Energy Audit Study

Of

ADITYA COLLEGE OF PHARMACY

(Permanently Affiliated to JNTUK, Kakinada, Approved by AICTE, New Delhi)

Recognized by UGC under Sec 2(f) and 12 (B) of the UGC Act 1956

Aditya Nagar, ADB Road, Surampalem- 533437

April 2023

Study Conducted and Prepared by:

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Contents

Acknowledgement

Executive Summary

Acknowledgement

KR Energy Consultants (called "KR Energy" hereafter) places on record, its sincere gratitude to the Management of ***"Aditya College of Pharmacy"***, for entrusting the prestigious project of Energy Audit of their College located at Surampalem, ADB Road, East Godavari District, AP State.

We also wish to thank the officers/ Executives & staff of the institute for providing necessary support extended during energy audit study.

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T KRISHNA
BEE Certified Energy Auditor no.3398
KR Energy Consultants
Hyderabad
Date: April 16, 2023

Executive Summary

M/s KR Energy Consultants has conducted a Detailed Energy Audit of "Aditya College of Pharmacy", Aditya Nagar, Surampalem, EG District, AP in April 2023 to identify energy saving measures for reducing energy consumption and electricity bill.

Electricity and HSD are main energy sources for the institute. Grid electricity supply by APEPDCL is the main source of electrical energy, which is augmented with power generation from DG Sets during load shedding:

The institute has also solar power plant of 500 kW capacity for captive use for the entire campus requirement

a) Electrical Energy

Table A: Profile of Electrical Energy Consumption

S. No.	Item	Value
1	Contract Maximum Demand (CMD) kVA	200
2	Solar power plant capacity of the campus, kW	500
3	*Solar generated units, kWh*	*611329*
4	*Solar college consumed units, kWh*	*386003*
5	*Solar export units, kWh*	*225326*
6	*Power import units, kWh*	*363624*
7	*Bill units, kWh*	*172197*
8	*Bill amount, Rs.*	*2285613*
9	*Net bill after adjustment, Rs.*	*2107134*
10	*College used amount, Rs. Lakhs*	*66.60*
11	*Solar saving amount, Rs. Lakhs*	*45.53*

b) Summary of Recommendations

The Tables below presents the summary of recommended energy saving projects, anticipated energy savings, and monetary savings, investment required, and simple payback period:

Table 1: Summary of Suggested Energy Saving Measures with Cost-Benefit Analysis

Energy Conservation Measure	**Energy savings** (kWh/ year)	**Monetary savings** (Rs. / year)	**Investment** (Rs.)	**Payback period (months)**
Replace old fans with Energy efficient/Super fans (100nos)	6,000	60,000	180,000	36
Install energy savers for ACs	1,215	12,150	15,000	15
Replace conventional tube lights with LED tube lights	6,090	60,900	50,750	10
Replace old pumps with new efficient pumps(1 no's)	1,500	15,000	50,000	40
Total	**14,805**	**1,14,050**	**2,95,750**	**31**

- *As can be observed from the above Table, the total electrical energy savings are estimated at 14,805 kWh/year and the corresponding monetary savings are Rs.1.14 lakh/year. The investment required is Rs.2.95 lakhs which will be paid back in **31** months.*

- *Equivalent CO2 reductions due to energy savings would be 12.1 tCO2/ yr*

- *Initially, the fans, ACs and tube lights operated for more hours in a day/year can be selected for replacement for maximum benefit.*

CHAPTER 1
Introduction

1.1 About Aditya College of Pharmacy

Aditya, the premier promoter of quality education in the coastal districts of Andhra Pradesh for the past two decades, leads various institutions ranging from K.G to P.G besides professional colleges like Engineering, Pharmacy and Nursing. Sri Nallamilli Sesha Reddy as a founder chairman, promoted the educational society in the name and style of Aditya Academy at Kakinada in the year 1984, with a vision and mission to create a platform for holistic growth and success to students at all levels.

Aditya has made its entry into the educational arena with a public school to meet the needs of primary and secondary education. In succession and with rapid strides, the academy established several Junior Colleges, Degree Colleges, PG Colleges, Engineering Colleges, Pharmacy Colleges, Nursing Colleges, Teacher Training Institutions.

The silver-jubilee educational group with 50,000+ students in 50+ institutions with 5000+ staff across three districts in Andhra Pradesh has become the standard bearer for quality education. In every stream, Aditya has become a spring-board for success through its powered vision, constant innovation, and professional excellence.

Aditya College of Pharmacy

Aditya College of Pharmacy was established in 2006 by Founder and Chairman , N.Sesha Reddy under **Sarojini Educational Society** who is the pioneer in educational institutions of Andhra Pradesh. The institute is affiliated to JNTUK, approved by AICTE and recognized by PCI, New Delhi. Aditya College of Pharmacy has a team of well experienced and most knowledgeable faculty members, and it facilitate the students to access well equipped laboratories and technologies available in the institute.

Aditya College of Pharmacy creates an environment that opens up new worlds of opportunity. From the day of its inception, the college is producing highly qualified human resources who are academically superior and ethically strong. The campus is located at Surampalem, East Godavari District of Andhra Pradesh equidistant from Rajahmundry and Kakinada, the two major cities of the district. It offers Pharmacy , Pharm D & M. Pharmacy courses in pharmaceutical technology, Pharmacology, Pharmaceutical Analysis & Quality assurance.

The following courses are offered in the college for under graduation and graduation courses:

Under Graduate Courses : B.PHARMACY

Post Graduate Courses : PHARM.D, M.PHARMACY

No. of students – studying all branches and classes :

S. No	Course	No. of Students
1	B.PHARMACY	429
2	PHARM.D	156
3	M.PHARMACY	23
Total		608

1.2 Energy Conservation Efforts made by the Management

The committee of the institute recognizes its responsibility to conserve and manage energy in all its operations.

- ✓ Make every effort to commit organizational resources towards energy management
- ✓ Minimize energy costs and give priority to energy efficiency (EE) by utilizing available resources more efficiently

Towards this objective, the management has installed LED lighting and Solar Power Plant of 500 kW for captive use of power for the two pharmacy colleges.

The management wants to explore further scope for energy conservation and energy cost reduction in the campus and thus entrusted the job of Energy audit to KR Energy Consultants.

1.3 Objectives of the Energy Audit

The key objectives of the Energy audit is to identify, prioritize, and recommend a set of proven, customized, low-cost, and implementable measures for reducing the consumption of electrical energy in the campus and emission reductions.

1.4 Scope of Work

The Energy audit has laid emphasis on performance assessment of electrical utilities comprising the following equipment/ areas for identification of cost-effective energy saving solutions:

1) Energy Consumption and Analysis
2) Pumps (Utility)
3) Air Conditioners
4) Fans
5) Lighting
6) DG sets

1.5 Methodology Adopted for conducting the Energy Audit study

KR Energy Consulting has conducted Energy audit field studies at the institute during April 2023. As a part of the Energy audit KR Energy Consulting audit team has visited campus for data collection, on-site measurements, and performance monitoring of various equipment using portable Energy audit instruments. KR Energy Consulting has adopted the following methodology for conducting the Energy audit:

- Kick-off meeting with the concerned personnel to finalize field action plan
- Inventory of all the electrical appliances installed by physical verification like air conditioners, luminaries, computers, and others. Physical inspection of the electrical distribution system.
- Monitoring of electrical parameters such as voltage, amps, kW, power factor etc. for individual equipment's and feeders
- Monitoring of harmonics at the identified DB's, feeders UPS with power and harmonic analyzer
- Collection of photocopies of monthly electricity bills for the past one year
- Critical analysis of data collected/ measured and assessment of energy efficiency and energy losses
- Identification of energy saving measures and assessment of energy saving potential
- Submission of the report

The approach/ methodology adopted for Energy audit is presented pictorially below in Figure 1.

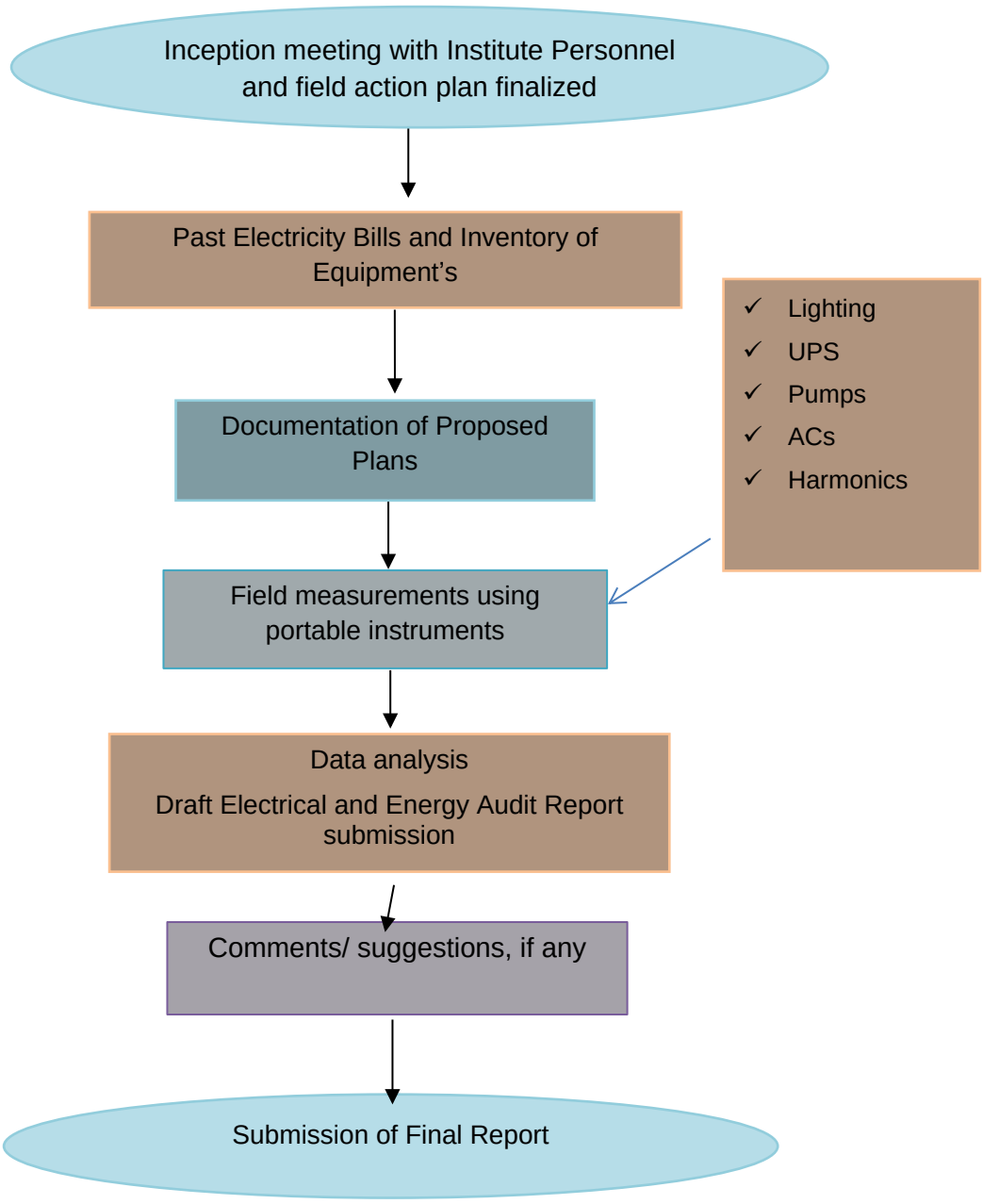


Figure 1: *Approach/ methodology adopted for conducting Energy Audit of Aditya College of Pharmacy, Surampalem, ADB Road, East Godavari District, AP State*

1.6 Measuring Instruments used for the Electrical and Energy Audit

KR Energy Consulting has used portable, micro-processor based, state-of-the-art, calibrated instruments for on-field monitoring of equipment performance during Energy audit. The list of portable instruments used in the study is as follows:

- Nanovip Plus Load Manager
- Harmonic Analyzer
- Lux meter
- Temperature measuring instruments
- Thermal Imager

CHAPTER 2

Energy Consumption & Analysis

The chapter presents the description of various energy inputs used in the Institute, their consumption trends & analysis, annual energy costs, and share of different energy inputs in total energy cost.

2.1 Energy Inputs

Energy sources for the Aditya college of Pharmacy are:

- Electricity
- HSD

Electricity is major energy source for the institute for lighting, fans, motors etc.

DG Sets are used as standby to grid power and will run during load shedding. HSD is the fuel for DG Sets.

The campus has a roof top solar power plant also of 500 kW and electricity generated is used for captive purpose for the entire campus and all colleges power requirement.

2.2 Electrical Energy Analysis

Grid electricity is supplied by the AP Eastern Power Distribution Company Limited (APEPDCL) voltage of 11kV. The connection meets the entire campus electricity requirement including all colleges of the group in the campus. During grid power shortage/ failure, DG Sets supply the required electricity. The institution has a Contract Maximum Demand (CMD) is 200 kVA for the two pharmacy colleges of the campus.

Data on monthly billed units, solar energy consumed units and bill amount for period year from January 2022 to December 2022 is collected, analyzed, and presented in Table 2.1 below:

Table 2.1: *Month-wise solar and grid electricity consumption (Jan 2022 to December 2022)*

S.NO.	MONTH	SOLAR PRESENT GENERATED UNITS (C)	SOLAR CONSUMPTION Rs./U ,(E)	SOLAR COLLEGE CONSUMED UNITS (F=C-H)	SOLAR COLLEGE CONSUMPTION UNITS AMOUNT (G=E*F)	SOLAR EXPORT UNITS (H)	SOLAR EXPORT COST/ U (I)	SOLAR EXPORT AMOUNT (J=I*H)	TOTAL SOLAR GENERATED UNITS AMOUNT (K=G+J)	POWER IMPORT UNITS (L)	BILL UNITS (M)	BILL AMOUNT (N)	COST ADJ. (O)	NET BILL(P=O-N)	COLLEGE USED AMOUNT SOL+POWER(Q=K+N)	SOLAR SAVING AMOUNT
1	Jan-22	56180	7.65	21261	**162647**	34919	3.5	122216.5	**284863.2**	18690	4000	114786	75672	39114	**399649.15**	360535.15
2	Feb-22	58878	7.65	31211	**238764**	27667	3.5	96834.5	**335598.7**	23010	4000	116339	32385	83954	**451937.65**	367983.65
3	Mar-22	63252	7.65	40440	**309366**	22812	7.6	173371.2	**482737.2**	41026	18214	231433	0	231433	**714170.2**	482737.2
4	Apr-22	58292	7.65	44657	**341626**	13635	7.6	103626	**445252.1**	42337	28704	356977	0	356977	**802229.05**	445252.05
5	May-22	53688	7.65	39412	**301502**	14276	3.5	49966	**351467.8**	41783	28381	35757	39478	-3721	**387224.8**	390945.8
6	Jun-22	46633	7.65	36343	**278024**	10290	7.6	78204	**356228**	40276	29986	365266	0	365266	**721493.95**	356227.95
7	Jul-22	39643	7.65	30203	**231053**	9440	7.6	71744	**302797**	24292	14852	231411	0	231411	**534207.95**	302796.95
8	Aug-22	46971	7.65	31397	**240187**	15574	7.6	118362.4	**358549.5**	22206	6632	167163	0	167163	**525712.45**	358549.45
9	Sep-22	43881	7.65	29355	**224565**	14526	7.6	110397.6	**334963.4**	26279	11753	216780	0	216780	**551743.35**	334963.35
10	Oct-22	47930	8.35	27541	**229967**	20389	3.5	71361.5	**301328.9**	20253	4000	128010	15472	112538	**429338.85**	316800.85
11	Nov-22	49800	8.35	29062	**242667**	20738	8.35	173162.3	**415830**	33573	12835	128010	15472	112538	**543840**	431302
12	Dec-22	46181	8.35	25121	**209760**	21060	9.3	195858	**405618.4**	29899	8840	193681	0	193681	**599299.35**	405618.35
TOTAL		**611329**	**8.35**	**386003**	**3010129**	**225326**	**8.35**	**1365104**	**4375234**	**363624**	**172197**	**2285613**	**178479**	**2107134**	**6660846.8**	**4553712.75**

The summary of the grid electricity, solar generation, export, captive use, and electricity bill is furnished below Table 2.2:

Table 2.2: Summary of Electrical Energy Scenario (Solar and Grid)
(Jan 2022 to December 2022)

S. No.	Item	Value
1	Contract Maximum Demand (CMD) kVA	200
2	Solar power plant capacity of the campus, kW	500
3	*Solar generated units, kWh*	*611329*
4	*Solar college consumed units, kWh*	*386003*
5	*Solar export units, kWh*	*225326*
6	*Power import units, kWh*	*363624*
7	*Bill units, kWh*	*172197*
8	*Bill amount, Rs.*	*2285613*
9	*Net bill after adjustment, Rs.*	*2107134*
10	*College used amount, Rs. lakhs*	*66.60*
11	*Solar saving amount, Rs. lakhs*	*45.53*

As can be seen from above, the solar energy is completely utilized by the college and surplus electricity is exported to the grid. Due to use of solar energy, about 574 tons of CO2 emissions has been reduced by the management to the atmosphere and supporting sustainable development and creating awareness of solar energy to the society. The management has reduced electricity bill by Rs.45.27 lakhs per year.

The grid electricity is almost avoided and hence reducing transmission and distribution losses.

The variation of electricity consumption, recorded demand, billed demand, solar power, and power factor demand is graphically furnished in fig 2.1. 2.2, and 2.3

Fig 2.1: Monthly Grid Import Units

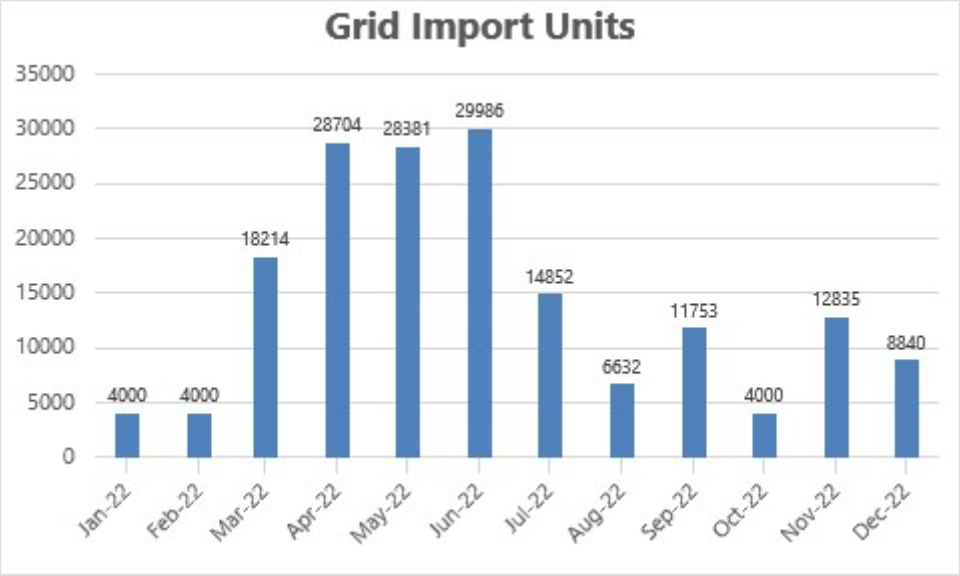
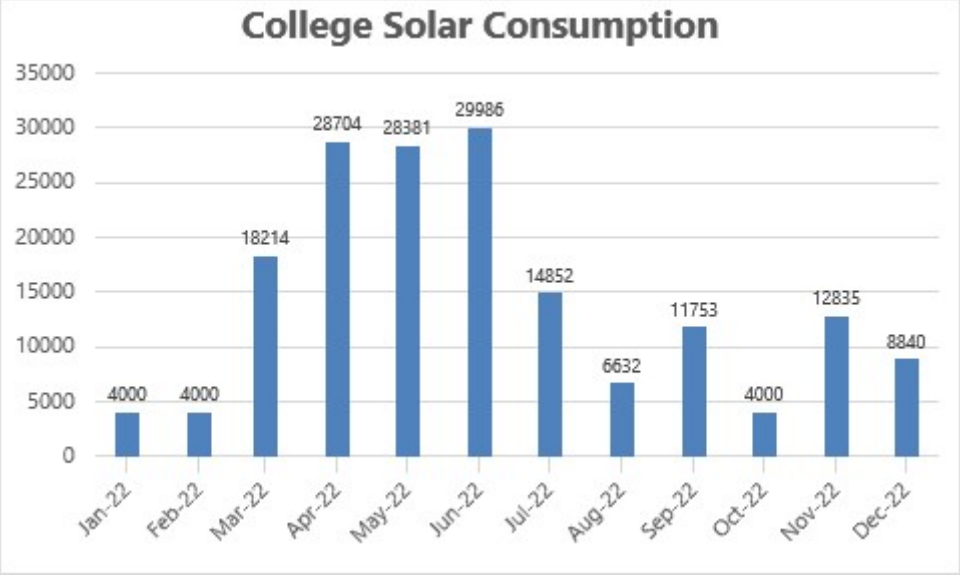


Fig 2.2: Monthly College Solar Consumption



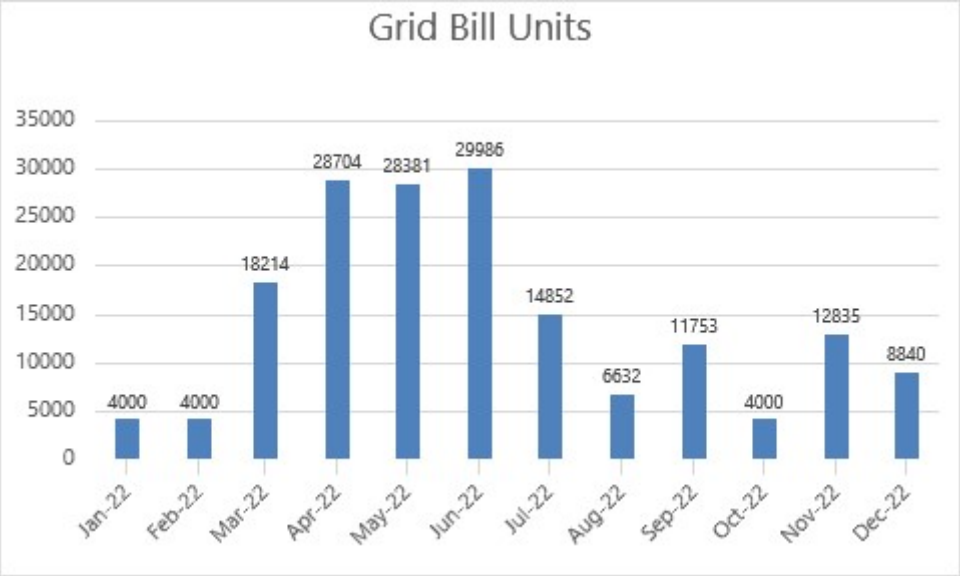


Fig 2.3: Monthly Grid Units (Minimum)

The key observations made from the analysis of the above data are furnished in Table 2.2 below:

Table 2.2: *Summary of Electrical Energy Consumption Data of Aditya College of Pharmacy – (January 2022 – December 2022)*

S. No.	Item	Value
1	Contract Maximum Demand (CMD) kVA	200
2	Solar power plant capacity of the campus, kW	500
3	*Solar generated units, kWh*	*611329*
4	*Solar college consumed units, kWh*	*386003*
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10	*College used amount, Rs. lakhs*	*66.60*
11	*Solar saving amount, Rs. lakhs*	*45.53*

2.3 Solar Power Plant GHG Emissions Reduction

The management has installed a roof top SPV Power plant as an initiative to offset GHG emissions to the world. The capacity of the SPV power plant is 500 kW with net metering facility.

So far, about 624 MWh has been generated from January 2022 to December 2022, the solar power is used for captive requirement for the campus, the power is also exported to grid during holidays. Due to solar power plant, about 574 tons of CO_2 is avoided to the climate every year and is almost offset of the grid power used during the same period.

2.5 Power Factor and Maximum Demand

(a) Contract Demand

- Contract Maximum Demand is 200 kVA and minimum billing demand is 160 kVA. The billing demand is always less than 160 kVA and never crossed and is OK.
- The maximum demand is OK for the present utilization and is satisfactory.
- The minimum billing demand is 80% of the CMD and is 160kVA

(b) Power Factor

The average monthly power factor was 0.99 as noted and as per electric bills. The power factor is well maintained and is OK.

2.7 Harmonics

This term refers to a wide variety of electromagnetic phenomena that characterize the voltage and current at a given location of a power system any power problem manifested in voltages, current, or frequency deviations those results in failure or malfunctioning of customer equipment. Power quality has become increasingly important for industrial and commercial electric power customers, particularly as today control processes rely on computerized equipment which is sensitive to power system interruptions and disturbances.

As harmonic levels increase, the likelihood of experiencing problems also increases. Typical problems include:

- Malfunctioning of microprocessor-based equipment by disruptions of operations.

- Heating effects in power handling equipment's such as motors, transformers, overheating in neutral conductors. There by reduces the operating life
- Deterioration or failure of power factor correction capacitors.
- Erratic operation of breakers and relays.
- Pronounced magnetic fields near transformers and switchgear.

The harmonics were measured for the selected panels and UPS. The Voltage & Current harmonics are ranged as below:

Table 2.4 *Harmonics Measurements values for Panel by Harmonic Analyzer*

Reference	***$THD_{rms,v}$***	***$THD_{rms,i}$***
Main panel	0.75% to 1.2% Voltage Harmonics within the limits	3.5% to 9.5% 5^{th} Harmonic - 5% 7^{th} Harmonic – 4.5% 5^{th} and 7^{th} harmonics are predominant.
Recommendation	No Harmonics exists and harmonics are within the limits	

2.6 DG Sets

The institution has a DG sets for catering to the two pharmacy colleges of 400 kVA (1 no's). The DG sets are operated as per the requirement and during grid power failures. which is sufficient to cater the load of the entire campus loads and is OK

CHAPTER 3

Fans & Air conditioners

This chapter presents the type of air conditioners and fans used, their energy performance, and cost-effective energy conservation measures for reducing energy consumption in air conditioners and fans.

3.1 Details of Fans

Hostel

The hostel has 204 fans of 50 Watt for class rooms, staff rooms, corridors, and other locations. The total connected load of the fans is 10.2 kW

College

The hostel has 245 fans of 80 Watt for class rooms, staff rooms, corridors, and other locations. The total connected load of the fans is 19.6 kW

3.2 Fans- Observations & recommendations

- ✓ Fans are provided with fixed and running capacitor. The speed drops if the value deteriorates with time. Timely replacement of capacitor is necessary.
- ✓ Presently, in many rooms conventional electrical regulators are installed and it is suggested to replace old conventional regulators with new electronic type regulators.
- ✓ In majority of the rooms, the fans are consuming more power than rated.

a) Cost benefit Analysis of Replacing old Ceiling Fans with new efficient fans or BLDC fans

Energy savings can be achieved by replacing the existing old ceiling fans with 5 Star Rating (BEE) energy efficient ceiling fans:

- ➥ Option 1: 5 Star rated Fans
- ➥ Option 2: Super Fans

Initially, it is recommended to replace old fans of 100 nos. and after successfully achieving the savings, other fans can be replaced in a phased manner. The cost benefit analysis made for a sample of replacement of 100 fans under two Options are furnished below:

i) Option (1) Replace old fans with 5 Star Rated Fans

Star Rating	Min. Air Delivery (AD) m^3/ min	Input Power in Watts	Service Factor (SV=AD/ Power) m3/min/Watt	Cost (Rs)
5 Star	215-225	50-53	>=4	1,850-2,200

A few good brands of the 5 Star rated Fans are Ortem, Relaxo, Orient, Usha, Crompton Greaves, Bajaj, and Havells. Normally, these fans come with a warranty of two years.

ii) Option 2: Super-Efficient Ceiling Fans

Features of Super-Efficient Ceiling fans are:

- Energy savings, more than 50% savings, lower electricity bill
- Remote control, no regulator needed, saves space on switchboard
- High air delivery
- Inverter/UPS friendly – Runs twice longer, no extra noise, no speed drop
- No speed change due to supply variations or low voltage
- Power factor better than 0.9
- Service value of more than 6 - more air per watt
- BLDC Motor runs cool - No heat generated
- LED Indication for remote operation
- Attractive colors and designer leaves
- 5 years warranty
- Cost Around Rs 3,200 per Fan

Presently, Super fan is the company, which manufactures these types of fans.

The comparison of ordinary fan, 5 star fan, and super fan in terms of design and operational aspects are furnished below in Table 3.1:

Table 3.1: *Comparison between Ordinary Fan, 5 Star Rated fan & Super Fan (1200mm)*

S.No	Parameter	Ordinary fan	5 Star rated Fan	Super fan
1	Rated Power, Watt	60-90	40	30
2	Min. Air Delivery, m^3/min	210-215-220	215-220	220
3	Service Factor, m^3/min/Watt	3.35-3.73	4.0-5.0	6.28
4	Cost, Rs/Fan	1200-1300	1800	2500
5	Life, Years	10-12	10-15	15
6	Warranty, Years	1	2	3-5

The cost-benefit analysis of replacing the existing ordinary fans with (i) 5 star rated fans and (ii) super-efficient fans is provided in Table 3.2:

Table 3.2: *Cost Benefit Analysis of Replacing Fans with 5 Star Rated & Super-Efficient Fans*

Description	Unit	Option1: 5 Star Rated Fans	Option2: Super-Efficient Fans
Number of Fans (*Considered 100 Nos. as sample for case study*)	Nos.	100	100
Actual power consumed	Watts	70	70
Power consumption of new Fan	Watts	40	30
Average operation	hours/day	8	8
	Days/year	250	250
Annual energy savings	kWh/yr.	6,000	10,000
Cost of energy	Rs/kWh	10	10
Total Annual saving	Rs	60,000	1,00,000
Cost of new Efficient fans	Rs/Fan	1,800	2,500
Investment	Rs	1,80,000	2,50,000
Simple Payback period	Months	36	30

Note: Price is subjective and be further reduced if taken on bulk quantity. The average life of fans is 10 years.

Initially, the management can replace 100 no's in first phase and after successfully achieving savings and recurring savings, all the fans can be replaced for power savings.

3.3 Air conditioners

The air-conditioning systems available at Institute are of split air conditioners. There are total of 3 air conditioners in the college. The rated capacity of AC's are 1.5 TR and total capacity is 4.5 TR. The total connected load of ACs is 5.4 kW

3.4 Air conditioners -Observations & Recommendations

(a) Observations

- It is beneficial to install 5 Star rated ACs in future as 5 star rated ACs will consume less power than 3 star rated, and additional investment is less as compared to the savings. Air conditioners over 10 years can be replaced with new 5 star rated ACs.

(b) Recommendations

(i) Install Energy Saver for ACs

Airtron is the most advanced AC SAVER with all the controls of a Precision AC.

Airtron's dual sensors reference the Room and Coil Temperature and working in tandem with its multiple algorithms in a “closed -loop circuit" ensure the high savings and adapts your AC to Ambient Temperatures and Climatic changes, by maintaining room temperature while compressor run time is substantially reduced.

Airtron allows to program the AC to climate & geographical locations and automatically adjusts itself to change the ambient conditions to save electricity. AIRTRON is available with a Remote for setting the Room Temperature and in Non-Flammable Polycarbonate Enclosure with SMPS Power Supply, to tolerate wide Voltage and Current fluctuations, Surges, Spikes and Sags.

Airtron has been validated on all ACs- Inverters, 5 Star, Splits, Multi-Splits, Packages, Ductable, Windows, Cassettes from 1.0 - 20.0 TR.

The salient features of Airtron AC saver are:

- ✓ Most advanced AC saver
- ✓ Display Room & Coil Temperature
- ✓ Automatically adapts AC to changes in ambient temperature & Climate
- ✓ Easy to install
- ✓ Applicable on ACs from 1.0 to 20TR, saves equally on inverters & 5 Star/ 1-Star AC's
- ✓ Energy saving up to 15 to 20%

Table 3.3: *Cost-benefit Analysis - Installation of AC Saver*

Description	Unit	Value
Total number of ACs	Nos.	3
Total AC load	kW	5.4
No. of hours of operation/ day	Hours/day	6
No. of days per annum	Days/year	250
Annual Energy Consumption	kWh/year	8100

Power saving due to AC Saver @15%	kWh/year	1215
Annual monetary savings(*@Rs.10.0 per kWh*)	Rs.	12,150
Investment for AC Savers *(@Rs.5,000 x 3 no's*	Rs.	15,000
Payback period	**Months**	**15**

3.4.1 Best Practices for Efficient Operation Air Conditioners

- *False ceiling*: good quality false ceiling must be maintained in the air conditioned rooms by keeping all doors and windows closed properly to prevent cool air go out and hot air come in.
- *Curtains*: Always keep curtains on windows to prevent direct sunlight inside the room to avoid heating of cooled air. This reduces AC load significantly.
- *Maintenance*: Proper maintenance and cleaning of ACs is required at regular intervals to make it work at highest efficiency. Any dirt in filter may reduce efficiency of ACs very significantly.
- *Operation*: ACs should be switched on 15 minutes before actual use and should be switched off before leaving the room
- Outdoor units need to be kept under shady area and direct expose to sunlight will increase the power consumption of the compressor
- AC false ceiling to be provided for the AC rooms, for better air conditioning and reduction of room area and reducing heat losses

By adopting the above measures, a minimum of 10% to 15% of electricity consumption by ACs can be reduced.

CHAPTER 4

Lighting

4.1 Details of Lighting

Lighting system was assessed through visual observation and technical specification data were noted. The inventory data of the luminaries was provided by the department. The total lighting load of the unit is considerable of the total electrical load of the unit and hence, lighting needs equal emphasis along with other energy consuming areas. The Aditya College of Pharmacy has the following types of luminaries as under:

- LED Tube Lights
- CFLs

Table 4.1: *Lighting load details*

S.No.	Type of luminary	Watts	Nos	Total load kW
Hostel				
1	LED tube lights	20	200	**4.0**
College				
3	Tube lights	40	203	**8.12**
	Total		**403**	**12.12**

Majority of the tube lights LED tube lights in the institution. The total connected load of lighting is 12.12 kW.

Replace Tube lights with LED tube lights

It is suggested to replace the tube lights of 40W with LEDs lights of 20W. The cost benefit analysis is furnished below:

Table 4.2: *Cost benefit Analysis of replacing 40W tube lights with LED tube lights*

Description	Unit	Tube Lights
Total number of CFLs	Nos.	203
Wattage	W	40
No. of hours of operation/ day	Hours/day	6
No. of days per annum	Days/year	250
Annual Energy Consumption	kWh/year	12,180
Power saving due to LEDs @50%	kWh/year	6,090
Annual monetary savings(*@Rs.10.0 per kWh*)	Rs.	60,900
Investment for LED 5W light	Rs.	50,750
(@Rs.250/- per bulb or light		
Payback period	Months	10

CHAPTER 5

Miscellaneous

5.1 Pumps-Observations & recommendations

There are 4 no's of pumps of catering to water requirements of the Institute, all pumps are non-star rated and it is suggested to replace the non-star rated pumps with 5 star rated pumps for energy savings. These pumps can be replaced on phase wise, as and when required when pumps will be problem. The total connected HP of the pumps is 23.5 HP. Normally 2 or 3 pumps will be in operation as per the requirement.

Cost benefit analysis of replacing existing old pumps with new efficient star rated pumps provided in table 5.1 below for a 5.0 HP Pump:

Table 5.1: *Cost benefit analysis of replacing old Pumps with EE pumps*

Description	Unit	Value
Capacity of the pump	kW	7.5
Efficiency	%	40
Efficiency of 5 star rated pump	%	60
Savings	%	33
Power savings	kW	2.475
No. of hours of operation/ day	Hours/ day	5
No. of days per annum	Days/ year	300
Power saving due to Energy efficient 5 star rated Pumps	kWh/ year	1500
Annual monetary savings (*@Rs.10 per unit)*	Rs	15,000
Investment for pump	Rs	50,000
Payback	Months	40

5.2 General Observations

All Class Rooms, hostel rooms and laboratories to have Display Messages or Posters regarding optimum use of electrical appliances in the room like, lights, fans, computers, and projectors. Few sample posters is furnished below:

(a) Sample Posters for Awareness towards Energy Conservation

Also have stickers/labels of slogans/lines for energy saving in Class rooms/ Common areas

- Energy saved is energy produced.
- Switch of Lights/ Fans if not used
- Conservation: It doesn't cost. It saves.
- Spare a Watt; Save a Lot
- Save Today. Survive Tomorrow
- Energy misused cannot be excused

(b) Safety posters