DETAILED ENERGY AUDIT REPORT

Year-2020-2021

SHRI UMIYA KANYA MAHAVIDHYALAY, RAU

Rangwasa Rau, Shri Umiya Dham Rangwasa Rau,
Indore,453331 Madhya Pradesh ,India

CONDUCTED BY :

ENERGY IS LIFE
BEE
CONSERVE IT

SABS INDIA

WE BUILD A SOLID FOUNDATION FOR SAVING ENERGY

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Project Title:	**Detailed Energy Audit**
Organization:	**SABS INDIA SALES CORPORATION**
Client:	**Shri Umiya Kanya Mahavidhyalay, Rau** Rangwasa Rau, Shri Umiya Dham Rangwasa Rau, Indore,453331 Madhya Pradesh ,India
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Acknowledgement

SABS INDIA expresses sincere thanks to the management of **Shri Umiya Kanya Mahavidhyalay, Indore** for inviting **SABS INDIA** to conduct comprehensive Energy Audit 2021-2022 of their Premises at **Shri Umiya Kanya Mahavidhyalay, Indore**.The field study of this audit was carried out on September 2021.

The officials of **Shri Umiya Kanya Mahavidhyalay, Indore** have coordinated and helped to the audit team during the field study and measurement. **SABS INDIA** express special thanks to the following persons of **Shri Umiya Kanya Mahavidhyalay, Indore.**

Internal Audit Team		
1	Dr. Anupama Chhajed	Principal
2	IQAC Coordinator	Mrs. Sarita Sharma
3	NAAC Coordinator	Mrs. Nidhi Pal
4	Audit Team Member	Mr. Tufan Benal
5	Electrician	Mr. Sunil
6	Audit Team Member	Mrs. Sonali Sharma
7	Audit Team Member	Dr. Neha Sengar
8	Audit Team Member	Ravi Patidar

We are also thankful to all other Teachers and staffs for the keen interest shown in this study and the courtesy extended. We are thankful to the management for giving us the opportunity to be involved in this very interesting and challenging project.

We would be happy to provide any further clarifications, if required, to facilitate implementation of the recommendations

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ABBREVIATION

O&M	Operation and maintenance
KW	Kilo Watt
P.F	Power Factor
kVA	Kilo Volt Ampere
kWh	Kilowatt Hour
kVAh	Kilovolt Amperes Hour
kVAr	Kilovolt Amperes Reactive
ACs	Air Conditioners
FTL	Fluorescent Tube Light Lamp
TR	Ton of Refrigeration
SPC	Specific Power Consumption
CMH	Cubic Meter per Hour
STL	Single Tube Light
DTL	Double Tube Light
Amp	Ampere
Volt	Voltage
BLDC	Brushless Direct current
Nos	Numbers
Hrs	Hours
MPPKVVCL	Madhya Pradesh Paschim Kshetra Vidyut Vitaran Company Ltd.

EXECUTIVE SUMMARY

❖ **College Details :**

Particulars	Units	Details
Name of the College	-	Shri Umiya Kanya Mahavidhyalay, Indore
Location	-	Indore (M.P), India
Owner	-	Government
Contact Person	-	Mrs. Anupama Chanjed
No. of Shifts	Nos.	1
Daily Operating Hours	Hrs./day	8
Annual Working Days	Days/yr.	300
Source of Electricity	-	MPMKVVCL
Total connected Load	kW	130.8 KW
Total Sanctioned Load	(kW)	100 KVA
Average Energy Charge in per unit	Rs./kWh	13.76

a) Existing Major Energy Consuming Technology and Electricity billing analysis :

The major equipments installed in **Shri Umiya Kanya Mahavidhyalay, Indore** like Lighting fixtures , Fans and Other appliances

Table 1 : Connected Load (kW)

S.No.	Connected Load	Power (kW)	*Connected Load (%)*
1	Lighting Systerm	20.91	10.00%
2	Fan System	72.98	16.00%
3	Air conditioning System	13.23	58.00%
4	Water Pumping	7.45	13.00%
5	Other Appliances	16.31	3.00%
Total Connected Load		***130.88***	***100%***

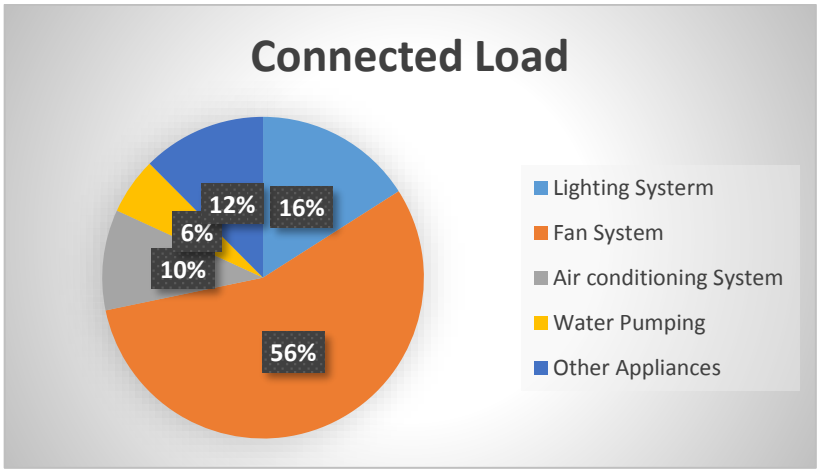

Figure 1 :Electricity Connected Load details of campus in different zone

- As per electricity bills observation and analysis, **Total Sanction load is 100 KVA** in College premises.
- As per electricity bills observation and analysis from **average electricity unit (kWh) consumed is 7,354 kWh** and **average electricity unit (KVAh) consumed is 7,748** for electricity bill in College premises.
- As per electricity bills observation and analysis **Total 12 month bill Paid is 12,62,143 Rs.**
- As per electricity bills observation and analysis, **electricity bill Power Factor varies from 0.91-0.96** .
- As per electricity bills observation and analysis, **Total Power factor incentive is 3,239**

Note –Please maintain electricity bill logbook properly in record for monitoring and analysis of electricity bill.

b) Proposed Energy Saving Technologies with Cost Economics

❖ LIGHTING SYSTEM

- We **appreciate to use LED Lighting luminaries** at some location as per site visit.
- We observed during visit, few Lights were FTL and T5 tubelight consuming high electricity.
- We **are suggesting to purchases all electrical** equipment as per star leveling program by Bureau of energy. efficiency, and will get huge amount of electricity saving .
- We are suggesting to conduct regular **Cleaning and maintenance of lighting fixtures** in every 5-6 months. to increase performance of Lighting and also improve their Lux level.
- As per data collection and site visit ,Total Connected lighting load at College Campus is **20.91 KW.**
- As per data collection and observation, **Total no. of lighting fixture is 1275**.
- We will get energy saving approximately **8089 KWh** per year and also will get amount saving approximately **Rs. 112437** per year by replacing Fluorescent Tubelight by LED Tubelight.

❖ Ceiling Fan System

- We observed that most of the Fans installed in campus were conventional.
- We are recommended to **replace 878 no. of 60 W Ceiling fan and 52 no. of 75 w Ceiling Fan with New Super energy efficient 5 star rated BLDC ceiling fan** and will get huge amount of electricity saving as per Star leveling program by Bureau of Energy Efficiency.
- We are **suggesting to purchases New energy efficient BLDC fan as per Star leveling program by Bureau of Energy Efficiency, and will get** huge amount of electricity saving.
- Energy Saving calculation **and recommendation for the existing Conventional** Ceiling fans with BLDC super energy efficient fan has been given in this report.
- We are suggesting **to conduct regular Cleaning and maintenance** of Fan at least in every 6 months to increase performance of Fan.
- We are also suggesting to improve their Air delivery of Fan by Replacing New energy efficient BLDC Fan as per 5 star leveling of Bureau of energy efficiency.
- We will get energy saving approximately **73295 KWh** per year and also will get amount saving approximately **Rs. 1018800** per year by replacing conventional Fan with new energy efficient BLDC fan.
- The total load for Ceiling Fan is **72.98 kW**.
- Total No. of Fan fixtures are **1178**.

❖ Pumping System

- We observed during Energy Audit and site visit**, 2 Pumps, one of Capacity 7.5 HP and the other of 2.5 HP were installed** within College campus for drinking water, Flushing and gardening purpose.
- Power consumption of 7.5 HP pump was **5.6 KW and 2.5 HP pump was 1.86 KW as** per site visit and measurement.

- We are suggesting to **purchse 5 star rated pumps and will get huge** amount of saving as per Star leveling program by Bureau of Energy Efficiency 2020.
- We are **suggesting to install Solar Pumping system and** will get huge amount of savings.

❖ Air Conditioning System

- Total Connected load of Air Conditioning System is 13.23 KW.
- Total No. of AC present in the campus are 7.
- We are **suggesting to purchases New AC as 5 star rated Air Conditioning** system as per Star leveling program by Bureau of Energy Efficiency 2020, and will get huge amount of electricity saving.
- We are suggesting to maintain air conditioning set temperature above **24 Degree Celsius** as per Bureau of Energy Efficiency.
- We are **suggesting conducting regular air condition maintenance** in every 3 months to increase performance of air conditioning.

❖ Other Diffrent Type Of Connected Load :

There are different types of other equipments like Computer, Printer, Xerox machine,Water Cooler,Refrigretor and other lab equipments are installed at various location and they also contribute electricity consumption

- We suggest to **purchase equipments as per Star leveling program** by Bureau of Energy Efficiency 2020, and will get huge amount of electricity saving.
- Maintainance of all the equipments should be done regularly.

c) Saving Highlights

Table 2 : Saving Highlights

1	Total savings as per available connected load of equipments in Rs.	1131242
2	Actual Energy Saving in Rs by 30 % of Electrical appliances working as per electricity bill observation	339373
3	Total savings in kWh	81384
4	Total investments in Rs.	2939400
5	Pay Back Period in months	31.18

Summary of Energy Conservation Measures

Table 3 : Summary of Energy Conservation Measures

S.No.	Energy Conservation Measures	Annual Savings		Investment	Payback
		kWh	Rs.	Rs.	Months
	LIGHTING SYSTEM				
1	**Replacement 35 nos. of 36 Watt Fluorescent Tube Light with energy efficient 18 W LED Tubelight installed in different places in .**	1840	25570	21000	9.86
2	**Replacement 214 nos. of 28 Watt T5 Fluorescent Tube Light with energy efficient 18 W LED Tubelight installed in different places in .**	6249	86858	128400	17.74
	FAN SYSTEM				
3	**Replacement of 878 no. Existing 60 W Ceiling Fan With Energy efficient Energy Efficient 28 W GORILLA Atomberg Fan in College**	67430	937283	2634000	34
4	**Replacement of 52 no. Existing 75 W Ceiling Fan With Energy efficient Energy Efficient 28 W GORILLA Atomberg Fan in College.**	5865	81531	156000	23
	Total	81384	1131242	2939400	31.18

1 INTRODUCTION

1.1 Energy Audit

Energy Audit is an effective means of establishment present efficiency levels and identifying Potential areas of improvement in energy consumption.

Energy audit of utility systems largely helps , Which are given below :

- Reducing the energy consumption with resultant reduction in electricity bills.
- Audit involves data collection , data verification and detailed analysis of the data.
- The analysis leads to recommendations, which are short term (with minimum investment), medium term (with moderate investment) and long term (with capital expenditure).
- The cost benefit analysis of various energy conservation proposals enables managements to take decisions regarding implementation schedules.

Energy conservation is a worldwide objective to save the human being from possible disaster. Under the mandate of The Energy Conservation Act 2001, the Bureau of Energy Efficiency and Government of India are implementing various programmers to provide momentum of the energy conservation movement in the country. Energy Auditing is most vital part of the conservation of energy. In order to improve the efficiency of the Energy consuming system, energy auditing is the first necessary action to be taken by the concerned firm. Through the energy auditing actual parameters can be detected at each step, which can be compared with the standard achievable parameters. For proper Energy auditing and energy accounting, parameters need to be monitored on regular.

Shri Umiya Kanya Mahavidhyalay Indorehas engaged **SABS INDIA** for conducting detailed energy audit in their premises for the year of 2020.

1.2 Methodology & Approach

The audit involved basic design data collection for various electrical & thermal utilities, kick of meeting with concern departmental engineers & managers, carrying out various field measurements, performance analysis and loss analysis covering all major energy consuming sections of **Shri Umiya Kanya Mahavidhyalay Indore**to realistically assess losses mainly in energy consuming utility areas and potential for energy savings. The major areas of study include:

- Building energy bills analysis.
- Electrical supply and distribution system analysis
- Lighting system analysis.
- Water pumping system analysis.
- Buildings envelop analysis.
- Specific Energy Consumption.

During study several interactions was made to the office personnel and technicians to share the actual operational features of equipment, equipment's maintenance schedule and equipment break down, down

time of machineries, safety measures etc. At the same time required data was collected from the various departments and review the same with the operational actual data.

The study focused on improving energy use efficiency and identifying energy saving opportunities at various equipments. The analyses included simple payback period and life cycle cost calculations where investments are required to be made to implement recommendations, to establish their economic viability.

1.3 Instrument used in Energy Audit:

We have a wide array of latest, sophisticated, portable, diagnostic and measuring instruments to support our energy audit investigations and analyses. The audit study made use of various portable instruments along with plant online instrumentations, for carrying out various measurements and analyses. The specialized instruments that were used during the energy audit include:

- Power Analyzer.
- Ultra Sonic Flow Meter.
- Digital power clamp meter & multi-meter (2745 KUSAM MECO)
- Digital Hygrometer HD-304 HTC
- Digital Lux Meter (LX-101A HTC TM)
- Digital Anemometer (AVM -07 HTC)
- IR Thermometers for temperature measurement HTC TM (IR -50 to 1550 0C)
- Digital distance meter
- Measuring Tap meter

2 CHAPTER
Site Visit and inspection

2.1 College Details

Shri Umiya Kanya Mahavidyalaya has been founded with an objective to promote higher education among girls, who belong to rural areas in Madhya Pradesh and bordering states. They are imparted qualitatively optimum education at minimum fees. A great deal of emphasis is laid on inculcating in them a sense of responsibility and ethical values. Moreover, the students are taught various skills which grooms up their entrepreneurial skills to shape them up as self-employed individuals eventually. In addition to academic pursuits the students are also inspired to participate in various co-curricular activities and interact with other sports clubs. Industrial visits are also conducted impart the desired exposure to them.

In order to uplift the social stature of students, they are given empirical knowledge enabling them to understand the realistic approach towards all the challenges that they confront in their lives. It is quite evident that educating a girl is akin to educate the entire family. Keeping in view the fulfilment of the cherished ambition of students, the right kind of platform is created. It is one of the prime objectives of the institute to promote Indian traditional values and in view of this aim regional festivals are celebrated at the college frequently, every day at Shri Umiya Kanya Mahavidyalaya starts with morning prayers. In keeping with much valued cultural ethics and to maintain equanimity, a decent dress-code has been designed.

2.2 Site visit and site inspection

Energy audit team visited at College campus premises and also had completed of electrical measurement and appliances data collection.

Figure 2 Front View of the College

Figure 3: Computer Lab

Figure 4: Fountain

Figure 5 : Well

3 CHAPTER
ELECTRICITY BILL ANALYSIS

Shri Umiya Kanya Mahavidhyalay, Indore receives power from ,Madhya Pradesh Madhya Kshetra Vidyut Vitran Company Limited.

3.1 Month Wise Energy Consumption

The maximum demand, energy consumption, fixed charges, energy charges and total bill in Rs for the Financial year 2020-2021 are shown in below tables as per the details from the Collegebill. All the one years data has been represented by the various graphs. This indicator addresses energy consumption, energy sources, energy monitoring, and electricity consumption .

Tariff Schedule LV - 2

NON-DOMESTIC:
LV 2.1

Applicability:
This tariff is applicable for light, fan and power to Schools / Educational Institutions including workshops and laboratories of Engineering Colleges / Polytechnics/ITIs (which are registered with /affiliated/ recognized by the relevant Govt. body or university), Hostels for students or working women or sports persons.

Tariff:
Tariff shall be as given in the following table:

Sub category	Energy Charge (paise/unit) Urban/ Rural areas	Monthly Fixed Charge (Rs.)	
		Urban areas	Rural areas
Sanctioned load-based tariff (only for connected load up to 10 kW)	630	150 per kW	120 per kW
Demand based tariff **Mandatory** for Connected load above 10 kW	630	270 per kW or 216 per kVA of billing demand	230 per kW or 184 per kVA of billing demand

Figure 6 Electricity Tariff 2020-21

Table 4 : Electricity Bill 2020-21

Monthly Electrical bill detail in shri Umiya Girls College Indore 2020-2021													
Months	**Sanctioned Load (KVA)**	**MDI (KVA)**	**KWH (Total Units)**	**KWH (Net Units)**	**KVAH (Total Units)**	**KVAH (Net Units)**	**Fixed charges (Rs)**	**Energy Charges (Rs)**	**Power Factor**	**Total bill (Rs)**	**Average Per unit Charges Rs/KWh**	**Electricity bill energy charge Rs/KVAh**	**PF Incentives (Rs)**
Jul-20	100	36	7437	7437	7845	7845	41400	52803	0.95	88754	11.93	11.31	
Aug-20	100	35	8034	8034	8366	8366	41400	57041	0.96	107393	13.37	12.84	1161
Sep-20	100	28	7863	7863	8217	8217	41400	55827	0.96	106771	13.58	12.99	568
Oct-20	100	35	8234	8234	8717	8717	41400	58461	0.94	127409	15.47	14.62	
Nov-20	100	32	8181	8181	8717	8717	41400	58085	0.94	127364	15.57	14.61	
Dec-20	100	32	8265	8265	8585	8585	41400	58681	0.96	126675	15.33	14.76	1191
Jan-21	100	21	4589	1264	4910	1340	42240	9151	0.94	74081	16.14	15.09	
Feb-21	100	25	4791	1330	5043	1400	42300	9642	0.95	72926	15.22	14.46	
Mar-21	100	49	11642	4337	12190	4541	42300	31443	0.96	96814	8.32	7.94	319
Apr-21	100	48	10027	5516	10560	5841	42300	40208	0.95	83348	8.31	7.89	
May-21	100	27	4687	1328	4942	1400	42300	9628	0.95	74861	15.97	15.15	
Jun-21	100	24	4497	1219	4885	1324	42300	8837	0.92	78659	17.49	16.10	
Average Values			**7354**	**5251**	**7748**	**5524**	**41845**	**37484**	**0.948**	**97088**	**13.89**	**13.1**	
Total Bill Paid in Whole year (Rs)										**1262143**			
Total incentive in whole Year (Rs)													**3239**

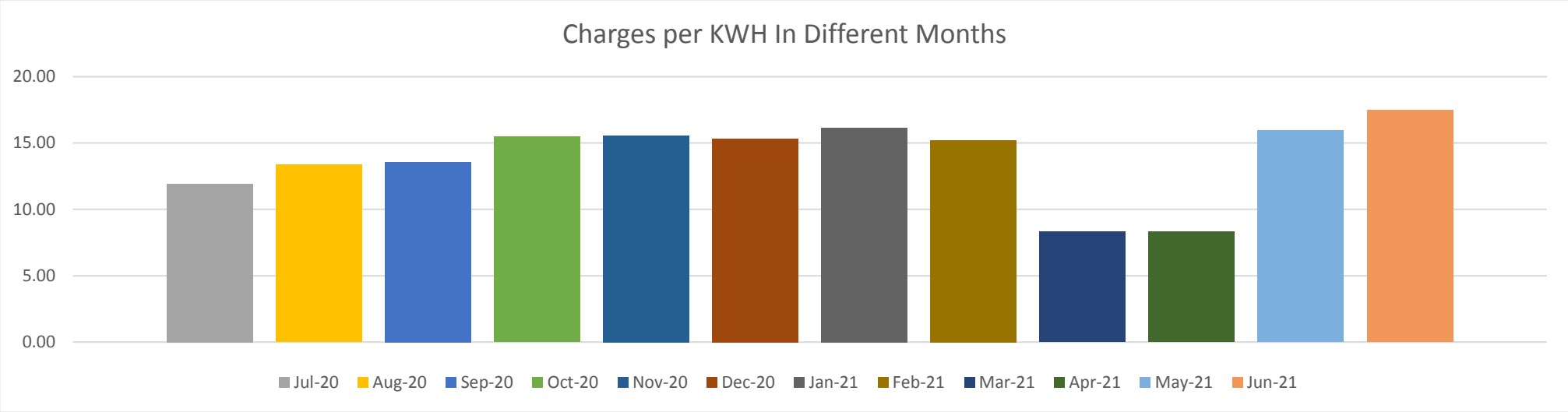

Figure 7 : Per Unit Charges in different months graph

3.2 OBSERVATIONS & COMMENTS

- As per electricity bills observation and analysis, **Total Sanction load is 100 KVA** in College premises.
- As per electricity bills observation and analysis from **average electricity unit (kWh) consumed is 7,354 kWh** and **average electricity unit (KVAh) consumed is 7,748** for electricity bill in College premises.
- As per electricity bills observation and analysis **Total 12 month bill Paid is 12,62,143 Rs.**
- As per electricity bills observation and analysis from Apr-2020 to Jul-2021 **electricity bill Power Factor varies from 0.91-0.96** .
- As per electricity bills observation and analysis from Apr-2020 to July- 2021, **Total Power factor incentive is 3,239**

Note –Please maintain electricity bill logbook properly in record for monitoring and analysis of electricity bill

4 CHAPTER
POWER MEASUREMNT AND ANALYSIS

4.1 Power Measurement

Power measurement was done in the campus by the audit team. Power is measured at the transformer section.

Figure 8 : Transformer Location

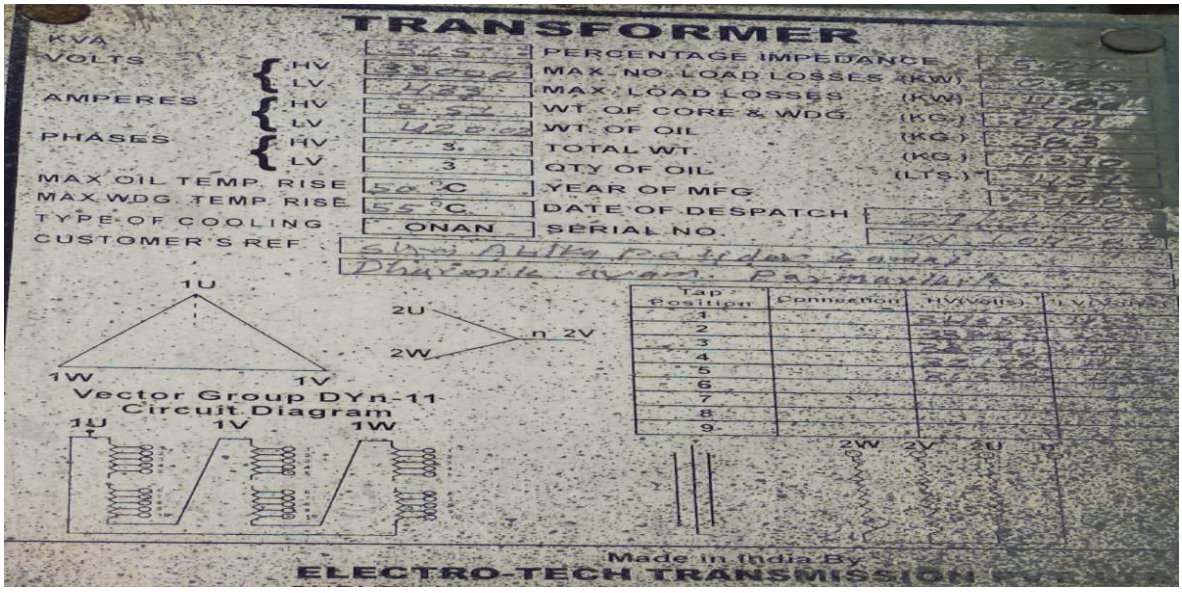

Figure 9 : Transformer Details

Power is also Measured at the Panels. The figure below shows the reading on the panels which was also measured by the auditor.

Figure 10 : Panel Reading

4.2 Electrical Safety

Electrical safety is also noticed in the audit. Electrical safety is very important aspect in Premises for safety of Students, Teachers and other Staff to prevent accidents .

We observed some places have need to improve electrical system for safety aspect.

Figure 11 : Complex wiring

4.3 Observations and Comments :

- We are suggesting to installed smart control panel for safety and power monitoring .
- We observed that at some places wires were not kept properly.
- We observed that some places electrical wiring connection more complicated and it occurs in future cause of accident.

5 CHAPTER
LIGHTING SYSTEM

5.1 Lighting Fixtures

The Shri Umiya Kanya Mahavidhyalay Indorehas high lighting load and various type of indoor and outdoor lighting fixture are installed in College campus .The lux measurement was also done at the time of audit. All the parameters are given in the below table:

Table 5 : Different type of lighting fixture

Shri Umiya Girls College Rau,Rangwasa							
Sr. No.	Location	Location of Fixtures	Types of Lighting	No.of Lighting fixture	Power (W)	Total Power (W)	Lux Level
1	Main Building Grounf floor	Principal Cabin	LED	12	9	108	158-194
			LED	16	5	80	158-195
			FTL	1	36	36	158-196
		Account Office-1	LED	12	9	108	157-194
			FTL	1	36	36	156-195
		Account Office-2	LED	12	9	108	145-189
			FTL	4	18	72	167-198
		Physics laboratory	T5	1	28	28	145-189
			LED	4	12	48	167-198
		BT Laboratory	LED	4	12	48	167-199
		Botany Laboratory	FTL	1	36	36	170-260
			LED	5	12	60	180-261
		NCC Room	LED	2	12	24	180-262
		G12 Room	LED	4	12	48	145-189
		G1 - G9 total 9 class rooms	LED	36	12	432	155-181
		B1-B9 basement 9 Class rooms	LED	36	12	432	90-115
2	First Floor	Zoology laboratory	LED	4	12	48	180-266
			FTL	2	36	72	180-267
		Computer laboratory-1	LED	4	15	60	180-268
			FTL	2	36	72	180-269
		Computer laboratory-2	LED	4	15	60	180-270
			FTL	2	36	72	180-271
		Room no 101-114, 14 class rooms	LED	56	15	840	180-270
			FTL	14	36	504	180-271
3	Second Floor	Library	LED	14	15	210	210-270
			FTL	2	36	72	218-271
			LED	8	15	120	210-270

Shri Umiya Girls College Rau,Rangwasa							
Sr. No.	Location	Location of Fixtures	Types of Lighting	No.of Lighting fixture	Power (W)	Total Power (W)	Lux Level
		Computer Laboratory-3	FTL	2	36	72	218-271
		Chemistry Laboratory	LED	8	15	120	210-270
		Room no 201-212, 12 class rooms	LED	56	14	784	180-273
4	Third Floor	Conference hall	LED	8	15	120	210-270
			FTL	2	36	72	218-271
		Room no 301-318, 18 class rooms	LED	72	12	864	218-272
5	Forth Floor	Room no 401-406, 6 class rooms	LED	24	12	288	218-273
			FTL	2	36	72	218-271
6	Fifth Floor	Room no 501-506, 6 class rooms	LED	24	12	288	218-273
			FTL	2	36	72	218-271
7	School Building	Room no 1-80	LED	320	9	2880	218-272
			FTL	2	36	72	218-271
Shri Umiya Girls College Rau,Rangwasa (Girls hostel)							
Sr. No.	Location	Location of Fixtures	Types of Lighting	No.of Lighting fixture	Power (W)	Total Power (W)	Lux Level
1	Girls hostel Building	Basement 1-15 Rooms	LED	15	18	270	158-194
			FTL	15	36	540	158-196
			LED	10	22	220	157-194
			FTL	1	36	36	156-195
			LED	10	22	220	145-189
			FTL	1	36	36	167-198
2		StoreRoom+Mess	LED	10	18	180	145-189
			FTL	2	36	72	167-198
	Ground Floor	Laxmi house 1-27,27 rooms	LED	27	18	486	145-189
			T5	27	28	756	167-198
		Ahilya house 1-25,25 rooms	LED	25	18	450	145-189
			T5	25	28	700	167-198
3	First Floor	Durga house 1-27,27 rooms	LED	27	18	486	145-189
			T5	27	28	756	167-198
		Ganga house 1-26,26 rooms	LED	26	18	468	145-189
			T5	26	28	728	167-198
4	Second Floor	Saraswati house 1-28,28 rooms	LED	28	18	504	145-189
			T5	28	28	784	167-198
		Ambika house 1-26,26 rooms	LED	26	18	468	145-189
			T5	26	28	728	167-198
5	Third Floor	Parwati house 1-27,27 rooms	LED	28	18	504	145-189
			T5	28	28	784	167-198

Shri Umiya Girls College Rau,Rangwasa							
Sr. No.	Location	Location of Fixtures	Types of Lighting	No.of Lighting fixture	Power (W)	Total Power (W)	Lux Level
		Narmda house 1-27,27 rooms	LED	26	18	468	145-189
			T5	26	28	728	167-198
Total Power Consumption in kW			20.91				
Total no. of Lighting Fixture			***1275***				

5.2 OBSERVATIONS & COMMENTS

- We **appreciate to use LED Lighting luminaries** at some location as per site visit.
- We observed during visit, few Lights were FTL consuming high electricity
- We **are suggesting to purchases all electrical** equipment as per star leveling program by Bureau of energy efficiency, and will get huge amount of electricity saving .
- We are suggesting to conduct regular **Cleaning and maintenance of lighting fixtures** in every 5-6 months to increase performance of Lighting and also improve their Lux level.
- As per data collection and site visit ,Total Connected lighting load at College Campus is **20.91 KW.**
- As per data collection and observation, **Total no. of lighting fixture is 1275**.
- We will get energy saving approximately **8089 KWh** per year and also will get amount saving approximately **Rs. 112437** per year by replacing Fluorescent Tubelight by LED Tubelight.

5.3 Lighting Proposal

Proposal 1

Replacement 35 nos. of 36 Watt Fluorescent Tube Light with energy efficient 18 W LED Tubelight installed in different places in .

Energy Saving	
Total no of Approximate 36 Watt FTL	35
Replacement of 36 Watt FTL with LED STL of capacity in watt	18
Average daily running time for 36 Watt FTL in hour	8
Total Energy Consumed by 36 Watt FTL	36
Total Energy Consumed by 35 no. of 36 Watt STL in kWh per day	10.1
Annual Energy Consumed by 35 no. of 36 STL with Choke (300 working Days) KWh	3679
Annual Energy Consumed by 18 W STL LED light in KWh	1840
Prospective Annual Energy Savings in kWh	1840
Annual Savings in Rupees (taking Average 13.9 Rs. Per unit charge for 300 day a year)	25570
Initial investment required for 35 nos.18 Watt LED STL (EE LED Tube Lights @ Rs 600 per STL per 18 W LED)	21000
Payback Period in months only	9.86
Life of the project years	15
Depreciation Cost Rs	1400
ROI {(Net annual savings – Depreciation cost)/ Investment} x 100%	115.10%

5.4 Proposal 2

Replacement 214 nos. of 28 Watt T5 Fluorescent Tube Light with energy efficient 18 W LED Tubelight installed in different places in .

Energy Saving	
Total no of Approximate 28 Watt FTL	214
Replacement of 28 Watt FTL with LED STL of capacity in watt	18
Average daily running time for 28 Watt FTL in hour	8
Total Energy Consumed by 28 Watt FTL	28
Total Energy Consumed by 214 no. of 28 Watt T5 Tubelight in kWh per day	47.9
Annual Energy Consumed by 214 no. of 28 watt T5 Tubelight (300 working Days) KWh	17497
Annual Energy Consumed by 18 W STL LED light in KWh	11248
Prospective Annual Energy Savings in kWh	6249
Annual Savings in Rupees (taking Average 13.9 Rs. Per unit charge for 300 day a year)	86858
Initial investment required for 35 nos.18 Watt LED STL (EE LED Tube Lights @ Rs 600 per STL per 18 W LED)	128400
Payback Period in months only	17.74
Life of the project years	15
Depreciation Cost Rs	8560
ROI {(Net annual savings – Depreciation cost)/ Investment} x 100%	60.98%

6 CHAPTER
FAN SYSTEM

There are various ceiling fan installed at various location in the Shri Umiya Kanya Mahavidhyalay Indore and they also contribute very high electricity consumption. All of the fans are conventional and hence high energy consuming.

6.1 Details of Different type of fans:

The detail of the fans is given in the below table:

Table 6 : Different type of Fan

Shri Umiya Girls College Rau,Rangwasa						
Sr. No.	Location	Location of Fan	Types of Fan	No.of Fan	Power (W)	Total Power (W)
1	Main Building Grounf floor	Principal Cabin	Ceiling Fan	2	60	120
		Account Office-1	Ceiling Fan	2	60	120
		Account Office-2	Ceiling Fan	2	60	120
		Physics laboratory	Ceiling Fan	4	60	240
		BT Laboratory	Ceiling Fan	4	60	240
		Botany Laboratory	Ceiling Fan	4	60	240
		NCC Room	Ceiling Fan	2	60	120
		G12 Room	Ceiling Fan	4	60	240
		G1 - G9 total 9 class rooms	Ceiling Fan	36	60	2160
		B1-B9 basement 9 Class rooms	Ceiling Fan	36	60	2160
2	First Floor	Zoology laboratory	Ceiling Fan	4	60	240
		Computer laboratory-1	Ceiling Fan	4	60	240
		Computer laboratory-2	Ceiling Fan	4	60	240
		Room no 101-114, 14 class rooms	Ceiling Fan	56	60	3360
3	Second Floor	Library	Ceiling Fan	16	60	960
		Computer Laboratory-3	Ceiling Fan	8	60	480
		Chemistry Laboratory	Ceiling Fan	8	60	480
		Room no 201-212, 12 class rooms	Ceiling Fan	48	60	2880
4	Third Floor	Conference hall	Ceiling Fan	8	60	480
		Room no 301-318, 18 class rooms	Ceiling Fan	72	60	4320
5	Forth Floor	Room no 401-406, 6 class rooms	Ceiling Fan	24	60	1440
	Fifth Floor	Room no 501-506, 6 class rooms	Ceiling Fan	24	60	1440
	School Building	Room no 1-80	Ceiling Fan	320	60	19200

Shri Umiya Girls College Rau,Rangwasa (Girls hostel)						
Sr. No.	Location	Location of Fan	Types of Fan	No.of Fan	Power (W)	Total Power (W)
1	Girls hostel Building	Basement 1-15 Rooms	Ceiling Fan	15	75	1125
			Exaust Fan	15	50	750
		Dining hall-1	Exaust Fan	10	250	2500
		Dining hall-2	Exaust Fan	10	250	2500
		StoreRoom+Mess	Ceiling Fan	10	75	750
2	Ground Floor	Laxmi house 1-27,27 rooms	Ceiling Fan	27	75	2025
			Exaust Fan	27	50	1350
		Ahilya house 1-25,25 rooms	Ceiling Fan	25	60	1500
			Exaust Fan	25	50	1250
3	First Floor	Durga house 1-27,27 rooms	Ceiling Fan	27	60	1620
			Exaust Fan	27	50	1350
		Ganga house 1-26,26 rooms	Ceiling Fan	26	60	1560
			Exaust Fan	26	50	1300
4	Second Floor	Saraswati house 1-28,28 rooms	Ceiling Fan	28	60	1680
			Exaust Fan	28	50	1400
		Ambika house 1-26,26 rooms	Ceiling Fan	26	60	1560
			Exaust Fan	26	50	1300
5	Third Floor	Parwati house 1-28,28 rooms	Ceiling Fan	28	60	1680
			Exaust Fan	28	50	1400
		Narmda house 1-26,26 rooms	Ceiling Fan	26	60	1560
			Exaust Fan	26	50	1300
Total Power Consumption in kW			72.98			
Total no. of Fan Fixture			***1178***			

6.2 OBSERVATIONS & COMMENTS

- We observed, most of the Fan were conventional.
- We are recommended to **replace 878 no. of 60 W Ceiling fan and 52 no. of 75 w Ceiling Fan with New Super energy efficient 5 star rated BLDC ceiling fan** and will get huge amount of electricity saving as per Star leveling program by Bureau of Energy Efficiency.
- We are **suggesting to purchases New energy efficient BLDC fan as per Star leveling program by Bureau of Energy Efficiency, and will get** huge amount of electricity saving.
- Energy Saving calculation **and recommendation for the existing Conventional** Ceiling fans with BLDC super energy efficient fan has been given in this report.

- We are suggesting **to conduct regular Cleaning and maintenance** of Fan at least in every 6 months to increase performance of Fan.
- We are also suggesting to improve their Air delivery of Fan by Replacing New energy efficient BLDC Fan as per 5 star leveling of Bureau of energy efficiency.
- We will get energy saving approximately **73295 KWh** per year and also will get amount saving approximately **Rs. 1018800** per year by replacing conventional Fan with new energy efficient BLDC fan.
- The total load for Ceiling Fan is **72.98 kW**.
- Total No. of Fan fixtures are **1178**.

6.3 CEILING FAN PROPOSAL

Proposal 1

Replacement of 878 no. Existing 60 W Ceiling Fan With Energy efficient Energy Efficient 28 W GORILLA Atomberg Fan in College.

Energy Saving	
Total no of Approximate 60 W Ceiling Fan	878
Replacement of 60 Watt Ceiling Fan with capacity of 28 Watt GORILLA Atomberg Fan	28
Average daily running time for 60 Watt Ceiling Fan in hour	8
Total Energy Consumed by 60 W Ceiling Fan	60
Total Energy Consumed by 878 no. of 60 Watt Ceiling Fan kWh per day	421
Annual Energy Consumed by 60 Watt Ceiling Fan (300 working Days) kWh	126432
Annual Energy Consumed by 878 no. of 28 Watt Ceiling Fan in kWh	59002
Prospective Annual Energy Savings in kWh	67430
Annual Savings in Rupees (taking Average 13.9 Rs. Per unit charge for 300 day a year)	937283
Initial investment required for 878 no. of 28 Watt Ceiling Fan(Price for GORILLA Atomberg Fan @ 3000 per 28 Watt GORILLA Atomberg Fan)	2634000
Payback Period in Months only	34
Life of the project years	15
Depreciation Cost Rs	175600
ROI {(Net annual savings – Depreciation cost)/ Investment} x 100%	29

Proposal 2

Replacement of 52 no. Existing 75 W Ceiling Fan With Energy efficient Energy Efficient 28 W GORILLA Atomberg Fan in College.

Energy Saving	
Total no of Approximate 75 W Ceiling Fan	52
Replacement of 75 Watt Ceiling Fan with capacity of 28 Watt GORILLA Atomberg Fan	28
Average daily running time for 75 Watt Ceiling Fan in hour	8
Total Energy Consumed by 75 W Ceiling Fan	75
Total Energy Consumed by 75 no. of 60 Watt Ceiling Fan kWh per day	31.2
Annual Energy Consumed by 75 Watt Ceiling Fan (300 working Days) kWh	9360
Annual Energy Consumed by 75 no. of 28 Watt Ceiling Fan in kWh	3494.4
Prospective Annual Energy Savings in kWh	5865.6
Annual Savings in Rupees (taking Average 13.9 Rs. Per unit charge for 300 day a year)	81531.84
Initial investment required for 3 no. of 28 Watt Ceiling Fan(Price for GORILLA Atomberg Fan @ 3000 per 28 Watt GORILLA Atomberg Fan)	156000
Payback Period in Months only	22.96
Life of the project years	15
Depreciation Cost Rs	10400
ROI {(Net annual savings – Depreciation cost)/ Investment} x 100%	45.60

7 CHAPTER
AIR CONDITIONING SYSTEM

7.1 **Air Conditioning System :** Air Conditioning load is also present in the campus although it quite less comparatively. Details of the air conditioners are given below.

Table 7 : Air conditioning system details

Air- Conditioning Sytem Location Wise									
Sr. No	Location	No. of AC	Air Conditioning				Power Consumption in		Specific Power Consumption
			Type	Star	Make	Ton	In W	Total Power (kW)	kW/TR
1	Trust office	5	Split	3		1.5	1890	9.45	1.26
2	College Building	2	Split	3		1.5	1890	3.78	1.26
Total no. of AC		7	TOTAL POWER CONSUMPTION (kW)					13.23	

7.2 Observations & Comments :

- Total Connected load of Air Conditioning System is 13.23 KW.
- Total No. of AC present in the campus are 7.
- We are **suggesting to purchases New AC as 5 star rated Air Conditioning** system as per Star leveling program by Bureau of Energy Efficiency 2020, and will get huge amount of electricity saving.
- We are suggesting to maintain air conditioning set temperature above **24 Degree Celsius** as per Bureau of Energy Efficiency.
- We are **suggesting conducting regular air condition maintenance** in every 3 months to increase performance of air conditioning.

8 CHAPTER
OTHER EQUIPMENTS LOAD

There are different types of other equipments like Printer,PC ,Water Cooler,Refrigretor and other lab equipments are installed at various location in the Umiya Girls College, Indore and they also contribute electricity consumption.

8.1 Different Type Other Equipments

Table 8 : Different type of equipment system

Other equipments location wise						
Sr. No.	**Location**	**Location of Product**	**Type of Product**	**Number of Product**	**Power (Watts)**	**Total Power (Watts)**
1	Girls College Main Building					
		Computer laboratory-1	PC	50	100	5000
			Projector	1	200	200
		Computer laboratory-2	PC	21	100	2100
			Projector	1	200	200
			Cooler	1	250	250
		Computer laboratory-3	PC	40	100	4000
			Printer	2	300	600
			Xerox	1	1000	1000
		Account Office-1	PC	2	100	200
			Printer	2	300	600
		G12	Sewing Machine	16	50	800
		Account Office-2	PC	2	100	200
			Printer	2	300	600
		Principal cabin	PC	1	100	100
			Printer	1	300	300
			Cooler	1	40	40
			LED TV	1	120	120
		Total Power in KW				

8.2 Observation and Comments

- We suggest to **purchase equipments as per Star leveling program** by Bureau of Energy Efficiency 2020, and will get huge amount of electricity saving.
- Maintainance of all the equipments should be done regularly.

9 CHAPTER
PUMPING SYSTEM

9.1 Submersible Pumps

There are 1 no. of 5 HP capacity of submersible pump installed within College campus for drinking water, Flushing and gardening purpose.

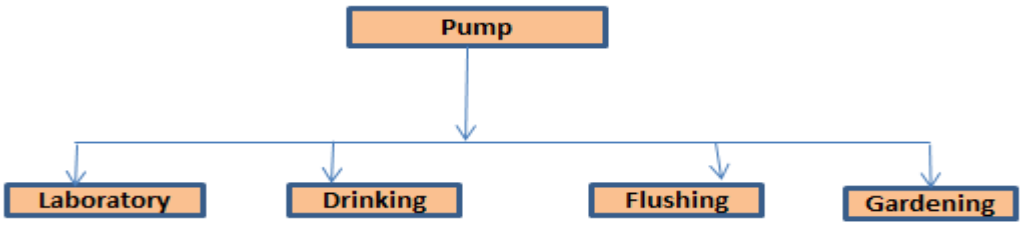

Figure 12: 5 Major usage area of pump

9.2 Pumps Details :

Pump Details		
No. of pump	2	
Location	Main Building	Garden
Power in HP	7.5	2.5
Power in KW	5.6	1.85
Total Power in KW	7.45	

9.3 Observation and Comments

- We observed during Energy Audit and site visit**, 2 Pumps, one of Capacity 7.5 HP and the other of 2.5 HP were installed** within College campus for drinking water, Flushing and gardening purpose.
- Power consumption of 7.5 HP pump was **5.6 KW as** per site visit and measurement.
- We are suggesting to **purchse 5 star rated pumps and will get huge** amount of saving as per Star leveling program by Bureau of Energy Efficiency 2020.
- We are **suggesting to install Solar Pumping system and** will get huge amount of savings.

10 CHAPTER
SOLAR POWERPLANT

10.1 Basic Details

There is a solar system installed in the campus. It saves a lot of energy as well as money for the college. The capacity of the system is 61.05 KW. The basic details of the solar system has been given in the following table.

Figure 13 : Solar panels installed on roof

10.2 Saving By Solar

The system fulfiills maximum requirement of the college and the remaining is fulfilled by the Electricity dept.

The power generation and calculation is given in the table.

Table 9 : Saving by solar system

Capacity of Solar System Installed in Campus					75 KW
Month	**Total units consumed**	**Total units supplied**	**Units generated per month by solar**	**Per unit energy charges**	**Saving**
	KWH	**KWH**	**KWH**	**Rs**	**Rs**
Jan-21	4589	1264	3325	7.25	24106.25
Feb-21	4791	1330	3461	7.25	25092.25
Mar-21	11642	4337	7305	7.25	52961.25
Apr-21	10027	5516	4511	7.25	32704.75
May-21	4687	1328	3359	7.25	24352.75
Jun-21	4497	1219	3278	7.25	23765.5
Total Units (KWH) generated by solar			**25239**	**Total Savings in Rs.**	**182983**

10.3 Observation and Comments

- We observed during Energy Audit and site visit that the Capacity of solar system is **75 KW**.
- We observed during Energy Audit that Total Units generated by solar system is **25239 KWH from Jan 2021 to June 2021.**
- We observed during Energy Audit that Total saving by solar system is **182983 Rs by energy charges**.
- We appreciate the decision of installing solar system in the campus.
- Solar system has saved a lot of energy as well as money of the college campus.

11 CHAPTER
GENERAL TIPS FOR ENERGY CONSERVATION IN DIFFERENT UTILITIES SYSTEMS

Electricity:

- Schedule your operations to maintain a high load factor
- Minimize maximum demand by tripping loads through a demand controller
- Use standby electric generation equipment for on-peak high load periods.
- Correct power factor to at least 0.99 under rated load conditions.
- Set transformer taps to optimum settings.
- Shut off unnecessary computers, printers, and copiers at night.

Motors:

- Properly size to the load for optimum efficiency.
- (High efficiency motors offer of 4 - 5% higher efficiency than standard motors)
- Check alignment.
- Provide proper ventilation
- (For every 10°C increase in motor operating temperature over recommended peak, the motor life is estimated to be halved)
- Check for under-voltage and over-voltage conditions.
- Balance the three-phase power supply.
- (An Imbalanced voltage can reduce 3 - 5% in motor input power)
- Demand efficiency restoration after motor rewinding.

Fans :

- Use smooth, well-rounded air inlet cones for fan air intakes.
- Avoid poor flow distribution at the fan inlet.
- Minimize fan inlet and outlet obstructions.
- Clean screens, filters, and fan blades regularly.
- Use aerofoil-shaped fan blades.
- Minimize fan speed.
- Use variable speed drives for large variable fan loads.

Pumps:

- Operate pumping near best efficiency point.
- Modify pumping to minimize throttling.
- Adept to wide load variation with variable speed drives or sequenced control of smaller units.
- Stop running both pumps -- add an auto-start for an on-line spare or add a booster pump in the problem area.
- Use booster pumps for small loads requiring higher pressures.
- Increase fluid temperature differentials to reduce pumping rates.
- Repair seals and packing to minimize water waste.
- Balance the system to minimize flows and reduce pump power requirements.
- Use siphon effect to advantage: don't waste pumping head with a free-fall (gravity) return.

Lighting:

- Reduce excessive illumination levels to standard levels using switching; delamping, etc. (Know the electrical effects before doing delamping.)
- Aggressively control lighting with clock timers, delay timers, photocells, and/or occupancy sensors.
- Install efficient alternatives to incandescent lighting, mercury vapor lighting, etc. Efficiency (lumens/watt) of various technologies range from best to worst approximately as follows: low pressure sodium, high-pressure sodium, metal halide, fluorescent, mercury vapor, incandescent.
- Select ballasts and lamps carefully with high power factor and long-term efficiency in mind.
- Upgrade obsolete fluorescent systems to Compact fluorescents and electronic ballasts
- Consider lowering the fixtures to enable using less of them.
- Consider day lighting, skylights, etc.
- Consider painting the walls a lighter color and using less lighting fixtures or lower wattages.
- Use task lighting and reduce background illumination.
- Re-evaluate exterior lighting strategy, type, and control. Control it aggressively.
- Change exit signs from incandescent to LED.

DG Sets:

- Optimize loading
- Use waste heat to generate steam/hot water /power an absorption chiller or preheat process or utility feeds.
- Use jacket and head cooling water for process needs

- Clean air filters regularly
- Insulate exhaust pipes to reduce DG set room temperatures
- Use cheaper heavy fuel oil for capacities more than 1MW

Buildings:

- Seal exterior cracks/openings/gaps with caulk, gasketing, weather stripping, etc.
- Consider new thermal doors, thermal windows, roofing insulation, etc.
- Install windbreaks near exterior doors.
- Replace single-pane glass with insulating glass.
- Consider covering some window and skylight areas with insulated wall panels inside the building.
- If visibility is not required but light is required, consider replacing exterior windows with insulated glass block.
- Consider tinted glass, reflective glass, coatings, awnings, overhangs, draperies, blinds, and shades for sunlit exterior windows.
- Use landscaping to advantage.
- Add vestibules or revolving doors to primary exterior personnel doors.
- Consider automatic doors, air curtains, strip doors, etc. at high-traffic passages between conditioned and non-conditioned spaces. Use self-closing doors if possible.
- Use intermediate doors in stairways and vertical passages to minimize building stack effect.
- Use dock seals at shipping and receiving doors.
- Bring cleaning personnel in during the working day or as soon after as possible to minimize lighting and HVAC costs.

Waste & Waste water:

- Recycle water, particularly for uses with less-critical quality requirements.
- Recycle water, especially if sewer costs are based on water consumption.
- Balance closed systems to minimize flows and reduce pump power requirements.
- Eliminate once-through cooling with water.
- Use the least expensive type of water that will satisfy the requirement.
- Fix water leaks.
- Test for underground water leaks. (It's easy to do over a holiday shutdown.)
- Check water overflow pipes for proper operating level.

- Automate blow down to minimize it.
- Provide proper tools for wash down -- especially self-closing nozzles.
- Install efficient irrigation.
- Reduce flows at water sampling stations.
- Eliminate continuous overflow at water tanks.
- Promptly repair leaking toilets and faucets.
- Use water restrictors on faucets, showers, etc.
- Use self-closing type faucets in restrooms.
- Use the lowest possible hot water temperature.
- Do not use a heating system hot water boiler to provide service hot water during the cooling season -- install a smaller, more-efficient system for the cooling season service hot water.
- If water must be heated electrically, consider accumulation in a large insulated storage tank to minimize heating at on-peak electric rates.
- Use multiple, distributed, small water heaters to minimize thermal losses in large piping systems.
- Use freeze protection valves rather than manual bleeding of lines.
- Consider leased and mobile water treatment systems, especially for deionized water.
- Seal sumps to prevent seepage inward from necessitating extra sump pump operation.
- Install pretreatment to reduce TOC and BOD surcharges.
- Verify the water meter readings. (You'd be amazed how long a meter reading can be estimated after the meter breaks or the meter pit fills with water!)
- Verify the sewer flows if the sewer bills are based on them.

Miscellaneous:

- Meter any unmetered utilities. Know what is normal efficient use. Track down causes of deviations.
- Shut down spare, idling, or unneeded equipment.
- Make sure that all of the utilities to redundant areas are turned off -- including utilities like cooling water.
- Install automatic control to efficiently coordinate , chillers, cooling tower cells, etc.
- Renegotiate utilities contracts to reflect current loads and variations.
- Consider buying utilities from neighbors, particularly to handle peaks.
- Minimize use of flow bypasses and minimize bypass flow rates.
- Consider alternatives to high-pressure drops across valves.
- Turn off winter heat tracing that is on in summer.

Annexure - 1

Standard Lux Level

Activity	Illumination *(lux, lumen/m^2)*
Public areas with dark surroundings	20 - 50
Simple orientation for short visits	50 - 100
Working areas where visual tasks are only occasionally performed	100 - 150
Warehouses, Homes, Theaters, Archives	150
Easy Office Work, Classes	250
Normal Office Work, PC Work, Study Library, Groceries, Show Rooms, Laboratories	500
Supermarkets, Mechanical Workshops, Office Landscapes	750
Normal Drawing Work, Detailed Mechanical Workshops, Operation Theatres	1,000
Detailed Drawing Work, Very Detailed Mechanical Works	1500 - 2000
Performance of visual tasks of low contrast and very small size for prolonged periods of time	2000 - 5000
Performance of very prolonged and exacting visual tasks	5000 - 10000
Performance of very special visual tasks of extremely low contrast and small size	10000 - 20000

Annexure - 2

Energy saver for air conditioning system

AIRTRON

PATENT PUBLISHED

Airtron is the World's First & Only *Programmable, Dual-Sensor Driven Microprocessor which saves up to 35% Electricity* on all Air Conditioners *with Precision Control* of Set Temperature and a payback of barely 4-6 months.

IMPORTANT VALIDATIONS

N.B. The Set Temp. was the Same *WITH / WITHOUT* the Airtron.

SL. NO.	NAME OF THE COMPANY	COUNTRY	AC TYPE	SAVINGS
1	ENERGY EFFICIENCY SERVICES LTD . (EESL GOVT. OF INDIA)	INDIA	SPLIT	44.00%
2	L.G. ELECTRONICS INDIA LTD.	INDIA	SPLIT (INVERTER)	26.00%
3	VIDEOCON TELECOM	INDIA	SPLIT	20.00%
4	TATA COMMUNICATION LTD.	INDIA	SPLIT	28.30%
5	LARSEN & TOUBRO LTD.	INDIA	SPLIT	25.80%
6	TATATELE SERVICES LTD.	INDIA	SPLIT	33.00%
7	TATA POWER LTD.	INDIA	SPLIT	37.50%
8	ASHOK LEYLAND LTD.	INDIA	WINDOW	29.40
9	ZENITH ENERGY (BEE, ACCREDITED ENERGY AUDITOR)	INDIA	SPLIT	37.00%
10	ACCENTURE SERVICES PVT. LTD.	INDIA	SPLIT	37.00%
11	M/S. UNIC MAGNATE	INDIA	SPLIT	58.00%
12	SATURN PYRO (UTIM REGISTRATION OFFICE)	MALAYSIA	CEILING-SPLIT	36.00%
13	SATURN PYRO (AT MALAYSIA POLICE H.Q.)	MALAYSIA	WALL -SPLIT	34.00%
14	CPE ENERGY SDN BHD	MALAYSIA	SPLIT	57.00%

Annexure – 3

Super Energy efficient BLDC Ceiling Fan

	900 mm	1050 mm	1200 mm	1400 mm
Warranty (Years)	3 Years	3 Years	3 Years	3 Years
Blade Span (mm/inch)	900/36	1050/42	1200/48	1400/56
RPM	450	430	350	270
Service Value	7.1	6.6	7.8	7.7
Input Voltage (V)	140-285	140-285	140-285	140-285
Power Consumption (W)	28	32	28	35
Frequency (Hz)	48-52	48-52	48-52	48-52
Air Delivery (CMM)	200	210	220	270
Power Factor	>0.98	>0.98	>0.98	>0.99
No. of Blades	3	3	3	3
Bearing (Double)	Deep Groove Double Sided Steel Shielding			
Remote Control (12 Keys)	Speed Control, Boost Mode, Timer and Sleep Mode			

Comparision Between Ordinary,5 Star Rated AndSuper Efficient Fans

Parameters	Ordinary Fan	5 Star Rated Fan	Super Efficient Fan
Wattage	75	50	28
RPM(speed)	380	**330**	360-380
CMM(air delivery)	230	**210**	220-230
Power factor	>0.9	>0.95	>0.99
Regulator	Yes	Yes	Not Required (Remote controlled)
Input Voltage	230	230	140-285V
Warranty	1-2 year	1-2 year	3 years
MRP	1300-1600	1800-2500	3690