A

Report

On

Energy Audit

For

Ahmednagar Jilha Maratha Vidya Prasharak Samaj's

Shri Chhatrapati Shivaji Maharaj College of Engineering, Ahmednagar

Prepared by

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ACKNOWLEDGEMENT

We express our sincere gratitude to the management of for Ahmednagar Jilha Maratha Vidya Prasarak Samaj's, Shri Chhatrapati Shivaji Maharaj College of Engineering for giving us an opportunity to carry out the project of Energy Audit.

We are extremely thankful to all the staffs for their support in carrying out the studies and for input data, and measurements related to the project of Energy audit. We also congratulate our Energy audit team members for successfully completing the assignment in time and making their best efforts to add value.

We do hope that you will find the recommendations given in this report will be useful to save energy. We welcome any suggestions from your side as to serve you better.

Mr.Sujitkumar Pote

Sarvashree Technogreen Private Limited

DISCLAIMER

Energy Audit Team has prepared this report for **Ahmednagar Jilha Maratha Vidya Prasarak Samaj's, Shri Chhatrapati Shivaji Maharaj College of Engineering** based on input data submitted by the representatives of Campus complemented with the best judgment capacity of the expert team. The audit was conducted on the sample basis by visiting the campus and interacting with the various stakeholders. Audit was conducted by interviewing the concerned persons, observing on-site implementation and verifying the documents and records.

While all reasonable 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 recommendations are arrived following best judgments 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.

Mr. Sujitkumar Pote

Sarvashree Technogreen Private Limited

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List of Abbreviations

SEC	-	Specific Energy Consumption

List of Units

^{o}C	-	Degree Celsius
CFM	-	Cubic Feet per Minute
CMH	-	Cubic Meter per Hour
LPM	-	Litres Per Minute
Kg/cm^{2}	-	Kilogram per centimetre square
kW	-	Kilo Watt
kWh	-	Kilowatt hour
KOE	-	Kg of Oil equivalent
m^{3} /hr.	-	Meter cube per hour
Nm^{3} /hr.	-	Normal Meter cube per hour
MW	-	Mega Watt
MWh	-	Megawatt hour

1. ENERGY CONSUMPTION PROFILE

The working details of assignment are as follows:

Project	Energy Audit
Client	Ahmednagar Jilha Maratha Vidya Prasarak Samaj's, Shri Chhatrapati Shivaji Maharaj College of Engineering.
Industry	Private Educational Engineering Institute
Contact	Mr. Nikam Sir
Site	Shri Chhatrapati Shivaji Maharaj College of Engineering, Ahmednagar-Kalyan Road, Nepti, Tal and Dist Ahmednagar
Consultant	Sarvashree Technogreen Private Limited
Duration	12-05-2023 to 15-05-2023
Project Work Scope	Detailed Energy Audit in the institute to study energy consumption and assess the loss in the system.
Report	This report gives Detail Energy consumption, suggestions to minimize energy losses

Table.1.Assignment

1.1 About Shri Chhatrapati Shivaji Maharaj College of Engineering

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's, Shri Chhatrapati Shivaji Maharaj College of Engineering, is affiliated by Savitribai Phule Pune University. The journey of Shri Chhatrapati Shivaji Maharaj College of Engineering began on year 2011 with a vision and mission of Shri Chhatrapati Shivaji Maharaj College of Engineering "to impart quality education through effective teaching learning methodologies".

Today, the college has four faculties – Civil Engineering, Mechanical Engineering, Electronic and Telecommunication Engineering and Computer Engineering. This is also certified by ISO 9001:2015.

Source of Energy:

Shri Chhatrapati Shivaji Maharaj College of Engineering, Nepti, Ahmednagar, uses Energy in following forms:

a. Electricity from MSEDCL :

Shri Chhatrapati Shivaji Maharaj College of Engineering receives Electricity from Ahmednagar, Nepti Circle.

b. High Speed Diesel Generator (HSDG):

HSD is used as a fuel for Diesel Generator which is run whenever power supply from MSEDCL is not available. Kirloskar 15KW and GPWLL 62.5KVA.

c. Roof Top PV Solar System (60 KW) installed on terrace of Annex Building.

Following are the major consumers of electricity in the facility:

Computers	Xerox machines
Lighting	CCTV
Air-Conditioning	UPS
Fans	LCD Projector
Other Lab Equipment	Router system
Printers	Flood light
	Pumping motor

2. APPROACH AND METHODOLOGY

2.1 Approach

A team of 4 engineers were involved in carrying out the study; the scope of study was as follows:

- Identify areas of opportunity for energy saving and recommend an action plan to bring down total energy cost
- Conduct energy performance evaluate on and process optimization on study
- Conduct efficiency test of equipment and make recommendations for replacement (if required) by more efficient equipment with projected benefits
- Suggest improved opera on & maintenance practices
- Provide details of investment for all the proposals for improvement
- Evaluate benefits that accrue through investment and payback period
- Analyse various energy conservation on measures and to prioritize based on the maximum energy saving & investment i.e. short, medium and long term.

Prioritization	Payback Period
Short Term Project	Less than 6 months
Medium Term Project	Between 6 to 12 months
Long Term Project	More than 12 months

Table 2.Scope of Study

- Discuss with the plant personnel, the individual Energy Saving Projects (ESPs) for agreement for implementation.

2.2 Methodology

- The general methodology followed is captured in the following figure –

Figure 1. Methodology flow

The study was conducted in 3 stages:

- Stage 1: Walk through audit to understand process energy drivers, measurability and formula one of audit plan
- Stage 2: Detailed Energy audit
- Stage 3: Off-site work for data analysis and report preparation

2.3. List of Equipment & Instruments Used for Energy Audit:

The following portable instruments were used for data measurement:

- 3 – phase Power Analyzer
- Single phase Power Analyzer
- Ultrasonic Water Flow Meter
- Anemometer
- Hygrometer
- Sling Hygrometer
- Digital Thermometer
- Infrared Thermometer
- Pressure gauge
- Thermal Imager
- Flue Gas Analyzer
- Lux Meter

3. HISTORICAL DATA ANALYSIS

3.1 Electricity supply and consumption

The electricity consumed through MSEDC is Charges: Rs. 2,95,662.00/-

The Diesel as a thermal energy source is used mainly in DG Sets of

Total Consumption on of Diesel in the Apr-2022 to March-2023 was:

Total Diesel in Ltr.1,004

Cost of Diesel: Rs. 85,400.00/-

The Institute has a solar power generating system of .

Total Solar Generated Electricity by unit is 34781 KWH of cost approx.5,66,234.70/-

Electricity (INR)	Diesel (INR)	Solar Energy	Total Cost of Energy	% of electricity	% of Diesel	% of Solar
2,95,662.00	85,400.00	5,66,234.70	9,47,296.70	31.21	9.02	59.77

Table 3. **Total Cost of Energy Consumed by Institute in the Last 12 Months**

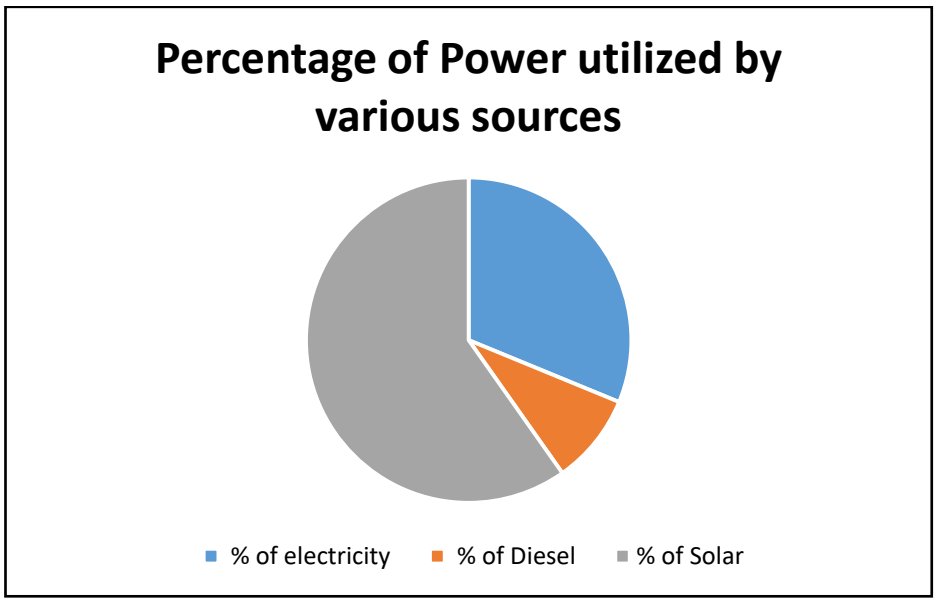

Fig.2 Percentage of Power utilized

3.2 Study of Variation of Monthly Units consumption, Electricity bill & Power Factor

In this Chapter, we study the details of the 12 month Electricity Bills.

Sr. No.	Month	Power Factor	Unit Consumption (KWH)	Bill Amount (RS)	Demand KVA
1.	April-22	0.99	1431	20978.85	16
2.	May -22	0.98	2294	29006.32	16
3.	June-22	0.96	2281	32589.26	16
4.	July-22	0.99	2163	31114.46	16
5.	August-22	0.99	1611	24714.76	16
6.	September-22	0.99	1807	26887.45	16
7.	October-22	0.99	1245	21657.49	16
8.	November-22	0.97	1241	22008.15	16
9.	December-22	0.99	1458	24472.71	16
10.	January-23	0.97	735	16638.48	16
11.	February-23	0.98	978	23264.69	16
12.	March-23	0.99	919	22329.39	16
	Average	**0.98**	**1513**	**24638.50**	**16**
	Yearly Total		**18163**	**295662.01**	

Table No 4 V a r i a t i o n in Units Consumption & Power Factor (PF)

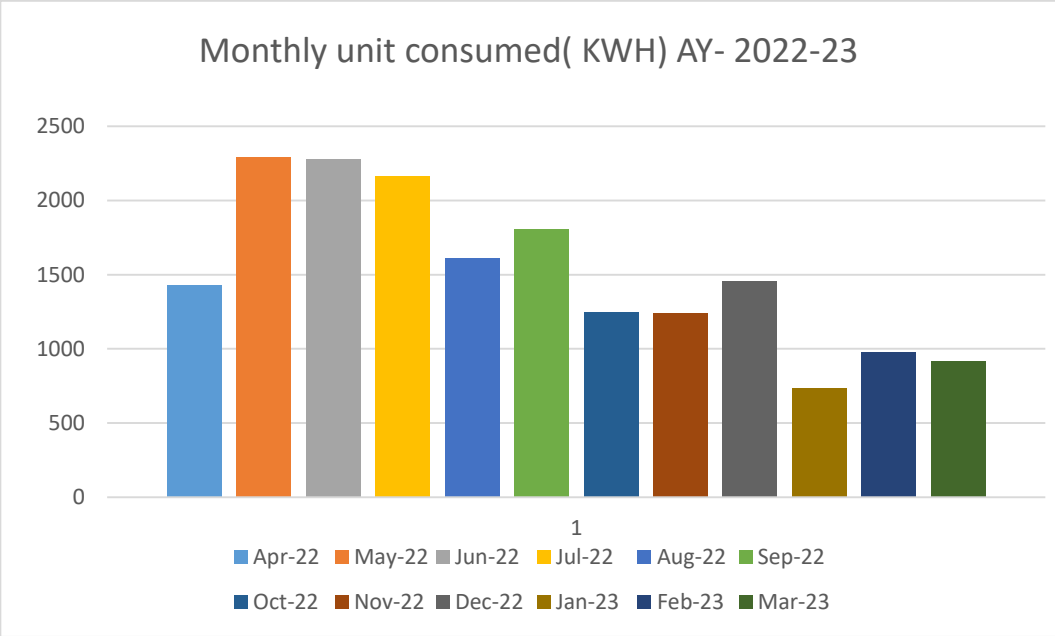

Figure 3. Electrical Energy Consumption month wise

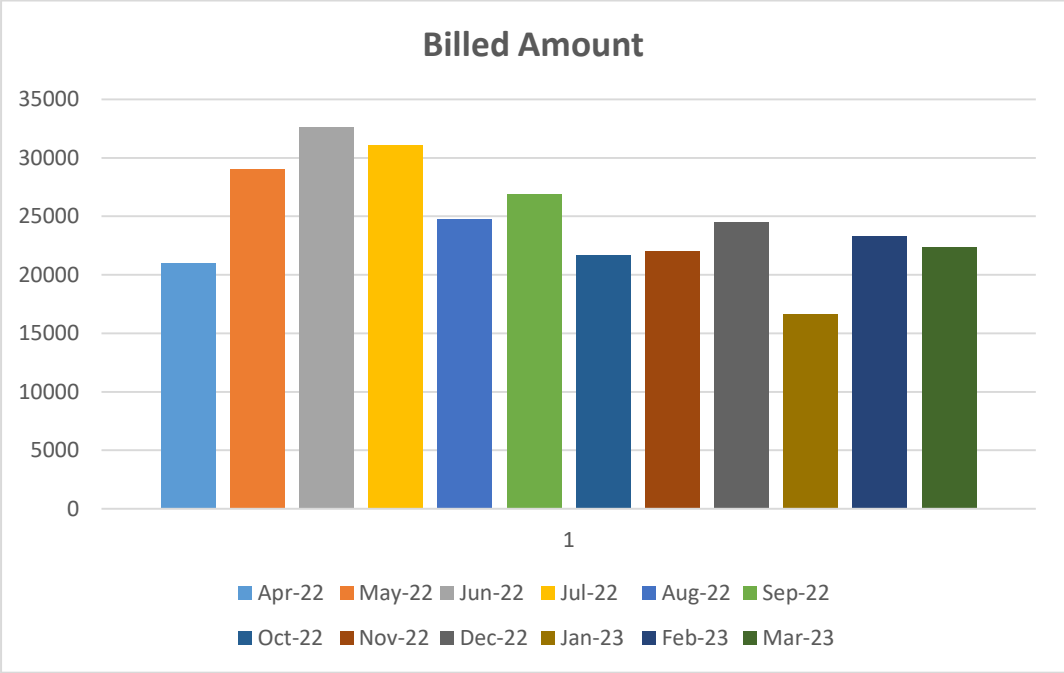

Figure 4. Billed Amount in last 12 months

- It can be seen from figure 1, that electricity consumption on in the month of May and June 22' is the highest. Average Power Factor in the period of Apr-22 to Mar-23 is 0.98. It is recommended to install Automatic Power Factor Control Panel to achieve Power Factor near to 1.00 .

- It is recommended to have a regular check on the Power Factor to maintain it. Capacitors shall be tested every quarter and replaced if not working properly.

Conclusion: Variation of PF, The Power Factor to reduce the utility power bill. Most utility bills are influenced by KVAR usage. A good Power Factor provides a better voltage. Reducing the pressure on electrical distribution network. Reducing cable heating, cable over loading and cable losses. Reducing over loadings of control gears and switch-gears etc.

Whenever the average power factor over a billing cycle or a month, whichever is lower, of a High Tension consumer is below 90%, Penal charges shall be levied to the consumer at the rate of 2 % (two %) of the amount of monthly energy bill (excluding of Demand Charges, FOCA, Electricity Duty and Regulatory Liability Charge etc.)

For power factor of 0.99, the effective incentive will amount to 5% (five percent) reduction in the energy bill and for unity power factor; the effective incentive will amount to 7% (seven percent) reduction in the energy bill.

3.3 General Observations based on Electricity Bill

1. For College Campus the Contract Demand (CD) is 39.5 kVA and minimum billing Demand is less than 50% of the Contract Demand, Maximum Demand recorded whichever is higher. Since, the MD recorded is less than 18kVA.
2. The average electricity cost is Rs.16.28 considering the last twelve months average units and bill.
3. Average monthly Power Factor is maintained near P.F. 0.98.
4. Power factor is affected during June 2022 is 0.96, which need to improve power factor up to 0.9.

4. ACTUAL LOAD MEASUREMENT

4.1 APPLIANCES/LIGHTING LOAD

Sr No.	Location	Name of Appliance	Power Rating (Watt)	Quantity	Power Consumption (Watt)	Usage per Day Hr	Power Consumption /day (Watt)
1	Principal Office	Fan	80	2	160	2	320
		CFL	40	1	40	2	80
		LED	9	10	90	2	180
		PC	60	1	60	2	120
		Printer HP1020	150	1	150	0.5	75
		LED TV 43Inch	40	1	40	1	40
		AC 1 Tonn	1750	2	3500	1	3500
		CCTV	5	1	5	24	120
		Modem	5	1	5	3	15
2	Principal Office Entrance	Fan	80	1	80	2	160
		FTL	40	1	40	2	80
		LED	40	2	80	1	80
3	Main Corridor	Electronic Bell	5	1	5	2	10
		Speaker	50	1	50	0.5	25
		Router	100	1	100	3	300
		D-Link	5	1	5	3	15
		CCTV	5	2	10	24	240
		FTL	40	1	40	2	80
4	Conference Room	FTL	40	2	80	2	160
		Fan	80	2	160	2	320
		Projector	180	1	180	0.5	90
		AC 1 Tonn	1750	1	1750	2	3500
5	Administration Office	FTL	40	4	160	1	160
		LED	18	2	36	2	72
		Fan	80	4	320	2	640
		PC	80	7	560	0.5	280
		Printer	150	4	600	0.5	300
		CCTV	5	2	10	24	240

		Thumb Machine	15	1	15	0.5	7.5
6	Ground Floor Corridor	D link	5	5	25	3	75
		Incandescent Bulb	60	5	300	3	900
		LED Bulb	50	4	200	2	400
		Display	20	1	20	3	60
		CCTV	5	1	5	24	120
		FTL	40	6	240	1	240
		Router	150	2	300	2	600
7	Room No. 038	FTL	40	1	40	1	40
		Fan	80	1	80	2	160
		PC	80	1	80	1	80
		Printer	150	1	150	0.5	75
8	Gymnasium	FTL	40	3	120	1	120
		Fan	80	3	240	2	480
9	Sport Section	LED	9	1	9	2	18
		Fan	80	3	240	2	480
		PC	80	2	160	1	160
		Printer	150	2	300	0.5	150
10	IQAC Cell	FTL	40	1	40	2	80
		LED	9	4	36	2	72
		Fan	80	3	240	2	480
		PC	80	5	400	1	400
		Printer	150	2	300	0.5	150
		Scanner	150	1	150	2	300
		Projector	150	1	150	0.5	75
11	Geotechnical Laboratory	Fan	80	3	240	2	480
12	CE HOD Cabin	FTL	40	1	40	2	80
		PC	80	1	80	3	240
		Printer	150	1	150	0.5	75
13	Fluid Mechanics	Incandescent Bulb	60	1	60	0	0
		Fan	80	3	240	2	480
14	Transportation Lab	FTL	40	3	120	1	120
		Fan	80	2	160	2	320
15	Concrete Technology Laboratory	FTL	40	1	40	1	40
		Incandescent Bulb	60	2	120	1	120

		Fan	80	3	240	2	480
16	Project Lab, Room No. 109	Fan	80	2	160	2	320
		FTL	40	2	80	1	80
17	Strength of Material	LED	18	1	18	2	36
		Fan	80	3	240	2	480
		PC	80	1	80	1	80
18	CAD Laboratory	LED	9	1	9	2	18
		Fan	80	3	240	2	480
		PC LCD	80	16	1280	1	1280
		Printer	150	2	300	0.5	150
		Laptop	80	1	80	3	240
		Projector	150	1	150	0.5	75
19	Environmental Laboratory	FTL	40	2	80	1	80
		Fan	80	1	80	2	160
20	Geology Laboratory	Fan	80	1	80	2	160
		Laptop	80	1	80	2	160
21	Classroom 106 to 113	Fan	80	32	2560	2	5120
		CCTV	5	8	40	24	960
22	MQC Laboratory	Fan	80	2	160	2	320
23	Fluid Mechanics	Fan	80	1	80	2	160
		Advance Hydraulic pump, 1HP/0.75w	0.75	1	0.75	2	1.5
		Fan	80	3	240	2	480
		FTL	40	1	40	1	40
24	IC Engine Laboratory	Fan	80	4	320	2	640
26	Theory of Machine Lab	Fan	80	2	160	2	320
		PC	80	1	80	1	80
27	Girls Common Room	Fan	80	2	160	3	480
		FTL	40	1	40	1	40
28	Applied	Fan	80	3	240	2	480

	Thermodynamics						
30	Basic Electronics Lab	Fan	80	2	160	2	320
31	Digital System Laboratory	Fan	80	1	80	2	160
32	Electronic and Communication Lab 1	Fan	80	1	80	2	160
34	Embedded & VLSL Lab	FTL	40	2	80	1	80
		DLink Switch	5	1	5	2	10
		PC	80	8	640	1	640
		Fan	80	1	80	2	160
35	Computer Lab E&TC	FTL	40	2	80	1	80
		Fan	80	3	240	2	480
		PC	80	8	640	1	640
37	Classroom No.139,143,144,145,146	Fan	80	20	1600	2	3200
		FTL	40	8	320	1	320
		PC	80	4	320	1	320
		CCTV	5	5	25	24	600
38	Physics	FTL	40	2	80	2	160
		Fan	80	3	240	2	480
39	Electronics and Telecommunication Lab	DTH Set Top	15	1	15	3	45
		Power Supply	15	1	15	3	45
		Fan	80	3	240	2	480
40	Room No. 135, 137	Fan	80	2	160	2	320
		PC	80	1	80	1	80
41	Computer Center	Fan	80	6	480	2	960
		PC	80	40	3200	4	12800
		CCTV	5	4	20	24	480
		D-Link Switch	5	4	20	2	40
42	Room No. 122	Fan	80	1	80	2	160
		PC	80	6	480	1	480
43	Room No. 122	FTL	40	1	40	2	80
		Fan	80	1	80	2	160
		PC	80	4	320	1	320
44	Hardware Lab	Fan	80	1	80	2	160

		FTL	40	1	40	2	80
		PC	80	1	80	1	80
		BSNL Internet Router, Batteries 12v, 42Ah	10	3	30	3	90
		Modem	5	1	5	3	15
45	Network Lab	Fan	80	3	240	2	480
		PC	80	4	320	1	320
46	Programming Lab	Fan	80	3	240	2	480
		PC	80	18	1440	1	1440
		D-Link Switch	5	1	5	2	10
		CCTV	5	1	5	24	120
47	Computer Graphics lab	PC	80	19	1520	1	1520
		Fan	80	4	320	2	640
		FTL	40	1	40	2	80
		D-Link Switch Connector	5	1	5	2	10
		CCTV	5	1	5	24	120
48	Network Lab	FTL	40	3	120	1	120
		PC	80	22	1760	4	7040
		D-Link Switch Connector	5	1	5	2	10
		CCTV	5	1	5	24	120
49	Project Lab 1	FTL	40	2	80	1	80
		Fan	80	3	240	2	480
		CCTV	5	2	10	24	240
		PC	80	18	1440	4	5760
		D-Link Switch Connector	5	1	5	2	10
50	Project Lab 2	FTL	40	1	40	1	40
		Fan	80	4	320	2	640
		CCTV	5	2	10	24	240

		PC	80	28	2240	0.5	1120
		D-Link Switch Connector	5	1	5	2	10
51	Server Room	PC	80	2	160	1	160
		Fan	80	1	80	2	160
		FTL	40	1	40	1	40
		CCTV	5	1	5	24	120
		Power Supply 3.9A, 150-235v,50-60Hz	15	1	15	3	45
52	Yoga Meditation Hall	FTL	40	6	240	1	240
53	First Floor Corridor	CCTV	5	8	40	24	960
		Display Board	80	1	80	1	80
54	Library	Xerox Machine	500	2	1000	1	1000
		Fan	80	10	800	2	1600
		FTL	40	2	80	1	80
		PC	80	8	640	1	640
		Printer	150	1	150	0.5	75
		CCTV	5	3	15	24	360
55	Tutorial Room	Router	100	1	100	3	300
		FTL	40	1	40	1	40
56	UPS Room	UPS Inverter 7.5KVA	750	2	1500	3	4500
		Batteries 160 A	150	16	2400	24	57600
		Batteries 150 A	150	16	2400	24	57600
58	Water Cooler/RO/	150 Lit	150	2	300	2	600
59	**Canteen**	Referigerator; 200 liter	430	1	430	24	10320
		FTL	40	6	240	3	720
		Fan	80	4	320	2	640

		Cooler Water	800	1	800	3	2400
60	**Porch**	FTL	40	1	40	3	120
		CCTV	5	2	10	24	240
61	**Campus**	Outdoor Flood LED	200	4	800	5	4000
		Pole Light LED	100	15	1500	5	7500
62	**Entry Security Cabin**	FTL	40	2	80	3	240
		Fan	80	2	160	2	320
63	**Main Gate**	CCTV	5	2	10	24	240
		Outdoor Flood LED	150	1	150	10	1500
64	**Second Floor**	FTL	40	15	600	8	4800
		Fan	80	15	1200	6	7200
		LED Bulb	12	3	36	8	288
		Outdoor FTL	40	4	160	8	1280
	2nd Floor Toilet	LED Bulb	9	4	36	8	288
	2nd Floor Wash room	LED Bulb	9	4	36	8	288
					Total Load	**Daily (Watt)**	**246679**
						Daily Kw	**246.68**
						Monthly Kw	**6413.65**
						Yearly Kw	**76963.8**

Table No.5 APPLIANCES/LIGHTING LOAD

4.2 LAB EQUIPMENT LOAD YEARLY

Sr No.	Location	Name of Appliance	Power Rating (Watt)	Qty	Power Consumption (Watt)	Usage per Year (HR)	Power Consumption/day (Watt)
1	Concrete Technology Lab	Sieve Shaker;0.5HP/0.37kw	370	1	370	18	6660
		Direct Share Testing M/c; 50Hz	300	1	300	18	5400
		Compression Testing machine	500	1	500	18	9000
		Oven;1.5kw	1500	1	1500	18	27000
		Vane Share Testing Machine	35	1	35	18	630
		Infrared Moisture Balance	300	1	300	18	5400
		Weighnig Machine 1kg	300	1	300	5	1500
2	Hydraulics Lab	Venturi/ Orifice meter Motor;0.25HP	186	2	372	2	744
		Bernollies Theorem Motor;0.25HP	186	1	186	2	372
		Multitube Manometer Speed Controller;3PH, 380v	150	1	150	2	300
		Tilting Fumes;1.5Hp/1.1Kw	1100	1	1100	2	2200
		Centrifugal Pump; 440v	500	1	500	2	1000
		Energy Regulator;230v	300	1	300	2	600
3	Geo Technical Laboratory	Marshall Stability Test	150	1	150	2	300
		Los Angel Test	0.75	1	0.75	2	1.5
		Ductility Test	500	1	500	2	1000
		Ring and Ball Testing Machine;2HP	1500	1	1500	2	3000
		Stipping Valve Test Apparatus; 230v	150	1	150	2	300
4	Concrete Technology	Weighing Machine 100kg	150	1	150	2	300

	Laboratory	Compression Testing machine,220v	600	1	600	2	1200
		Vibrating Machine;0.8HP	597	1	597	2	1194
		Vibrating Machine; 0.75HP	560	1	560	2	1120
5	Strength of Material Laboratory	Tile Abrasion Testing Machine; 0.37kw	370	1	370	2	740
		Torsion Testing, 1Hp	750	1	750	2	1500
		UTM 100 KN	1000	1	1000	2	2000
6	Environmental Laboratory	Flocculator; 0.5HP	375	1	375	2	750
		Conductivity Meter, 230v	300	1	300	2	600
		COD, 1kw	1000	1	1000	2	2000
		Soxhlet Extraction Heater, 220v	300	1	300	2	600
		Flame Photometer, 220v	300	1	300	2	600
		Compressor, 220v	300	1	300	2	600
		Weighing balance, 220v	300	1	300	2	600
		Microbial Colony Counter, 220v	300	1	300	2	600
		Oven Furnace, 2.5Kw	2500	1	2500	2	5000
		BOD Incubator, 0.75kw	750	1	750	2	1500
		High Volume Sampler, 0.75kw	750	1	750	2	1500
7	MQC & I.C Engine Lab	Reciprocating Pump Test, 0.5HP	375	1	375	2	750
8	Fluid Mechanics	Pnumatic Trainer , 1HP	750	1	750	2	1500
		Gear Pump Rig	0.75	1	0.75	2	1.5
		Centrifugal Pump, 1HP/0.75w	0.75	1	0.75	2	1.5
		Impact Jet Apparatus, 0.5HP	375	1	375	2	750
		Turbo Kirloskar Pump, 3.7kw/5HP	3700	1	3700	2	7400

		Turbine Test Rig, 15HP	11190	1	11190	2	22380
9	Heat Transfer Lab	Incandescent Bulb	60	1	60	2	120
		Emmisivity Measurement Apparatus	300	1	300	2	600
		Flux Meter	300	1	300	2	600
		Pin Fin Appartus, 0.5HP	375	1	375	2	750
		Thermal Conductivity Meter	300	1	300	2	600
10	Tom Lab	Cam Analysis	500	1	500	2	1000
		Epicyclic Gear Train, 0.5HP	375	1	375	2	750
11	Girls Common Room	CFL	40	2	80	2	160
		Weighing Machine220gm	300	1	300	2	600
		Weighing Machine120gm	300	1	300	2	600
13	Basic Electronic Lab	Dimmer, 8AMPS	180	1	180	2	360
		Dc Shunt, 50Hz	50	1	50	2	100
		3PH Induction Motor	750	1	750	2	1500
		Slip Rig	300	1	300	2	600
		Squirrel Cage I.M 1 hp	750	1	750	2	1500
		DC Motor, 2HP	1500	1	1500	2	3000
14	Wave Theory and Antenna Lab	RF Motor 10 - 600MHZ	300	1	300	2	600
		Oscillator 50Oh,10-600MHz	300	1	300	2	600
		Communication System Trainer	300	1	300	2	600
15	Basic Electronic Lab	Frequency contrller 50Hz	300	1	300	2	600
		Osciloscope	300	1	300	2	600
16	Classromms	Internet Connector Switch	50	5	250	2	500
17	Physics	Digital Gauss Meter; 200v	300	1	300	2	600

		Hall Effect Set up;200v	300	1	300	2	600
		Ultasonic Interferometer, 200v	300	2	600	2	1200
		Regulator Power Supply;	300	1	300	2	600
18	Electronics & Communication Engineering Lab	CRT TV 220v	100	3	300	2	600
		HDTV Trainer	300	1	300	2	600
		Dipcot	300	1	300	2	600
		PhotoeTech	300	1	300	2	600
		VSWR Meter	300	1	300	2	600
19	Hardware Lab	Catalyst	300	1	300	2	600
20	Yoga Meditation Hall	Incandescent Bulb	60	3	180	2	360
21	First Floor Corridor	Incandescent Bulb	60	10	600	2	1200
		Incandescent Bulb	60	1	60	2	120
22	Workshop	Lath Machine, 3HP	1500	8	12000	2	24000
		Surface planning M/C Motor, 3HP	1500	1	1500	2	3000
		R. Drilling M/C, 3PH, 0.75kw	750	1	750	2	1500
		R. Drilling M/C, 3PH, 0.37kw	750	1	750	2	1500
		Power Hexa M/C,1HP	750	1	750	2	1500
		Grinding M/C, 1.5HP	750	1	750	2	1500
		Drill M/C, 1.5 HP	750	1	750	2	1500
		welding M/C	300	1	300	2	600
		Cutter Machine	300	1	300	2	600
		Lath Machine, 2HP	750	2	1500	2	3000
					Total	**Yearly**	**183914.50**
						Monthly	**15326.21**
						Daily	**589.47**

Table No.6 LAB EQUIPMENT LOAD YEARLY

4.3 SOLAR POWER GENARTAION

Sr. No.	Details of Solar Panel installed				Capacity Factor	Assessed Annual Energy Generation in KWH	Avg. Cost of Utility Power Rs./KWH	Total Assessed Annual Cost Saving in Rs.
	Make	Watt/ Panel	No. of Panel	Total installed generation capacity in KW				
1	Vikram Solar	325	63	20	5	34781	16.28	5,66,234.70

Table No.7 ***SOLAR POWER GENARTAION***

**** This is total load consumption considered approximately. Actual load consumption might be different according to actual use of power for particular time period.***

Calculations:

1. **Total Calculated Load = Yearly Daily load + Yearly Equipment's load**
   A = 76,964+184 =77,148 units

2. **Solar Power Generated= B= 34781 units approx...**
3. **Difference of Load calculated and Solar power generated**
   =C= 77,148- 34,781=42,367 units

4. Yearly approximate units consumed =Electric Unit Consumed + Solar Energy Generated+ Offset Grid Export Unit

=18,163 + 34,781 +8,977= 61,921 units

5. Difference of Total Calculated Load and Yearly Load Consumed

=D=77,148-61, 921=15,227 units

The difference in Total load calculated and actual units utilized is due to the fact that majority of labs are used in semester pattern remains closed or unutilized, so the difference is near about 15,227 units per year or 42 units per day.

Remarks:

- It has been observed that in college majority of electrical power consumption is through light load such as fan, FTL & power load such a etc. unnecessary use of electrical equipment must be avoided.
- As per individual department level load consumption, we understand the scope for improvement of energy saving. Hence our electricity bill will be reduced by proper load management techniques along with optimum utilization of resources.

Observations and suggestions:

- It is found that FTL, Bulbs, CFLs is installed in the facility.
- It is recommended that some tube lights in this area be switched off when sufficient daylight is available.
- Presently, there are no reflectors installed for tube lights.
- Every light or electric gadget left on when not needed is wasting energy and money and is causing pollution that is totally unnecessary.

Don't forget to power down these things when not in use:

- Lights
- Heaters and fans (or air-conditioning)
- Printers and scanners
- Battery and phone chargers
- Computers
- Gaming consoles
- TVs, DVD players
- Stereos
- Kitchen gadgets such as blenders, kettles, toasters etc.

4.4 Merits/Existing Features for Energy Savings

1. Staff vigilance.
2. Computers are connected in LAN.
3. Printers are shared in LAN.
4. Screen savers facility implemented for every computer.
5. AC's used are of three STARS.
6. Refrigerators are of three STARS.
7. Incandescent Bulbs are nowhere used.
8. They are replaced by CFL tubes with electronic choke.
9. Maximum use of natural light.
10. Cross Ventilation is provided in laboratory & class rooms, which reduced number of fans.
11. Most of the practical's are scheduled in noon time where Billing Rate in normal.
12. Walls are painted with off white colour to have sufficient brightness.
13. Solar powered street lamp is used.
14. LED flash light is used in Seminar hall.
15. PV solar system (20KW) is installed which is expected to generate 100 Unit/day.

This saves Rs. 5,66,234.70/Year

5. STUDY OF AIR CONDITIONERS

In the facility for air conditioning there is no centralized system with AHU (air handling unit), but mostly spilt air conditioners are installed.

Load of ACs was as follows:

Item	**Rated Power (kW)**	**Qty**	**Voltage**	**Current Amp**	**Actual Power**
ACs	4	3	406	8.4	3.5

Observations and suggestions:

1. Normal air conditioning temperature should be kept as high as possible (I.e.24 d.cel.).
   By thumb rule, increase in 3 degrees in indoor air temperatures can save 1% of electricity.
2. The ventilation in area can be provided with installation of natural ventilation. Natural Ventilation will also minimize the requirement of exhaust fans.

6. ENERGY CONSERVATION PROPOSALS

6.1 Providing Energy Saver Circuit to the Air Conditioners

The **energy saver circuits for the air conditioners, intelligently reduces the operating hours** of the compressors either by timing or temperature difference logic without affecting the human comfort. This can save around 15% to 30% of the electricity depending on the weather conditions and temperature settings.

There are total 3 split type air conditioners. It is Recommended that the old air conditioners are being replaced with new energy efficient BEE STAR labeled (3 Star and above) air conditioners in a phased manner.

6.2 Replacing Fluorescent Tube Lights (FTL) with LED Tube Lights

The CFLs and FTLs can be replaced with the LED tube lights 16 W. These changes can be made at the places where the life is higher. Usually minimum of 3 years warranty is given and approximate burning hours is 40 000. (15 years considering 8 hours per day running).

6.3 General Recommendations

- All Class Rooms and labs to have **Display Messages** regarding optimum use of electrical appliances in the room like, lights, fans, computers and projectors. Save electricity. **Display the stickers of save electricity**, save nature everywhere in the campus. So that all stakeholders encouraged to save the electricity.
- Sometime the tube lights in a class room are kept ON, even there is sufficient light level near the window opening.
- Trying to get the benefit of -01.50 rates in addition to actual rate for per unit consumption of **electric motor pumping during 2200 – 0600 Hrs.**
- All projectors to be kept OFF or in idle mode if there will be no presentation slides.
- All computers to have power saving settings to turn off monitors and hard discs, say after10 minutes/30 minutes.
- The comfort/Default air conditioning temperature to be set between 24˚C to26˚C.
- Lights in toilet area may be kept OFF during daytime.
- Use AUTOMATIC POWER FACTOR CORRECTION (APFC) Panel FOR PF improvement
- Need to use power saver circuits for AC.

- Need to replace FTL by smart LED Tube.
- Need to replace ordinary bulb by LED bulb.
- Need to replace ordinary CRT monitor by LED.
- Need to replace ordinary refrigerator by BEE power saver refrigerator if possible.
- Out of total electricity bill paid, 53 percentages are actual energy utilized charges and remaining expense belongs to additional taxes on energy consumption.
- Recently govt. has declared the exemption on electricity duty charges for school and colleges trying to get the benefit of the same as soon as possible.

6.4 Executive Recommendations

1. **There has to be Institute level student community that keeps track of the energy consumption.**
   Parameters of the various departments, class rooms, halls, areas, meters, etc
2. **Energy auditing inside the campus has to be done on a regular basis and report should be made public to generate awareness.**
3. **Need to create energy efficiency/ renewable energy awareness among the college campus i.e. solar, wind, Biogas energy. College should take initiative to arrange seminars, lectures, paper presentation competition among students and staff for general awareness.**

7. REFERENCES

1) "Energy Management, Audit and Conservation" by Barun Kumar De

2) "Guide to Energy Management" by Barney L

3) "Energy Audits: A Workbook for Energy Management in Buildings" by Tarik Al–Shemmeri

4) "Fundamentals of Energy Conservation and Audit" by Agarkar Santosh Vyankatro and Mateti Naresh Kumar

5) "Industrial Energy Conservation (UNESCO Energy Engineering)" by Charles MGottscha

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GSTIN: 27ABECS0697R1ZG

AUDIT CERTIFICATE

This is to certify that an Energy Audit for **Shri Chhatrapati Shivaji Maharaj College of Engineering, Ahmednagar** has been conducted in May 2023 for year 2022-2023 to access energy costs, availability and reliability of supply of energy, energy conservation technologies and ways to reduce energy consumption.

Place: Ahmednagar

Date: 15th May 2023

SARVASHREE TECHNOGREEN PVT. LTD. U74999 PN2020 PTC192445

Susheel Pote
Director

Anil Dube
Certified Energy Auditor
EA-4973

Regn. No. EA-4973

No. 2487

National Productivity Council

(National Certifying Agency)

PROVISIONAL CERTIFICATE

This is to certify that Mr. / Ms. Anil Siddhanarayan Dube

son / daughter of Mr. Siddhanarayan Dube

has passed the National Certification Examination for Energy Auditors in 2006, conducted on behalf of the Bureau of Energy Efficiency, Ministry of Power, Government of India.

He / She is qualified as Certified Energy Manager as well as Certified Energy Auditor.

He / She shall be entitled to practice as Energy Auditor under the Energy Conservation Act 2001, subject to the fulfillment of qualifications for the Accredited Energy Auditor and issue of certificate of Accreditation by the Bureau of Energy Efficiency under the said Act.

This certificate is valid till the issuance of an official certificate by the Bureau of Energy Efficiency.

Place : Chennai, India

Date : 30th April 2007

Controller of Examination