Energy audit

Sr. No.	Particulars	Remarks
1	Report	Attached

SBES COLLEGE OF ARTS & COMMERCE, AURANGABAD-431001 * SBES
IQAC

I/C Principal
SBES College of Arts & Commerce
Aurangabad.

Detailed Energy Audit Report of SBES Arts and Commerece College, Aurangabad

From: Vinayak Apte (vinayak.engg@gmail.com)

To: sbescollegeac@yahoo.com

Cc: admin@ppsenergy.in; ravi@ppsenergy.in; nilesh@ppsenergy.in; vedmurthy@ppsenergy.in

Date: Tuesday, March 3, 2020 at 04:46 PM GMT+5:30

Dear Sir,

Greetings from **PPS Energy Solutions Pvt. Ltd !!!**

Please find the attachment for Detailed Energy Audit Report of SBES Arts and Commerece College, Aurangabad

Thanks & Regards,

Vinayak R Apte

Sr. Consultant

PPS Energy Solutions Pvt. Ltd.

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SBES COLLEGE OF ARTS & COMMERCE, AURANGABAD-431001 * IQAC

DETAILED ENERGY AUDIT REPORT

SBES Arts and Commerce College, Aurangabad

Aurangapura, Saraswati Nagar,
Aurangabad, Maharashtra

January 2020

Conducted By
PPS Energy Solutions Pvt. Ltd.
Engineering Consultants
Plot No-18, Girish Housing Society
Warje, Pune – 411058, Maharashtra, India

WHY ENERGY AUDIT?

An energy audit determines the amount of energy consumption affiliated with a facility and the potential savings associated with that energy consumption. Additionally, an energy audit is designed to understand the specific conditions that are impacting the performance and comfort in your facility to maximize the overall impact of energy-focused building improvements.

An energy audit is a systematic review of the energy consuming installations in a facility to ensure that energy is being used sensibly and efficiently. An energy audit usually commences with the collection and analysis of all information that may affect the energy consumption of the facility, then follows with reviewing and analyzing the condition and performance of various installations and facility management, with an aim at identifying areas of inefficiency and suggesting means for improvement.

Through implementation of the suggested improvement measures, facility owners can get the immediate benefit for paying less energy bills. On the other hand, lowering of energy consumption in facility will lead to the chain effect that the power supply companies will burn less fossil fuel for electricity generation and relatively less pollutants and greenhouse gases will be introduced into the atmosphere, thus contributing to conserve the environment and to enhance sustainable development.

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About PPSES

M/s. PPS Energy Solutions Pvt. Ltd (PPSES) is an ambitious company, established by enterprising engineering professionals in the year 2009. The company offers services pertaining to Energy and Engineering to clients across the globe. Our team is based in Pune, a city known for its Software and Engineering talent in India. We are a rapidly growing company with a team of about 100 people which includes highly trained and experienced Techno-Managers, Analysts, and Engineers & Detailers.

We are presently working in India (Maharashtra, Assam, Madhya Pradesh, Gujarat, Andhra Pradesh, Delhi, Orissa, Chhattisgarh, Bihar, Andhra Pradesh, Telangana and Jharkhand) and Abroad (Bahrain, Stanford)

- We serve in majorly four areas,
  - Energy Audit, Management and System Evaluations
  - Power Distribution System Design, Evaluations and Monitoring
  - MEP Design and Project management
  - Research and Training

PPSES Team Members

Name	Role	Academics and Expertise
Dr. Ravi Deshmukh	ECM verification, Report verification and presentation	Accredited Energy Auditor, PhD, M tech, MBA (Power), Graduate E&TC Engineer with over 18 years of experience in Energy Management, Management of Power System, street light projects, Power Exchange Operations, Power Trading and Analysis, Electrical Automation. Has worked as Expert in Iron & Steel sector and Energy
Mr .Nilesh Saraf	Co-ordination with officers, project status review.	Expert in Energy sector with 16 years of experience in Energy efficiency assessment, Industrial engineering sector & Renewable Energy.
Mr. Vinayak Apte	Energy Audit Expert	Graduate Electrical Engineer with more than 10 years of experience in various sectors. He handled Energy Audits, Energy Conservation and Energy Efficiency projects in Industries, Commercial and Residential Buildings, Pump House
Mr. Vedmurthy Swamy	Field study, data tabulation and analysis, report preparation	Graduate Mechanical Engineer with 5 years of experience in project management, energy efficiency assessment
Mrs. Utkarsha Bharate	Data tabulation and analysis, report preparation	Graduate in Electrical & Electronics Engineering, Sr. Engineer, 3 years of experience in Energy & Power projects

Sr. No.	ECM Details	Investment (Rs. Lacs)	Savings (kWh/year)	Carbon credit (Tons of Co2)	Saving (Rs. Lacs /Year)	Payback (Years)
4	Optimize the temperature setting to 23-25 degree Celsius	0.00	61.61	0.06	0.00	0.00
5	Replacement of pump sets with energy efficient pump set	0.28	57.18	0.05	0.003	87.50
	Total	**10.51**	**9666.23**	**8.33**	**0.53**	**19.76**

Note: Estimated savings may base on operating conditions

During the Energy Audit, Total Estimated Investment of Rs.1050674/- yields Total Estimated Savings of Rs. 53000/- which is 18% of the Total Energy Cost of Rs. 281533/- with an overall payback period of 19.76 Months.

Other Recommendations:

A. Regular cleaning and maintenance of equipment's is important to reduce energy losses.
B. Use of star rated equipment's is also strongly recommended specially in case of Fans and Air conditioning.
C. Cleaning of ceiling fan and exhaust fan blades will reduce the drag on the fan and intern will reduce energy loss.
D. Awareness amongst energy users is very essential step to reduce wastage of electricity
E. Energy conservation awareness programs can be conducted once a year. Increasing energy awareness of energy users motivates them to work as a team can lead to reductions in energy consumption and save the money.

Year	Investment (Rs. In Lacs)	Saving (Rs.In Lacs /Year)	Cum Savings(Rs Lakh)	Net savings (Rs Lakh)
0	-11	0	0	-11
1	0	1	1	-10
2	0	1	1	-9
3	0	1	2	-9
4	0	1	2	-8
5	0	1	3	-8
6	0	1	3	-7
7	0	1	4	-7
8	0	1	4	-6
9	0	1	5	-6
10	0	1	5	-5
11	0	1	6	-5
12	0	1	6	-4
13	0	1	7	-4

2. GENERAL AUDIT REVIEW

Facility can implement faster payback energy conservation measures (ECMs) which have already been considered and for which the ECMs are fully developed.

Other General Points:

1. Energy conservation awareness programs can be conducted once a year. Increasing energy awareness of staff, students and motivating them to work as a team can lead to reductions in energy consumption and save the money. Savings estimates range in the order of 5 to 10%. When implemented effectively these savings can be realized quickly and cost effectively.
2. Most of the fans are energy inefficient.
3. Most of the places the tube light installed are energy inefficient and fittings are in healthy condition.
4. Natural day light is efficiently used in corridor and few classrooms and labs areas.

It is believed that with the current approach and organization of energy management, energy can be reduced in a systematic, cost effective manner. We hope that this report will help facility to implement these changes and provide direction to the Energy Management Team.

e. Study of air conditioner operations and system requirements

f. Analysis of readings obtained from field with the standard consumption.

3.2. Approach and Methodology

1. Understanding the Scope of Work and Resource Planning
2. Identification of Key Personnel for the assignment/ project
3. Structured Organization Matrix
4. 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 personnel about identified energy losses.
5. 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
6. Preparation of the Draft Energy Audit Report
7. Preparation and submission of final Energy Audit Report after discussion with concerned persons

Consumption Details

Table 3 Billing Data

Month	KWH	KVAH	RKVAH (Lag)	RKVAH (Lead)	Recorded MD	Billed MD	Demand Rate (Rs/KVA)	Billed PF	Unit rate (Rs/kWh)	Demand Charges (Rs)	Energy Charges (Rs)	PF Penal /Incentive (Rs)	Total Current Bill (Rs)
Jan-19	267	0	0	0	4	0	350	0.0	6.8	350	1283	0	2571
Feb-19	519	0	0	0	4	0	350	0.0	6.8	350	2464	0	4322
Mar-19	315	0	0	0	4	0	350	0.0	6.8	350	1609	0	2975
Apr-19	274	0	0	0	4	0	351	0.0	6.9	351	1344	0	2579
May-19	269	0	0	0	5	0	351	0.0	6.9	351	1363	0	2594
Jun-19	164	0	0	0	5	0	351	0.0	6.9	351	697	0	1572
Jul-19	381	0	0	0	4	0	351	0.0	6.9	351	2099	0	3601
Aug-19	418	0	0	0	4	0	351	0.0	6.9	351	2370	0	3857
Sep-19	463	0	0	0	4	0	351	0.0	6.9	351	2649	0	4381
Oct-19	352	0	0	0	4	0	351	0.0	6.9	351	1899	0	3365
Nov-19	193	0	0	0	4	0	351	0.0	6.9	351	820	0	1814
Dec-19	222	0	0	0	4	0	351	0.0	6.9	351	1002	0	2099
Avg	**320**	**0**	**0**	**0**	**4**	**0**	**351**	**0.0**	**6.9**	**351**	**1633**	**0**	**2977**
Max	**519**	**0**	**0**	**0**	**5**	**0**	**351**	**0.0**	**6.9**	**351**	**2649**	**0**	**4381**
Min	**164**	**0**	**0**	**0**	**4**	**0**	**350**	**0.0**	**6.8**	**350**	**697**	**0**	**1572**

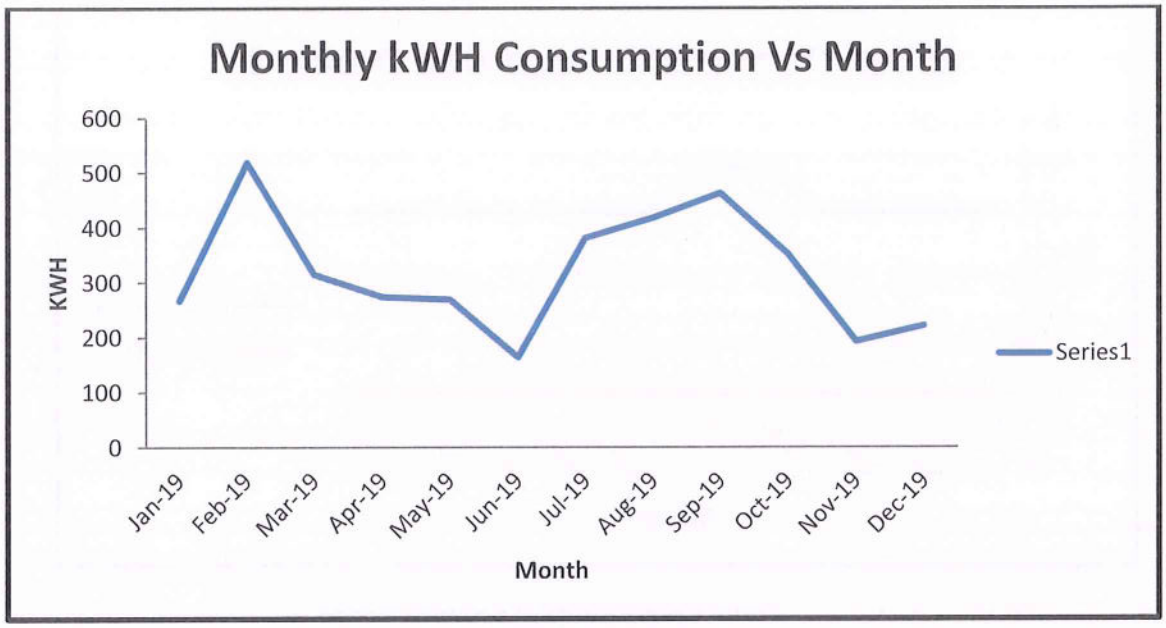


Figure 1 Monthly kWh Consumption

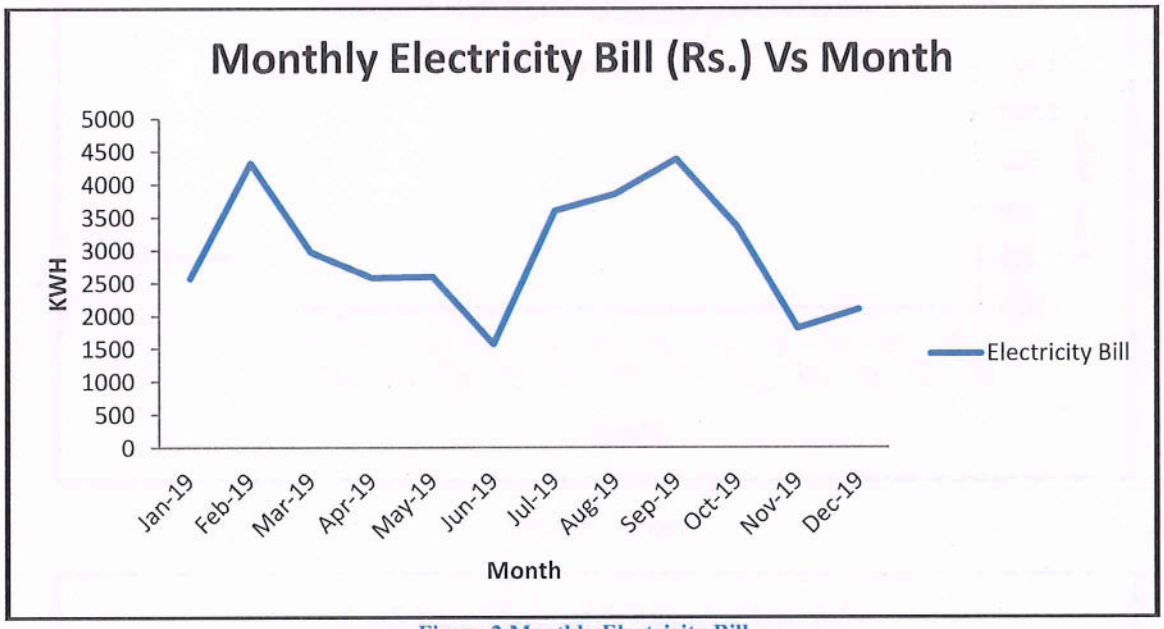


Figure 2 Monthly Electricity Bill

Comments:

1. Average monthly units consumed is 320 kWh equivalent to Rs. 2977/-
2. Average electricity charges works out to be Rs. 5/-

2. Consumer Details of Meter No. 490018457811

Consumer Details

Table 4 Consumer Details

Parameter	Details
Consumer No.	**490018457811**
Consumer Name	Principal S.B Arts & Commerce College
Address	CTS NO 4987 Principal S.B Arts & Commerce College AURANGPURA
Pin Code	431001
Sanction load (KW)	15
Tariff	LT X B I

Month	"A" Zone Units	"A" Zone Demand	"B" Zone Units	"B" Zone Demand	"C" Zone Units	"C" Zone Demand	"D" Zone Units	"D" Zone Demand
Jan-19	0	4	0	7	0	3	0	5
Feb-19	0	3	0	9	0	3	0	6
Mar-19	0	4	0	17	0	12	0	10
Apr-19	892	9	788	20	0	14	626	15
May-19	0	6	0	10	0	5	0	9
Jun-19	762	6	1793	27	535	26	481	16
Jul-19	0	4	0	12	0	11	0	4
Aug-19	0	6	0	13	0	13	0	6
Sep-19	0	3	0	16	0	15	0	7
Oct-19	0	4	0	19	0	12	0	8
Nov-19	0	3	0	10	0	3	0	5
Dec-19	0	4	0	8	0	7	0	6
Avg	**138**	**5**	**215**	**14**	**45**	**10**	**92**	**8**
Max	**892**	**9**	**1793**	**27**	**535**	**26**	**626**	**16**
Min	**0**	**3**	**0**	**7**	**0**	**3**	**0**	**4**

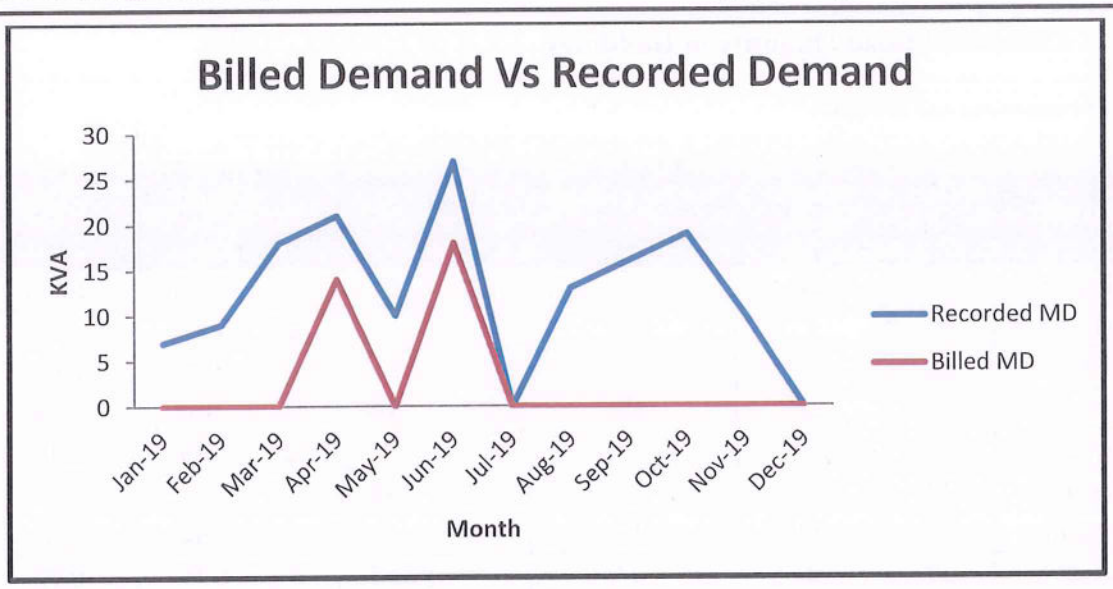


Figure 8 Billed Demand vs Recorded Demand

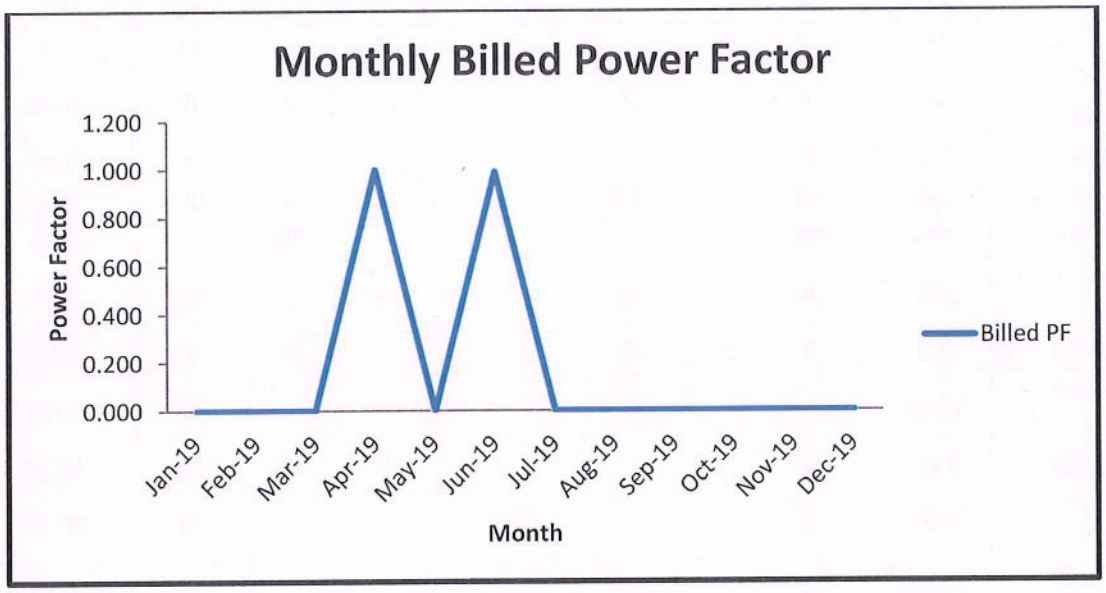


Figure 9 Billed PF

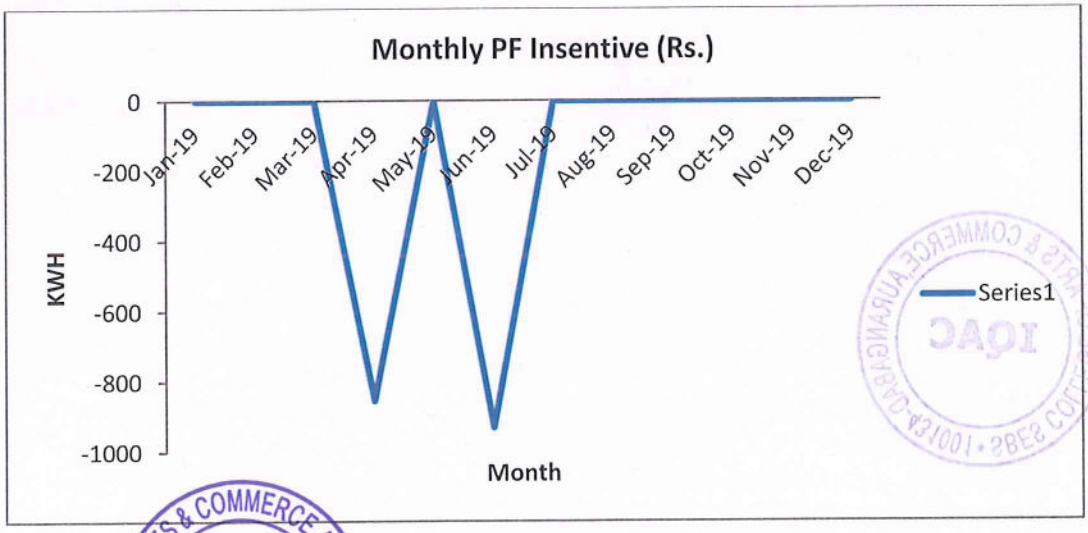


Figure 10 PF Incentive

5. ENERGY CONSERVATION MEASURES

ECM1: Replacement of Tube Lights with More Efficient Lights

ECM No.	Energy efficiency improvement measures	Investment Rs. In Lakh	Estimated saving		Estimated Savings Rs. In Lacs	Estimated Payback Years
			Electricity kWh	Carbon credit (Tons of CO_2)		
1	Replacement of Conventional Lights with More Efficient Lights	2.47	3759.60	3.20	0.21	11.96

Observations:

Facility has installed Type of Tube light of 28, 36, 40W and CFL of 15 and 18 W in their premises

Recommendations:

During energy audit, it is observed that facility has installed Tube light of 28, 36, 40W and CFL of 15 and 18 W at some of the places in the facility. The operating hours for these lightings are around 5 hours. Tube light of 28, 36, 40W and CFL of 15 and 18 W lights with equivalent LED fixture thereby achieving significant reduction in energy consumption. 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 lights have better efficacy as well as better lifetime than conventional lights

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

ECM No.	Energy efficiency improvement measures	Investment Rs. In Lakh	Estimated saving		Estimated Savings Rs. In Lacs	Estimated Payback Years
			Electricity kWh	Carbon credit (Tons of CO_2)		
2	Replacement of Existing Fans with Energy Efficient Fans	3.99	3460.80	2.94	0.19	20.96

Observations: During energy audit, it is observed that facility has old 75 watts' fan and its energy consumption is on higher side.

Recommendations: During energy audit it is observed that facility has installed non star rated fan of 75 watts so we recommend to replace energy consuming fan with energy efficient super fan

Energy Saving Calculations:

Particular	Unit	Value
Existing energy consumption of Fan	kWh/year	9270
Fan Wattage	Watt	35
Energy consumption after replacing with Energy Efficient Super Fan	kWh/year	4326
Operating hrs/year	Hrs/year	600
Diversity factor	%	70%
Annual Saving	kWh/year	3461
Unit rate	Rs/kWh	5.5
Annual Saving	Rs. In Lacs	0.19

Category	Nos	Estimated Running kW
Ceiling Fan 75 W	206	15.45

ECM 4: Optimize The AC Temperature Setting to 23-25 Degree Celsius

ECM No.	Energy efficiency improvement measures	Investment Rs. In Lakh	Estimated saving Electricity kWh	Carbon credit (Tons of CO2)	Estimated Savings Rs. In Lacs	Estimated Payback Years
4	Optimize The AC Temperature Setting To 23-25 Degree Celsius	0.00	61.61	0.06	0.003	0.00

Observations:

During Energy Audit, it is observed that ACs installed in facility run with lower temperature than the recommended temperatures.

Recommendations:

We recommend to keep the set temperature of AC between 23 to 25^{0}C to get the energy saving.

Standard:
It is known that a 1°C raise in AC temperature can help to save almost 3 % on power consumption (this can also be verified in BEE guideline: Chapter 4. HVAC and Refrigeration System).

The TR capacity of the same AC systems will also increase with the increase in evaporator temperature (AC set points), as given in Table below:

Effect of variation in Evaporator Temperature on Compressor Power Consumption			
Evaporator temperature(^{0}C)	Refrigeration Capacity* (tons)	Specific Power Consumption	Increase in kW/ton (%)
5	67.58	0.81	-
0	56.07	0.94	16
-5	45.98	1.08	33
-10	37.2	1.25	54
-20	23.12	1.67	106

* Condenser temperature 40°C

Present Energy Consumption Details:

Sr No	Type	Ton	Qty	Annual Consumption
1	Air Conditioner (Split) (1 Ton) (3*)	1	2	1001.28
2	Air Conditioner (Split) (1.5 Ton) (5*)	1.5	2	1052.35
Total			4	2053.63

ECM 5: Replacement of Existing Pumps with Energy Efficient Pumps

ECM No.	Energy efficiency improvement measures	Investment Rs. In Lakh	Estimated saving Electricity kWh	Carbon credit (Tons of CO2)	Estimated Savings Rs. In Lacs	Estimated Payback Years
5	Replacement of Existing Pumps with Energy Efficient Pumps	0.27517	57.18	0.05	0.003	87.50

Observations:

During Energy Audit, it is observed that facility has 1 No of old submersible Water pump to fulfil the water requirement.

Recommendations:

We recommend to replace Existing pumps with Energy Efficient pumps to get the energy saving

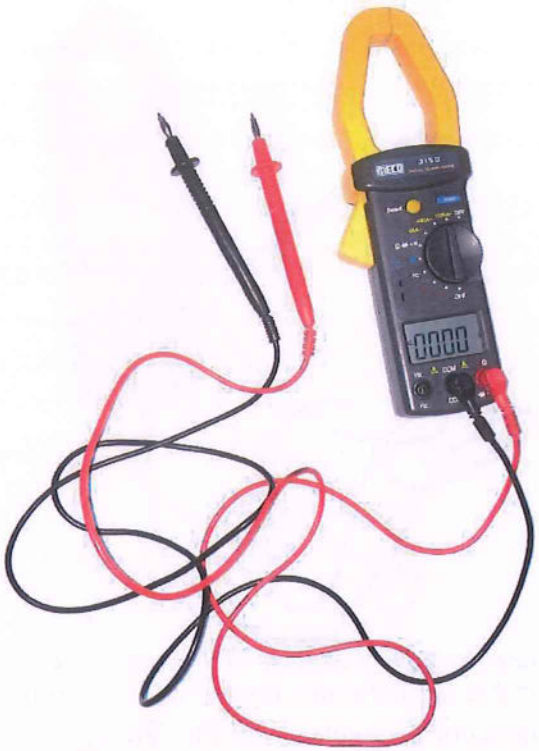
Load Calculations and Investment Details:

Location	Quantity	Type	HP	kW	CSR	Invest ment Cost	Working Hours	Days	Total Load
Under ground floor	1	Subm ersible	1.5	1.12	12-2-33	27517	2.00	300	2.238
Total						**27517**			**2.238**

Energy Saving Calculations:

Particular	unit	value
Estimated Running load of old motors	Kw	2.24
Avg. Operating hrs./day	Hrs	4.00
Avg. Operating days/year	Days	365.00
Estimated saving	%	7
unit rate	Rs/Kwh	5.50
Estimated Existing Energy consumption Kwh	Kwh/year	817
Estimated Proposed Energy consumption Kwh	Kwh/year	759
Annual saving	Kwh	57
Estimated savings	Rs in Lacs/year	0.003

DIGITAL CLAMP METER



Picture 2 MECO 3150 DIGITAL CLAMP METER

Power Clamp meter is a Portable Digital multi-functional measuring instrument. Designed for Measuring selected power network parameters, AC/DC Voltage, AC/DC current, Resistance, Continuity, Diode and Frequency.

TECHNICAL SPECIFICATIONS

DC VOLTAGE (Auto Ranging)	
Ranges	4V, 40V, 400V, 1000V
Overload Protection	1200V DC/800V AC
AC VOLTAGE (Auto Ranging) 40-500Hz	
Range	4V, 40V, 400V, 750V
Overload Protection	1200V DC/800V AC
RESISTANCE (Auto Ranging)	
Range	400Ω, 4KΩ, 40KΩ, 400KΩ, 4MΩ, 40MΩ
Test Current	0.7mA on 400Ω, 0.1mA on 4KΩ
Diode Test	
Measurement Current	1.0 ± 0.6 mA Approx
Open Circuit Voltage	0.4V Approx
Overload Protection	500V DC / AC
Frequency (Auto Ranging)	
Range	10.00Hz, 50.00Hz, 500.0Hz, 5.000kHz, 50.00kHz, 500.0kHz
Sensitivity	3V
Overvoltage Protection	200V DC or AC peak

THERMAL IMAGER

Picture 4 FLIR TG 167 Thermal imager

FLIR TG 167Thermal imager is designed to easily find unseen hot and cold spots in electrical cabinets or switch boxes, giving you quality image detail on even small connectors and wires.

TECHNICAL SPECIFICATIONS

Accuracy	±1.5% or 1.5°C (2.7°F)
Detector Type	Focal plane array (FPA), uncooled micro bolometer
IR Resolution	80 × 60 pixels
Laser	Dual diverging lasers indicate the temperature measurement area, activated by pulling the trigger
Memory Type	Micro SD card
Object Temperature Range	-25°C to 380°C (-13°F to 716°F)
Thermal Sensitivity/NETD	<150 mK
Display	2.0 in TFT LCD

LUX METER

Picture 6 Nishant NE 1010 Lux meter

Nishant NE 1010 Lux meter is used to measure the lux levels.

TECHNICAL SPECIFICATIONS

Measuring range	0 Lux ~200, 000 Lux/0 Fc~185, 806 Fc
Accuracy	± 3% rdg ± 0.5% f.s.(<10,000 Lux)
	± 4% rdg ± 10% f.s.(>10,000 Lux)
Digital Updates	2 times/s
Photometric sensor	Silicon diode
Battery life	18 hours (continuous operation)
Operating temperature and humidity	0°C ~ 40°C, 10% RH ~ 90% RH
Storage temperature and humidity	-20°C ~ 50°C, 10% RH ~ 90% RH
Power	9V battery
Unit Size	52.5 x 52.5 x 166 mm
Auto power off	After 5 minutes

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