	Projector	AC	Computer	Printer	LED Light (12W)	Cooler	Wall Fan
1	Room No. 101	2	2	6		1	-	-	2		
2	Principal Cabin RN 102	2	-	6		1	1	1			
3	Vice Principal RN 103	2	-	5		1	4		-		3
4	Exam Control Room 104	5	2	5			5	1		1	
5	Room No. 105	6	2		1						
6	Room No. 106	6	2								
7	Room No. 107	6	2								
8	Room No. 108	6	3								
9	Room No. 109	6	3								
10	Room No. 110	5	3								
11	Room No. 111	9	6								
12	Room No. 112	6	2								
13	Room No. 113	2	1								
14	Room No. 114	2	1								
15	Room No. 115	6	3								
16	Room No. 116	6	4								
17	Room No. 117	6	6								
18	Diploma Exam Control 118	2	1				2	1			
19	Room No. 119	4	3								
20	Room No. 120	4	3								
21	Computer Lab 121	12	4		2		60				
Total		**105**	**54**	**22**	**3**	**3**	**72**	**3**	**2**	**1**	**3**

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4.2 Engg. Block First Floor

Sr. No.	Location	Fan	Tube light (36W)	Tube light (40W)	Projector	AC	Computer	Printer	LED Light (12W)	Cooler	Wall Fan
1	Conference Room 201	4	2	-		2	4	2			
2	Room no. 202	2	2								
3	Room no. 203	4	2								
4	HOD Room no. 204	5	3				3	1		1	2
5	Room no. 205	6	3		1						
6	Room no. 206	6	2	1	1						
7	Room no. 207	6	3								
8	Room no. 208	6	3								
9	Room no. 209	5	3								
10	Room no. 210	5	3								
11	Computer Lab- 211	8	6		1		20				
12	Room no. 212	4	2								
13	HOD Room no. 213	4	4				2	1		1	
14	Room no. 215	6	3								
15	HOD Room no. 216	6	3				1	1		1	
16	FR9 & Seminar Hall-217	8	7		1	2	1		8		
17	Room no. 218 & 219 &220	18	8		1						
18	Computer Lab- 221	10	9		2		60				
19	Room no. 222 & 223	12	6								
20	Room no. 224	6	3								
TOTAL		131	77	1	7	4	91	5	8	3	2

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4.3 Engg. Block Second Floor

S.No.	Location	Fan	Tube Light (36W)	Tube Light (40W)	Projector	AC	Computer	Printer	LED Light 12W	Cooler	Exhaust Fan
1	Room no. 301	1	1								
2	Room no. 302	4	2								
3	Room no. 303	4	3								
4	Room no. 304	6	3								
5	Room no. 305	6	3								
6	Room no. 306	6	3		1						
7	Room no. 307	1	1								
8	Room no. 308	5	3								
9	Room no. 309	6	3								1
10	Room no. 310	5	3								
11	Room no. 311	4	2								
12	Room no. 312	4	4		1						
13	Room no. 313	4	4				1	1		1	
14	Room no. 315	6	3		1						
15	Room no. 316	4	4								
16	Room no. 317	6	3								
17	Room no. 318	4	3								
18	Room no. 319	6	4								
19	Room no. 320	6	3								
20	Room no. 321	7	3								
21	Room no. 322(A)	12	6								
22	Room no. 323	4	2								
23	Room no. 325	8	4								
Total		119	69	0	3	0	1	1	0	1	1

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4.4 Admin Block

Sr. No.	Location	Fan	Freeze	Water Heater	Projector	AC	Computer	Printer	LED Light	Photocopy Machine	TV	CFL
1	Admin RM-1	1				1			1			
2	Wash Room	2							12			
3	Admin RM-2	1				1			7			
4	Wash Room								4			
5	Board Room-3	6			1	2						33
6	Wash Room	1							5			
7	Admin Corridor	2					2	1	7	1		33
8	Chairman office 201	2				1			12			36
9	Rest Room	1				1			4		1	12
10	Wash Room			1					2			6
11	Dinning RM	2	1	1		1			10		1	33
12	Guest Room	2		1		1						
13	Pantry	1							2			
14	RM-204	2				2			1			39
15	RM-206	3				1						60
16	RM-208	1		1		1					1	12
Total		27	1	4	1	12	2	1	67	1	3	264

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4.5 Admin Ground Floor

Sr. No.	Location	Fan	Tube Light	Exhaust Fan	Wall Fan	AC	Computer	Printer	LED Light	Photocopy Machine	TV	CFL
1	Library	37	35	1			62	1	9	1		30
2	T & P	1				1			3			
3	Sch Dept-101	8			1		3	1	8			6
4	Account Dept-102	3			1	2	4	2	16	1		9
5	Wash RM-103		1	1								
6	Wash RM-104		1	1								
5	Corridor	4							4			12
6	Admission Dept-105	6	1		1	3	3	3	6	1	1	21
7	Corridor	1	1	2	1				6			21
8	RM-101											
8	RM-102	3							6			
Total		63	39	5	4	6	72	7	58	3	1	99

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4.6 MBA BLOCK

Sr. No.	Location	Fan	Exhaust Fan	Wall Fan	AC	Computer	Tube Light	LED Light	Photocopy Machine	TV	CFL
1	RM-101 TO RM-111	26					22				
2	RM-201 TO RM-211	22					20				
3	RM-301 TO RM-311	63					35				
Total		111					77				

4.6 Load Sharing Equipment

Total Connected electrical load 117.23 KW & share % of equipments.

Sr. No.	Equipment's Type	Unit Power (watt)	Quantity	Total Power (Watt)	Load share%
1	Tube light	36	317	11,412	9.73
2	Water Heater	1000	5	5,000	4.26
3	Projector	200	12	2,400	2.04
4	LED light	15	129	1,935	1.65
5	TV	150	4	600	0.51
6	Computer	75	238	17,850	15.22
7	Printer	250	17	4,250	3.62
8	A.C.	1500	25	37,500	31.98
9	Street light (LED)	240	4	960	0.81
10	Fridge	200	1	200	0.17
11	Wall fan	50	9	450	0.38
12	Fan	50	556	27,800	23.71
13	Exhaust Fan	60	7	420	0.35
14	CFL	15	408	6,120	5.22
15	Photo copy M/c	85	4	340	0.29
	Total			**1,17,237 W**	**100%**

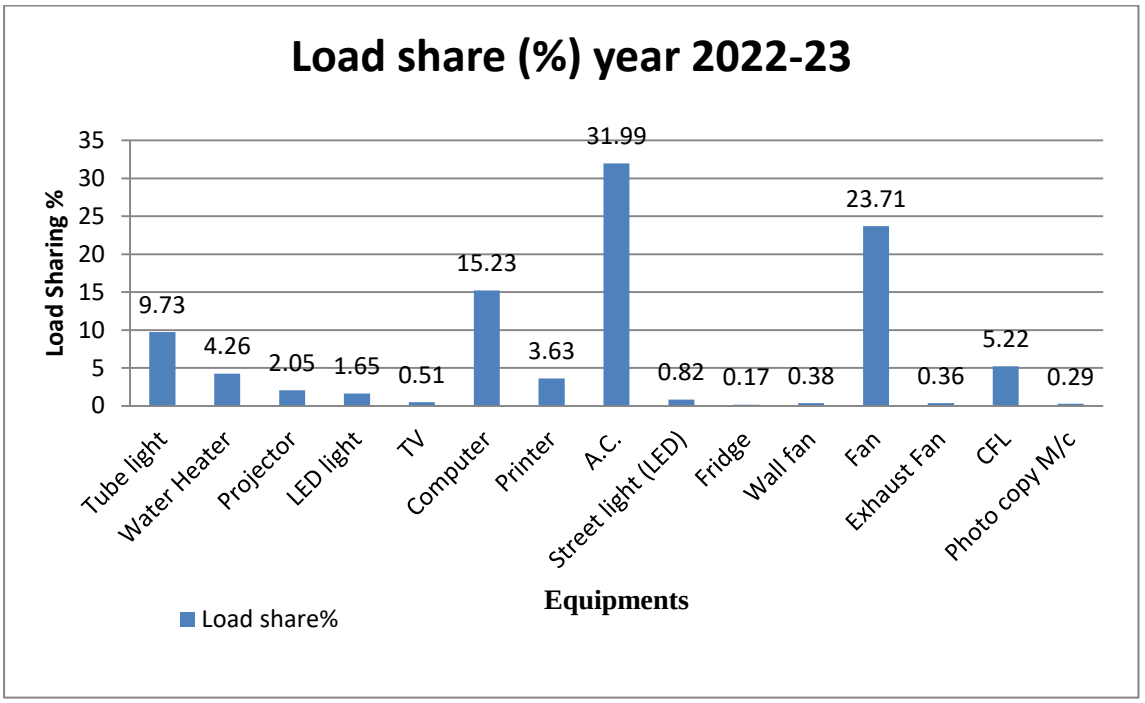

Figure 4.1:- Equipment loading Share % year-2022-23

Observation- The load sharing graph show the maximum load shared by AC (31.99 %), Fan (23.71%) & computers (15.23%).

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Fig. 4.2- 24 Hours 3-phase load recording by power analyzer LM-30

Fig. 4.3- Engg. Block 3-phase load recording by power analyzer LM-30

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4.7 Some Photographs of Electrical Equipment's

Figure 4.4 Electrical Equipments in college

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CHAPTER- 5
ENERGY CONSERVATION MEASURES

Case Study No. 1-Installation of capacitor bank to improve power factor

Sr. No.	Month & Year	Average Power Factor	PF Incentive loss@7% of energy charges (Rs.)	PF Surcharge (Rs.)
1	Aug-22	0.79	3223	7931
2	Sep-22	0.84	3323	3368
3	Oct-22	0.83	3081	4068
4	Nov-22	0.81	963	1836
5	Dec-22	0.77	944	2907
6	Jan-23	0.73	432	1870
7	Feb-23	0.76	411	1410
8	Mar-23	0.77	1129	3541
9	Apr-23	0.87	2546	1141
10	May-23	0.87	3293	1482
11	Jun-23	0.82	3458	5891
12	Jul-23	0.78	3715	10704
13	Aug-23	0.62	3583	18478
	Average	**0.79**	**30,101/-**	**64,623/-**

Observation- It is observed that due to low power factor grid charges penalty per month around **Rs. 64623/-** & good potential to convert PF incentive loss **Rs. 30,101/-** into saving. Total potential to save per year is **Rs.94, 724/-.**

PF saving calculation

- Existing power factor= 0.79
- Recommended power factor=0.998
- Recommended capacity of capacitor bank (Total Load) 100 KVA) =35 KVAr
- Recommended capacity of capacitor bank (MBA+ENGG+ADMIN Block) =25 KVAr
- Expected saving= 94,724/-
- Expected investment = 50,000/-
- Simple payback period= 6.5 months

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Case Study No. 2

Replacement of 50W conventional ceiling Fans by 28W BLDC Energy efficient ceiling fans in phase manner.

Sr. No	Item	Parameter	Unit
1	Rated Power of Ceiling Fan	50	Watt
2	No. of Fan	556	Nos
3	Working Hrs./Day	8	Hrs./Day
4	Working Days/Year	250	Days/Year
5	Energy Efficient BLDC Fan Rated power	28	Watt
6	Energy Saving Potential	24,464	kWh/Year
7	Load Factor	0.8	%
8	Expected Annual Energy Saving	19,571	kWh/Year
9	Per Unit Charges	7.38	Rs/kWh
10	Expected Money Saving	1,44,433	Rs./Year
11	Cost of New Celling Fan	2,000	Rs./Pices
12	Investment on New Fan Purchasing	11,12,000	Rs.
13	Maintenance Investment@2%	22,240	Rs.
14	Total Investment	11,34,240	Rs.
15	Simple Pay Back Period	7.8	Year

Total Calculated Monetary Saving Potential in Celling Fan replacement is

= Rs 1, 44,433/year

Note:- Energy savings depend on the operation hour per day and the load factor of thesystems.

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Case Study No. 2

Replacement of 36W conventional Tube Light by 15W LED bulb.

Sr. No	Item	Parameter	Unit
1	Rated Power of conventional Tube Light	36	Watt
2	No. of Tube Light	317	Nos
3	Working Hrs./Day	5	Hrs./Day
4	Working Days/Year	250	Days/Year
5	Energy Efficient LED Rated power	15	Watt
6	Energy Saving Potential	8,321	kWh/Year
7	Load Factor	0.8	%
8	Expected Annual Energy Saving	66657	kWh/Year
9	Per Unit Charges	7.38	Rs/kWh
10	Expected Money Saving	49,128	Rs./Year
11	Cost of New LED Bulb	80	Rs./Pices
12	Investment on New LED Purchasing	25,360	Rs.
13	Maintenance Investment	0	Rs.
14	Total Investment	25,360	Rs.
15	Simple Pay Back Period	5	Month

Observation- Total 317 conventional tube lights connected in institute campus of 36 W. In which 80% tube lights count in working at a time & 20% tube light count as a stand by load, so load factor consider 0.8 % on this basis expected annual energy saving is 8,321 kWh/year.

Grid charge per unit Rs. 7.38/- so expected yearly saving is Rs 49,128/-. Unit price of LED bulb is Rs. 80/- on this basis Rs.25,360/- investment to replace conventional tube lights .

This investment payback period is only 5 months

Total Calculated Monetary Saving Potential in Tube Light replacement = Rs 49,128/year-

Note:- Energy savings depend on the operation hour per day and the load factor of the Systems

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Case Study No. 3

Replacement of 15W conventional CFL by 9W LED bulb.

Sr. No	Item	Parameter	Unit
1	Rated Power of conventional CFL	15	Watt
2	No. of CFL	408	Nos
3	Working Hrs./Day	5	Hrs./Day
4	Working Days/Year	250	Days/Year
5	Energy Efficient LED Rated power	9	Watt
6	Energy Saving Potential	3060	kWh/Year
7	Load Factor	0.8	%
8	Expected Annual Energy Saving	2448	kWh/Year
9	Per Unit Charges	7.83	Rs/kWh
10	Expected Money Saving	19,167	Rs./Year
11	Cost of New LED Bulb	80	Rs./Pices
12	Investment on New LED Purchasing	32,640	Rs.
13	Maintenance Investment	0	Rs.
14	Total Investment	32,640	Rs.
15	Simple Pay Back Period	1.7	year

Observation- Total 136 conventional CFL connected in institute campus of 15 W. In which 80% CFL count in working at a time & 20% CFL count as a stand by load, so load factor consider 0.8 % on this basis expected annual energy saving is 3060 kWh/year.

Grid charge per unit Rs. 7.83/- so expected yearly saving is Rs 19,167/-. Unit price of LED bulb is Rs. 80/- on this basis Rs.32, 640/- investment to replace conventional CFL .
This investment payback period is only 1.7 years

Total Calculated Monetary Saving Potential yearly in CFL replacement = Rs 19,167/-

Note:- Energy savings depend on the operation hour per day and the load factor of the Systems

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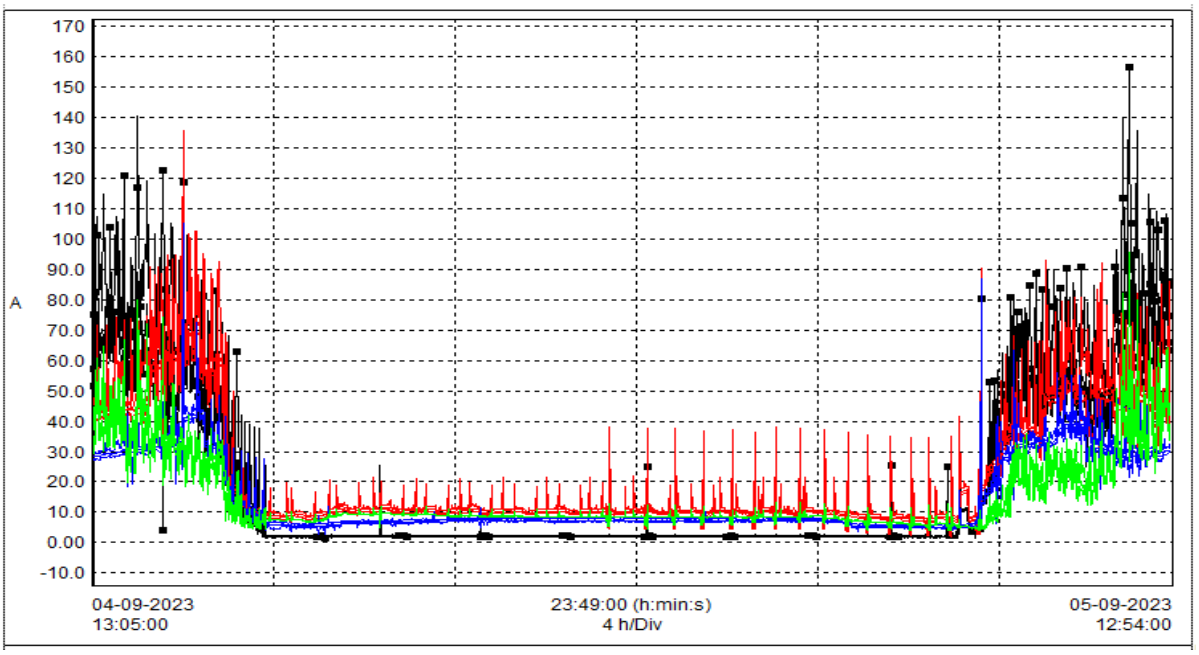
Case Study No. 4-

Load sharing current recorded by LM-30 Power Analyzer

Name	Date	Time	AVG	MIN	MAX	Units	Duration	Units
A1 rms	04-09-2023	13:05:00	31.19	1.330	156.8	A	23:50:00	(h:min:s)
A2 rms	04-09-2023	13:05:00	27.15	2.090	135.9	A	23:50:00	(h:min:s)
A3 rms	04-09-2023	13:05:00	18.21	2.750	105.3	A	23:50:00	(h:min:s)
AN rms	04-09-2023	13:05:00	18.06	3.960	95.71	A	23:50:00	(h:min:s)



Observation- It is observing that 3-phase current recorded as R-Phase Maximum 156 A & Average 31 A, Y-Phase Maximum 135 A & Average 27 A & B-Phase Maximum 95 A & Average 18 A. It is also observe that the Neutral current recorded about 18 A due unbalance condition in 3-phase.

Unbalance current sharing increase the connected devices heat may be over heated & lamination fails.

Recommendation: Maintenance required balancing the 3-phase load sharing. Unbalance Load sharing also increase the energy meter reading. Proper Ground Earthing required

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Case Study No. 5

Solar power generation yearly & expected saving

Sr. No.	Month & Year	Grid Consumption	Solar Generation Export (kWh)	Grid Energy Charge (Rs.)	Total Charge (Rs.)	Solar Export Saving (Rs.)	Billing Charge (Rs.)
1	Aug-22	6237	410	7.38	49054.86	3025.8	46029.06
2	Sep-22	6432	0	7.38	47468.16	0	47468.16
3	Oct-22	5963	1311	7.38	53682.12	9675.18	44006.94
4	Nov-22	1863	1802	7.38	27047.7	13298.76	13748.94
5	Dec-22	1826	1430	7.38	24029.28	10553.4	13475.88
6	Jan-23	835	2054	7.38	21320.82	15158.52	6162.3
7	Feb-23	794	2076	7.38	21180.6	15320.88	5859.72
8	Mar-23	2184	1372	7.38	26243.28	10125.36	16117.92
9	Apr-23	4871	1204	7.53	45744.75	9066.12	36678.63
10	May-23	6245	762	7.53	52762.71	5737.86	47024.85
11	Jun-23	6560	668	7.53	54426.84	5030.04	49396.8
12	Jul-23	7047	135	7.53	54080.46	1016.55	53063.91
13	Aug-23	6797	175	7.53	52499.16	1317.75	51181.41
Total		**57,654**	**13399**		**5,29,540**	**9,9,326**	**4,30,214**

- Total electricity consumption from Grid (Aug-22 to Aug-23) is 57,654 units on this consumption electricity charge paid Rs. 5, 29,540/- . The Solar energy export to grid is 13399 units and save the amount Rs. 9, 9,326/-
- Two 25 KWp Solar system units installed on Institute Roof Top.
- 1 KWp Solar system can generate around 3.5 Units/day
- 25 KWp Solar system can generate around 87 Units/day
- 2 Units of 25-25 KWp solar system should generate 174 Units/day
- Expected annual solar unit loss 63,510 Units/year.

Recommendation:

- 25-25 KWp Solar system required maintenance
- Solar Power Saving **Rs. 99326/-** may increase maximum up to **Rs. 531360/-** per year

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Fig. 5.1 Transformer & MBA block power measurement

Fig. 5.2 Admin block power measurement

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Case Study No. 6

Energy saving potential to replace conventional water pump by energy efficient star rated pump

Sr. No.	Location	Voltage (V)	Current (I)	Power Factor	Input Power KW	Working Hours	Energy KWh/day	Power consumed/ month KWh
1	Water Pump (Ground)	420	15.2	0.84	3.7	5	18.5	462.5

Fig. 5.3 Water Pump

Observation: It is noted that the 5 HP motor used to supply the water in Engg. Block, MBA block & canteen in 5 hours running motor consumed the 18.5 KWh/day, means 18.5 units/day. College working days count 250 days per year than annual energy consumption 4625 units.

Recommendation: It is recommended that the old motor pump replaced by energy efficient star rated motor good scope to save power.

Expected annual energy saving @ 25% of annual energy consumption units.

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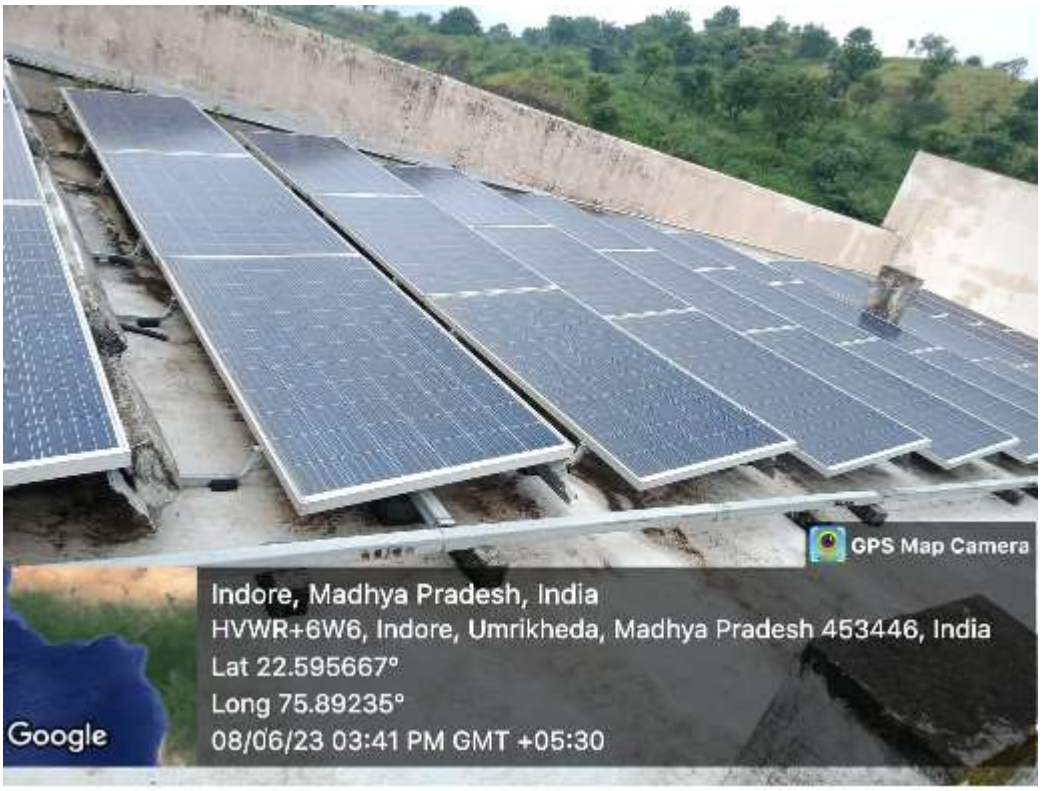

Fig.- 5.4 - 25 KWp PV Power Tech Solar Panels Installation

Fig.-5.5 25 KWp PV Renewsys Solar Panels Installation

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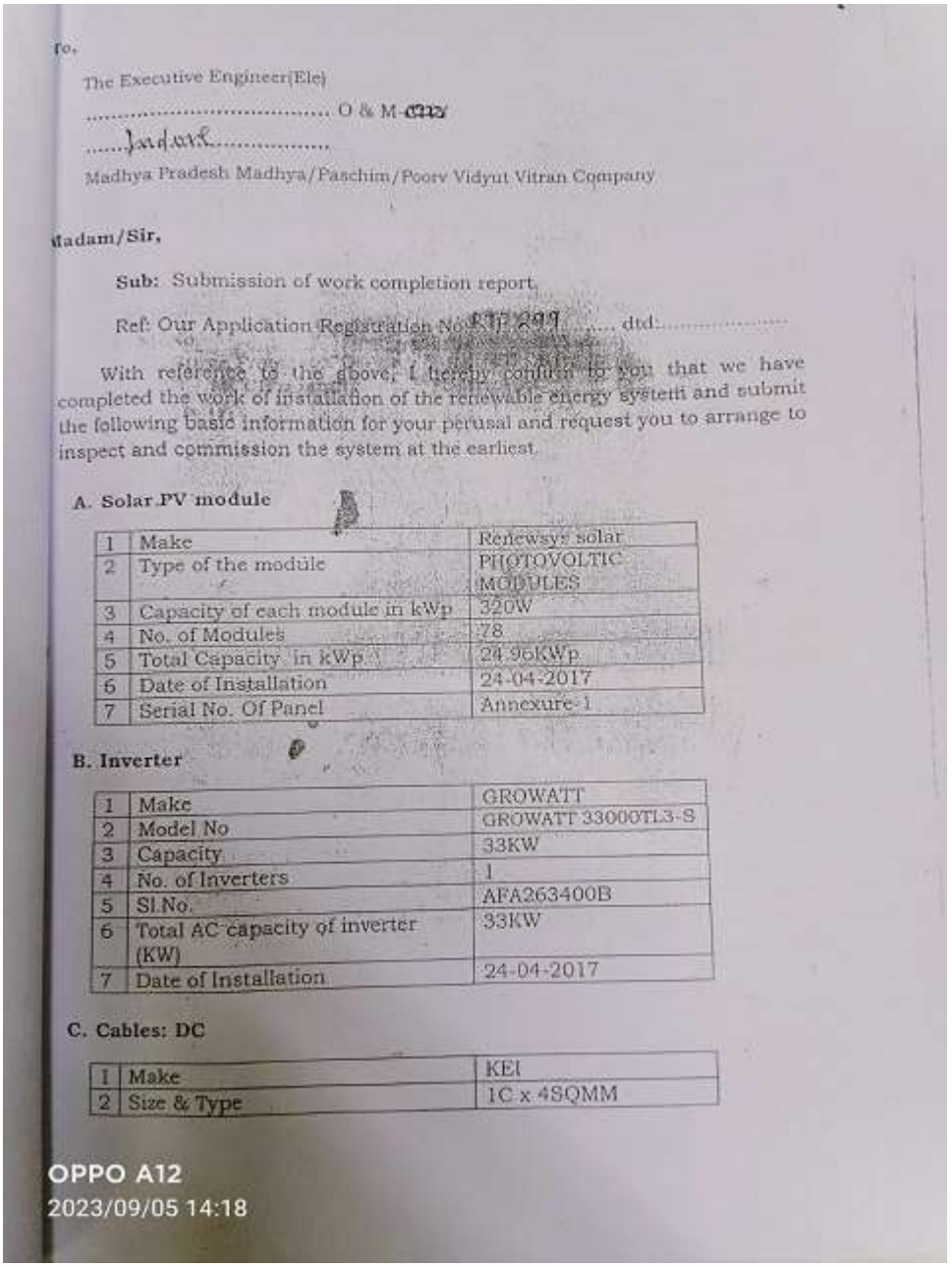
Annexture-01 Purchase Order & work completion of Solar System



To,

The Executive Engineer(Ele)

..... O & M-

.....Indore.....

Madhya Pradesh Madhya/Paschim/Poorv Vidyut Vitran Company

Madam/Sir,

Sub: Submission of work completion report.

Ref: Our Application Registration No. ..... dtd:.....

With reference to the above, I hereby confirm to you that we have completed the work of installation of the renewable energy systetn and submit the following basic information for your perusal and request you to arrange to inspect and commission the system at the earliest.

A. Solar PV module

1	Make	Renewsys solar
2	Type of the module	PHOTOVOLTIC MODULES
3	Capacity of each module in kWp	320W
4	No. of Modules	78
5	Total Capacity in kWp	24.96kWp
6	Date of Installation	24-04-2017
7	Serial No. Of Panel	Annexure-1

B. Inverter

1	Make	GROWATT
2	Model No	GROWATT 33000TL3-S
3	Capacity	33KW
4	No. of Inverters	1
5	Sl.No.	AFA263400B
6	Total AC capacity of inverter (KW)	33KW
7	Date of Installation	24-04-2017

C. Cables: DC

1	Make	KEI
2	Size & Type	1C x 4SQMM

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END OF THE REPORT

THANKS

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