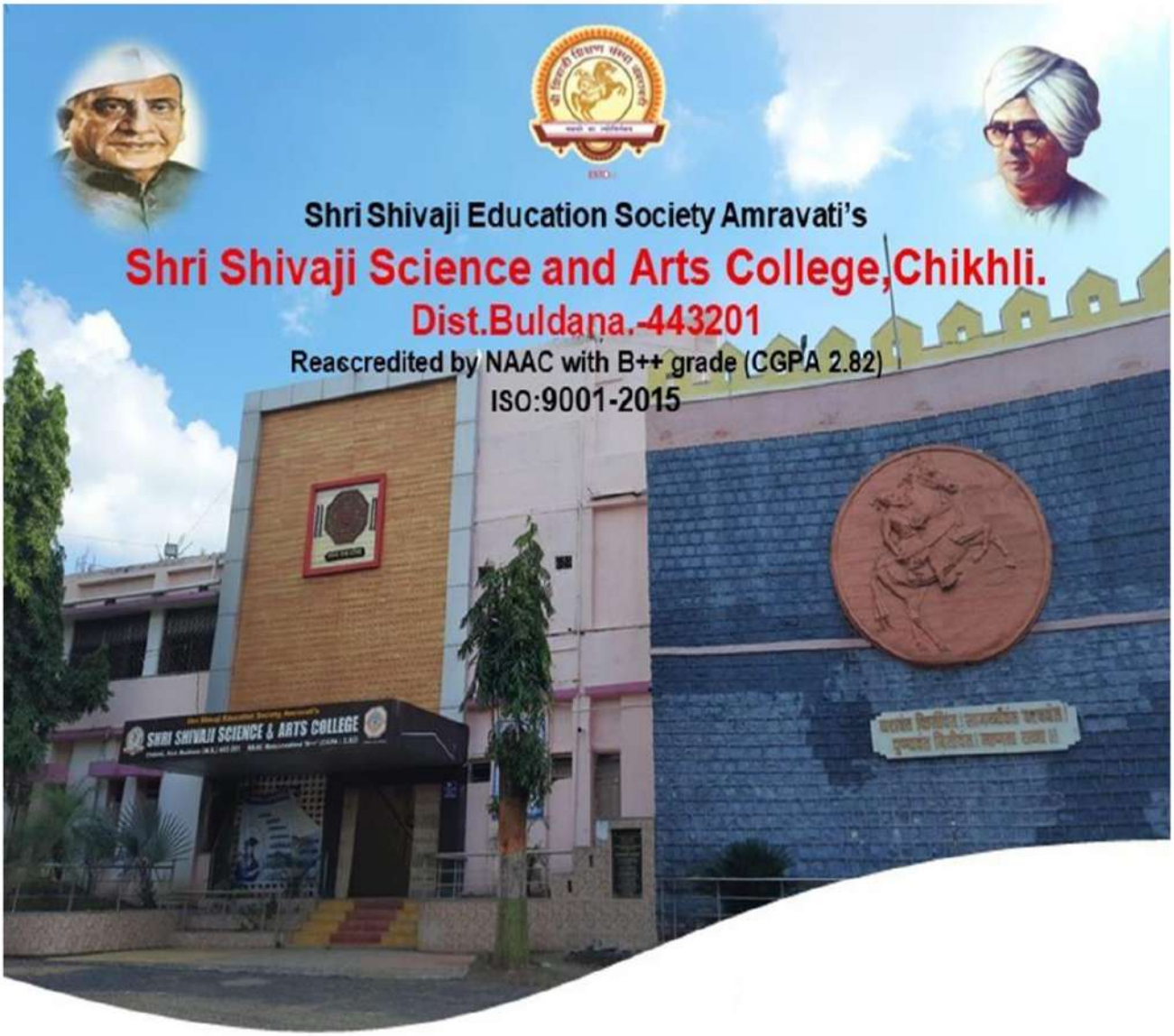

Shri Shivaji Science & Art College, Chikhli, Dist. Buldhana

Address:

DL/755, Chikhli, Maharashtra- 443201.

February 2021

Conducted By:

Maharashtra State Electricity Distribution Company Limited

Chikhli, Dist. Buldhana

Maharashtra State Electricity Distribution Company Limited

Date: 12/02/2021

CERTIFICATE

TO WHOMSOEVER IT MAY CONCERN

This is to certify that we, Maharashtra State Electricity Distribution Company Limited, Chikhli, Dist. Buldhana, has successfully completed Energy audit at Shri Shivaji Science and Arts College, Chikhli, and submitted the report. It is found that the institute has made improvements in installing energy efficient equipments in its campus.

Assistant Engineer
Maha. State Elect. Dist. Co. Ltd
Chikhli Urban D/c

Er. Arun B. Bhusari

Content:

ACKNOWLEDGEMENT

We express our sincere gratitude to the authorities of Shri Shivaji Science & Art College, Chikhli, Dist. Buldhana for the trust given to us and offering the opportunity to conduct energy assessment. We appreciate the initiative taken by the management of institute, O.S. Deshmukh (Principal) and Prof. N.B. Thakare (Department of Physics).

We are grateful to Department of Physics of Shri Shivaji Science & Art College, Chikhli, Dist. Buldhana for their initiative to undertake Energy Audit and continuous help and support before and during the audit also we are thankful for their positive support in undertaking the task of system mapping and energy efficiency assessment of all electrical system, air-conditioners, utilities and other equipment.

We are pleased to submit this Detailed Energy Audit Report to Hon. Principal Dr. O.S. Deshmukh, Shri Shivaji Science and Arts College, Chikhli, Dist. Buldhana representing on behalf of management of Shri Shivaji Education Society, Amravati and wish him all the best for implementation of identified Energy Conservation Opportunity as well as recommendations after sincere study & observations.

Er. Arun B. Bhusari

Assistant Engineer
M.S. Elect. Dist Co. Ltd
Chikhli Urban D/c

Energy Audit Study Team:

Sr. No	Name	Designation	Experience
1	Mr. Arun Bhagwan Bhusari	Engineer (MSEB)	25 Yrs.
2	Miss Pooja Waghmare	Assistant	10 Yrs.
3	Mr. Arun Muley	Electrician	15 Yrs.

1) Executive Summary

The Energy Efficiency Assessment was undertaken in order to evaluate energy performance and identify potential energy conservation measures. The assessment was undertaken in three steps, i.e., document review of data and information initially provided by facility, on site activity and preparation of this report.

The on-site activity was conducted by assessment team on 2-May-2019 consist of interviews with staff, electricians, collection/review of further data and a field inspection of the facilities and equipment's. The facility has executed a number of energy conservation measures at the time of audit itself. This brief report has therefore sought to provide a high-level overview of the status of energy efficiency at Shri Shivaji Science & Art College, Chikhali, combined with an illustration of areas where further, previously unidentified savings opportunities may exist.

Our survey has identified further potential opportunities, ranging from "no & low cost" measures, through to those that will require significant capital expenditure.

Note: Investment figures mentioned in are only indicative, further detailed study is recommended

Summary of Recommended Energy Conservation Measures:

S.N.	Equipment Name	ECM Details	Investment (Rs. In Lacs)	Savings (kWh/year)	Saving (Rs. In Lacs / Year)	Payback (Years)
1	Lights	Replacement of conventional lights (TFL, CFL) of 40 W with suitable LED tubes.	0.33	6380	0.42	0.7
2	Fan	Replacement of Old Fan with Energy Efficient Super Fan	3.9	10998	0.77	5
3	Refrigerators	Replacement of refrigerators below 2* rating with 5* rated AC	1	2000	0.15	6
4	AC	Optimize the AC temperature setting	0	70	Rs.500	0
Total						

Note: Estimated savings alterations are on operating conditions and considering 10 hours per day operation and 180 days working per annum.

Prioritization of Energy Conservation Measures:

On energy saving basis:

Sr. No.	Equipment Name	ECM Details	Investment (Rs. In Lacs)	Savings (kWh/year)	Saving (Rs. In Lacs /Year)	Payback (Years)
1	Fan	Replacement of Old Fan with Energy Efficient Super Fan	3.9	10998	0.77	5
2	Lights	Replacement of conventional lights (TFL, CFL) of 40 W with suitable LED tubes.	0.45	7128	0.4986	0.9
3	Refrigerators	Replacement of refrigerators below 2* rating with 5* rated AC	1	2000	.15	6
4	AC	Optimize the AC temperature setting	0	70	Rs. 500	0

Note: Investment figures mentioned in are only indicative, further detailed study is recommended.

General audit review:

Shri Shivaji Science & Art College, Chikhli can implement faster payback energy conservation measures (ECMs) which have already been considered and for which the ECMs are fully developed.

Other general points:

Awareness amongst students and staff is very essential step to reduce wastage of electricity Energy conservation awareness programs can be conducted once a year. Increasing energy awareness of employees and students motivates them to work as a team can lead to reductions in energy consumption and save the money. Savings estimates range in the order of 25 to 30%. When implemented effectively these savings can be realized quickly and cost effectively.

It is believed that with a revised approach and organization of energy management, energy losses can be reduced in a systematic, cost-effective manner. We hope that this report will help Shri Shivaji Science & Art College, Chikhli to implement these changes and provide direction to the Energy Management Team.

2) About Shri Shivaji Science & Art College, Chikhli.

The Shri Shivaji Science & Art College, Chikhli is Shri Shivaji Science & Arts College Chikhli is a co-ed college offering Science, Arts, Commerce streams at PU, UG and PG level founded in 1967. It is located at MH SH 176, Gandhi Nagar, Chikhli, Maharashtra 443201.

Objective

The overall objective of the assignment is to quantify energy savings in existing system and achieve reduction in energy consumption pattern.

Hence the detail objectives are as under,

i) To carry out the energy consumption.
ii) To find out the energy saving opportunities.
iii) To quantify the total energy savings.
iv) 4To find out the ways to achieve energy efficiency.

2.1 Scope of work

Following is the scope of work envisaged for this assignment,

Data collection

To collect the details of various electrical and mechanical system and their ratings, the available drawings and details shall be studied. Detail load list shall be prepared and checked.

A, B, C Analysis

With the details available from load list, analysis shall be carried out depending on the present usage trends. All the power consuming equipments shall be classified in three categories depending on their ratings, condition and operating time. The area for larger potentials for savings shall be identified.

Field Study

The detail field study on site shall include the following as well as all other measures required for energy audit study,

a) Lay out the system and study of Electrical distribution.
b) Study of area wise power distribution and Measurement of power consumption.
c) Study of instrumentation provided.
d) Measurement of motor currents, voltages, power etc. parameters by energy analyzer and measurement of water flow, pressures etc. parameters of pumps simultaneously and other measurements as needed to characterize the system and required for calculating efficiency at various combinations.
e) Study of air conditioner operations and system requirements.
f) Analysis of readings obtained from field with the standard consumption.

2.2 Approach and Methodology

i) Understanding the Scope of Work and Resource Planning.

ii) Identification of Key Personnel for the assignment/ project.

iii) Structured Organization Matrix.

iv) Steps in preparing and implementing energy audit assignment.

a) Discussions with key facility personnel.

b) Site visits and conducting "walk-through audit".

c) Preliminary Data Collection through questionnaire before audit team's site visit.

d) Steps for conducting the detailed audit.

- Plan the activities of site data collection in coordination with the facility in-charge.
- Study the existing operations involving energy consumption.
- Collect and collate the energy consumption data with respect to electricity consumption.
- Conduct performance tests to assess the efficiency of the system equipment/ electricity distribution, lighting, and identify energy losses.
- Discuss with facility operation / maintenance personnel about identified energy losses.

v) List proposed efficiency measures.

- Develop a set of potential efficiency improvement proposals.
- Baseline parameters.
- Data presentation.
- System mapping.
- List of potential Energy Savings proposals with cost benefit analysis.
- Review of current operation & maintenance practices.

vi) Preparation of the Draft Energy Audit Report.

vii) Preparation and submission of final Energy Audit Report after discussion with concerned persons.

3) Energy Details:

The energy efficiency assessment was conducted for the load connected to the mains supply used. Mainly energy is used on this facility for the following purposes:

i) Lighting.

ii) Ceiling fans.

iii) Refrigerators

iv) Ovens and Lab Equipments

v) Computer Systems

vi) Workshop Utilities

vii) Air Conditioner.

Based on above it is clear that followings buildings have highest potential for energy savings

Sr. No.	Name of the Building	Particulars
1	Wing-A	Class Rooms
2	Wing-B	Administration Department
3	Wing-C	Zoology, Botany, Chemistry, Physics, Microbiology, Commerce
4	Wing-D	Workshop
5	Wing-E	Hostel, Playground

3.1 Analysis of Electricity Bills.

The energy consumption of last 12 months is tabulated as follows.

Summary of Energy Bill for Last Twelve Months			
Sr. No	**Month & Year Electricity**	**Consumer No. 300331050761/711/880/614 Bill Amount (in Rs.)**	**Total (in Rs.)**
1	Mar-20	4517.68	54450.45
2	April-20	6436.22	
3	May-20	6448.44	
4	June-20	6448.44	
5	July-20	5220.33	
6	Aug-20	3216.25	
7	Sept-20	3564.52	
8	Oct-20	3626.62	
9	Nov-20	6246.81	
10	Dec-20	2717.46	
11	Jan-21	2837.43	
12	Feb.21	3271.24	

3.2 Connected Load of Shri Shivaji Science & Art College, Chikhli

Sr No.	Name of Department	Name of Block of department	Appliance	Quantity	Wattage (KW)	No of working Hours	Total KWh Aprox. Consumption per year
1	Zoology	Staff Room	FANS	2	0.07	10	252
			LED	2	0.04	10	144
		LAB	FANS	8	0.07	10	1008
			LED	6	0.04	10	432
			COMP SYSTEM	1	0.08	10	144
			OVEN	2	1.7	10	6120
			REF	1	0.3	10	540
2	Micro-Biology	Staff Room	LED	2	0.018	10	64.8
			FANS	1	0.08	10	144
		Lab	LED	5	0.02	10	180
			FANS	5	0.08	10	720
			LED	3	0.04	10	216
			REF	1	0.3	10	540
			DEEP FREEZER	1		10	0
			INCUBATORS	3		10	0
			HOT AIR OVEN	1		10	0
			AUTOCLAVE	2		10	0
			COMP SYSTEM	1		10	0
		RESEARCH LAB	FANS	3	0.08	10	432
			COMP SYSTEM	1	0.08	10	144
			LED	4	0.04	10	288
			LED	1	0.025	10	45
			FL	1	0.04	10	72
			INCUBATORS	1		10	0
			HOT AIR OVEN	1		10	0
			REF	5	0.3	10	2700
			CENTRIFUGE	1	0.09	10	162
3	BOTANY	Staff Room	FANS	2	0.08	10	288
			LED	1	0.04	10	72
		LAB-I	FANS	2	0.08	10	288
			LED	2	0.04	10	144
			LED	2	0.04	10	144
			COMP SYSTEM	1	0.08	10	144
		LAB-II	REF	1	0.3	10	540
			INCUBATORS	1		10	0
			OVEN	1		10	0
4	CHEMISTRY	Staff Room	FANS	3	0.08	10	432
			LED	2	0.04	10	144
			COMP SYSTEM	1	0.08	10	144
			PRINTER	1	0.08	10	144
			FRIDGE	1	0.3	10	540
			FANS	1	0.08	10	144

		STORE ROOM	TFL	1	0.04	10	72
			OVEN	1		10	0
		LAB	LED	7	0.04	10	504
			EXHAUST	2	0.075	10	270
5	ELECTRONICS	Staff Room	FANS	5	0.08	10	720
			LED	4	0.04	10	288
			COMP SYSTEM	1	0.08	10	144
			TELEVISION	1	0.06	10	108
		LAB	FANS	4	0.08	10	576
			TFL	6	0.04	10	432
6	COMPUTER	Staff Room	FANS	2	0.08	10	288
			TFL	3	0.04	10	216
			COMP SYSTEM	1	0.08	10	144
			PRINTER	1	0.08	10	144
		LAB	COMP SYSTEM	18	0.08	10	2592
			FANS	5	0.08	10	720
			TFL	3	0.04	10	216
			CFL	2	0.025	10	90
			WINDOW AC	3		10	0
			PRINTER	2	0.08	10	288
			EXHAUST	3	0.06	10	324
			SCANNER	1	0.06	10	108
		PG LAB	FANS	3	0.08	10	432
			TFL	5	0.04	10	360
7	COMMERCE	Staff Room	FANS	1	0.08	10	144
			TFL	1	0.04	10	72
		LAB	TFL	5	0.04	10	360
			FANS	2	0.08	10	288
			COMP SYSTEM	16	0.08	10	2304
			PRINTER	1	0.08	10	144
8	PHYSICAL EDUCATION	GYM	FANS	3	0.08	10	432
			TFL	2	0.04	10	144
			CFL	1	0.025	10	45
		STORE ROOM	TFL	1	0.04	10	72
		Main Ground	LED	5	0.02	10	180
			CFL	1	0.025	10	45
		OUTER GROUND	CFL	2	0.02	10	72
9	MCVC DEPT	CLASS 01	TFL	1	0.04	10	72
			FANS	1	0.08	10	144
		CLASS 02	TFL	1	0.04	10	72
			FANS	1	0.08	10	144
		WORKSHOP	WELDING M/C	1		10	0
			DRILLING M/C	1		10	0
			GRINDING	1		10	0
			COMPRESSOR	1		10	0
			FL	2	0.04	10	144

			TFL	5	0.04	10	360
			FANS	2	0.08	10	288
			MOTORS	6		10	0
10	MARATHI	Room	TFL	2	0.04	10	144
			FANS	2	0.08	10	288
11	CLASSROOMS	1	FANS	4	0.08	10	576
			TFL	3	0.04	10	216
		2	TFL	3	0.04	10	216
			FANS	3	0.08	10	432
		3	TFL	2	0.04	10	144
			FANS	3	0.08	10	432
		7	FANS	1	0.08	10	144
			TFL	3	0.04	10	216
		8	TFL	3	0.04	10	216
			FANS	2	0.08	10	288
		9	FANS	3	0.08	10	432
			TFL	2	0.04	10	144
			FL	1	0.04	10	72
12	CENTRAL LIBRARY	MAIN LIBRARY	FANS	15	0.08	10	2160
			CFL	14	0.04	10	1008
			TV	1	0.065	10	117
			COMP SYSTEM	8	0.08	10	1152
			PRINTER	1	0.08	10	144
13	GROUND FLOOR	Staff Room	FANS	1	0.08	10	144
			TFL	1	0.04	10	72
			FANS	1	0.08	10	144
			CFL	1	0.02	10	36
		PASSAGE UPPER	CFL	4	0.02	10	144
		PASSAGE GROUND	FL	2	0.04	10	144
14	ADMIN DEPT	PRINCIPAL CABIN	AC	2		10	0
			TV	1		10	0
			COMP SYSTEM	1	0.08	10	144
			LED	5	0.12	10	1080
			CCTV			10	0
			FANS	1	0.08	10	144
		OFFICE	TFL	7	0.04	10	504
			FANS	6	0.08	10	864
			XEROX	1	0.25	10	450
			COMP SYSTEM	10	0.08	10	1440
			PRINTER	3	0.08	10	432
			FILTER	1	0.1	10	180
15	YCMU		COMP SYSTEM	2	0.08	10	288
			PRINTER	1	8	10	14400
			TFL	2	0.04	10	144
			FANS	1	0.08	10	144
16	HOSTEL BUILDING		FANS	2	0.08	10	288
			TFL	12	0.04	10	864
17	LANGUAGE LAB		FANS	2	0.08	10	288
			TFL	2	0.04	10	144
			COMP SYSTEM	10	0.08	10	1440

18	STORE ROOM		FANS	1	0.08	10	144
			TFL	1	0.04	10	72
19	HOME ECONOMICS		FANS	1	0.08	10	144
			TFL	2	0.04	10	144
			OVEN	1		10	0
			FRIDGE	1	0.3	10	540
20	ENGLISH DEPT		TFL	1	0.04	10	72
			FANS	1	0.08	10	144
			COMP SYSTEM	1	0.04	10	72
21	NCC OFFICE		TFL	1	0.04	10	72
			FANS	1	0.08	10	144
			COMP SYSTEM	1	0.08	10	144
22	GUEST ROOM		TFL	3	0.04	10	216
			FANS	1	0.08	10	144
			AC	1	0.04	10	72
			FRIDGE	1	0.3	10	540
23	KALPATARU		TFL	4	0.04	10	288
			COOLER	2		10	0
			FANS	3	0.08	10	432
24	PHYSICS	Staff Room	COMP SYSTEM	1	0.08	10	144
			FANS	1	0.08	10	144
			TFL	1	0.04	10	72
			FL	1	0.04	10	72
		LAB-I	FANS	2	0.08	10	288
			LE	4	0.04	10	288
		LAB-II	FANS	2	0.08	10	288
			LED	4	0.04	10	288
		DARK ROOM	TFL	1	0.04	10	72
			FL	1	0.04	10	72
25	SEMINAR HALL		FANS	10	0.08	10	1440
			LED	7	0.04	10	504
26			FANS	2	0.08	10	288
	HISTORY AND POLITICAL SCIENCE		TFL	2	0.04	10	144
27	IQAC		FANS	2	0.08	10	288
			TFL	2	0.04	10	144

3.3 Total Quantity of Fixture in Shri Shivaji Science & Art College, Chikhli

Following is the Shri Shivaji Science & Art College, Chikhli fixture list,

Sr. No.	Appliances	Wattage	Quantity
1	Ceiling Fan	70	130
2	Table Fan/ wall Fan	55	2
3	Cooler	150	2
4	CFL Bulb	25 and 20	33
5	TFL Bulb	40	140
6	Xerox Machine	500	2
7	FL	50	8
8	Exhaust Fan	125	5
9	Computer	80	75
10	Water Cooler	250	2
11	Printer	800	5
12	AC	1500	3

3.4 Current data of Shri Shivaji Science & Art College, Chikhli

Sr. No.	Consumer No	Meter No	Voltage			Current			
			RN	YN	BN	R	Y	B	N
1	300331041711		237	-	-	3.2	-	-	-
2	300331050761		239	-	-	2.6	-	-	-
3	3003300004880		242	232	243	7.2	2.2	7.5	5.2
4	300331041614		245	254	238	1.2	2.7	5.3	5.2

4) Energy Conservation Measures

ECM 1: Replacement of conventional lights (TL, FL and CFL) with more efficient LED lamps

There are around 120 Nos. of lights. It is recommended to replace 120 nos. of tube lights, FL and CFL, which are having working hours 10-12 hrs./day.

ECM No.	Energy efficiency improvement measures	Investment Rs.	Estimated savings Electricity kWh	Estimated Savings Lac.	Estimated Payback Years
1	Replacement of conventional lights (TFL, CFL and FL) of 40,50 W with suitable 18W LEDs	32000	6380	0.42	0.7

Note: Estimated savings alterations are on operating conditions and considering 10 hours per day operation and 180 days working per annum.

Observation:

As per energy audit done in 2019 there were 180 of nos. of TFL, FL and CFL with wattage of 20W,30W, 40W are in use, which are having working hours 10-12 hrs./day. Now there were now reduced to 120 nos but needs to be replaced by suitable LED lights.

Recommendations:

The 40-Watt Fluorescent tubular lights could be replaced with 18 Watt LEDs and CFL will replace with 18 W LEDs. LEDs have better efficacy per watt as well as they have much larger lifespan than TFLs.

During energy audit it is observed that facility has installed T8/T12 tubes, CFL and FL lights at some of the places in the building. The operating hours for these lightings are around 10-12 hours. T8 tube and other lightings can be replaced with the LED lightings thereby achieving significant energy consumption reduction. The LEDs could be replaced in such a manner that it has same fixture so there will not be retrofitting cost attached to the replacement. The replacement could be done in a phased manner. LED lightings have better efficacy as well as better lifetime than T8 lightings.

Energy Saving Calculations		
Particular	Unit	Value
Power consumption of TFL, CFL lamps	KW	0.04
Average power saving after replacement with LED Street light	KW	0.022
Total no. of fixtures (TFL, CFL) of 40 W to be replaced with suitable LED fittings	Nos	180
Average working hour per day	hrs	10
No. of working days in a year	Days	180
Cost Benefit Calculation		
Annual Energy Saving potential	kWh	7128
Electricity tariff	Rs/unit	7
Annual Cost Saving	Rs. Lakh	49896

Total investment cost	Rs. Lakh	45000
Simple Payback Period	Years	0.9018759
Note- Electricity tariff rate is based on Total Bill in Rs. / Billing unit Kwh.		

Simple Payback period: 9months

Saving achieved after project implementation = Rs. 50000/-.

ECM 2: Replacement of Old Fan with Energy Efficient Super Fan

There are around 130 Nos. of fans. It is recommended to replace all Ceiling fans with super- efficient fans. Which are having working hours 10 hrs./day.

ECM No.	Energy efficiency improvement measures	Investment Rs. In Lakh	Estimated saving Electricity kWh	Estimated Savings Rs.	Estimated Payback Years
2	Replacement of Old Fan with Energy Efficient Super Fan	3.9	10998	77000	5

Observation:

All fans are old condition and older technology. During survey it is observed that facility has above 70- and 110-watt fans.

Recommendations:

During energy audit it is observed that facility has installed non star rated fan of above 70 watts so we recommend to replace energy consuming fan with energy efficient super fan.

Energy Saving Calculations:

Particular	Unit	Value
Current Fan Wattage	KW	0.075
Number of fans	Qty	130
Existing energy consumption of Fan	kWh/year	17550
Total Cost per annum	Rs. /Year	122850
Proposed Fan Wattage	Watt	0.028
Energy consumption after replacing with Energy Efficient Super Fan	kWh/year	6552
Operating hrs/year	Hrs./year	45864
Diversity factor	%	70%
Annual Saving	Rs/year	76986
Cost Benefit Calculation		
Annual Energy Saving potential	kWh	10998
Electricity tariff	Rs/unit	7
Annual Cost Saving	Rs. Lakh	76986
Total investment cost	Rs. Lakh	390000
Simple Payback Period	Years	5.06585613

Simple Payback period: 5 years, Saving achieved after project implementation = Rs. 39000/-
Capital Investment required for the proposed Project is given in the following table,

Sr. No	Item	C.S.R No.	Rate	Unit
1	Ceiling Fan 5 Star 1200 mm.	2/13/22	3000	Each
2	Dismantling of old C. Fans	2/14/4	31	Each
3	Electronic regulator 2 module	1/8/23.	0	Each
	GST		18%	
	Unit cost inclusive of GST Approx.		3540	

ECM3: Replacement of old refrigerators:

ECM No.	Energy efficiency improvement measures	Investment Rs. In Lakh	Estimated saving Electricity kWh	Estimated Savings Rs.	Estimated Payback Years
3	Replacement of refrigerators	1	2000	.15	6

Observation:

Most of the refrigerators are old in condition and non-star rated with older technology.

Recommendations:

It is recommended to replace 5 stars rated and inverter technology-based refrigerators which are less energy consuming as well performs better.

ECM 4: Optimize the AC temperature setting

ECM No.	Energy efficiency improvement measures	Investment Rs. In Lakh	Estimated saving Electricity kWh	Estimated Savings Rs.	Estimated Payback Years
4	Optimize the AC temperature setting	0	70	500/-	0

Recommendations:

Having the optimum / minimum driving force (temperature difference) can help to achieve highest possible suction pressure at the compressor, thereby leading to less energy requirement. This requires proper sizing of heat transfer areas of process heat exchangers and evaporators as well as rationalizing the temperature requirement to highest possible value. A 1°C raise in evaporator temperature can help to save almost 3 % on power consumption. The TR capacity of the same machine will also increase with the evaporator temperature, as given in Table.

Effect of variation in Evaporator Temperature on Compressor Power Consumption			
Evaporator temperature(°C)	Refrigeration Capacity* (tons)	Specific Power Consumption	Increase in kW/ton (%)
5.0	67.58	0.81	-
0.0	56.07	0.94	16.0
-5.0	45.98	1.08	33.0
-10.0	37.20	1.25	54.0
-20.0	23.12	1.67	106.0

Condenser temperature 40°C. Hence it is recommended to change the AC temperature setting to 27 °C.

Other Recommendations:

i) Recommended to install at least 10 kW in campus as measure non-conventional energy source.

ii) Regular cleaning and maintenance of equipment's is important to reduce energy losses.

iii) Use of start rates equipment's is also strongly recommended specially in case of refrigerators.

iv) Use less papers and minimization of paper work is also strongly recommended to avoid loss of paper.

v) Cleaning of ceiling fan and exhaust fan blades will reduce the drag on the fan and inturn will reduce energy loss.

vi) Awareness amongst students and staff is very essential step to reduce wastage of electricity

vii) Energy conservation awareness programs can be conducted once a year. Increasing energy awareness of employees and students motivates them to work as a team can lead to reductions in energy consumption and save the money.

5) List of Instruments used:

i) Power analyzer

Picture 1 Fluke Power Analyzer

Specification of the 434 Fluke power analyzer:

Electrical	
Single Phase	YES
Three Phase	YES
USER INTERFACE	
LCD-Type	Graphic LCD
LCD-Dimension	127 x 88 mm
Traditional energy analysis	V, I, P, Q, S, F, PF, cos ϕ, peak, minimum, maximum, demand etc.
Voltage	1V to 1000 V phase to neutral
Current	Up to 6000 A
Frequency	42.50 to 57.50 Hz
Precision Voltage, Current, Power	±0.1 %

ii) Luxmeter:

Indi 6171 Luxmeter was used to measure the lux levels in the ground floor as well as the first floor. The lux levels at the workplaces were found to be adequate.

Picture 2 Luxmeter

iii) Digital Clamp Meter:

Mastech M266C Digital AC Clamp Meter is used to measure the instantaneous current. The temporary measurements were recorded for the Main feeder, Lightings panel, ducted air conditioners. Following is the specification for this clamp meter:

Picture 3 Mastech M266 clamp meter

Specification	Range	Accuracy
DC Voltage	200mV	-1.005
	2V/20V/200V	-3.005
	1000V	-3.008
AC Voltage	200V	-5.01
	750V	-5.012
AC Current	20A	-5.04
	200A	-5.025
	1000A	-10.03
Resistance	200Ω	-5.01
	2KΩ/20KΩ/200KΩ/2MΩ	-8.01
Temperature	0°C~400°C(32°F~752°F)	-3.01
	401°C~750°C(752°F~1382°F)	-3.02
Insulation Test	20MΩ	-2.02
	2000MΩ(Note<500Ω)	-2.04
	2000MΩ(Note>500Ω)	-2.05

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