

Energy Audit Report

(2023~2024)

of



ADITYA

PHARMACY COLLEGE

ADITYA PHARMACY COLLEGE

(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 2024

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[Signature]
Aditya Pharmacy College
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Acknowledgement

KR Energy Consultants (called "KR Energy" hereafter) places on record, its sincere gratitude to the Management of M/s Aditya Pharmacy College, for entrusting the prestigious project of Energy Audit of their College located at Surampalem, ADB Road, East Godavari District, Andhra Pradesh 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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Date: April 21, 2024




Principal
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Executive Summary

M/s KR Energy Consultants has conducted a Detailed Energy Audit of M/s Aditya Pharmacy, Aditya Nagar, Surampalem, EG District, AP in April 2024 to identify energy savings 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

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 CFLs with LED lights	75	750	1,000	16
Replace old pumps with new efficient pumps (1 no's)	1,440	14,400	40,000	32
Total	8,730	87,300	2,36,000	32

- As can be observed from the above Table, the total electrical energy savings are estimated at 8,730 kWh/year and the corresponding monetary savings are Rs.0.87 lakh/year. The investment required is Rs.2.36 lakhs which will be paid back in 32 months.
- Equivalent CO₂ reductions due to energy savings would be 7t of CO₂/ yr
- Initially, the fans, ACs and tube lights operated for more hours in a day/year can be selected for replacement for maximum benefit.



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CHAPTER 1

Introduction

1.1 About Aditya Pharmacy College

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, and 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 Pharmacy College

The Aditya Pharmacy College has commenced working from the academic year 2004-05. The first batch of students has passed out in the year 2008. The students are given coaching in the III and IV year for the GPAT examination as a result the number of students who are qualified in the GPAT examination is quite high. The students participate in various scientific poster presentations and seminars that are organised in different colleges and present seminars and poster presentations and secured prizes for their participation.

Distinguished scientists from noted industries such as Hetero Drugs, Shantha Biotech, Dr.Reddy's and Aurobindo Pharma visit the college and present guest lectures and seminars and there is an active placement cell which facilitates the process of the students getting recruited in various companies.

The College has over the years acquired advanced equipment and installed in various laboratories. Realizing the importance of web based learning the management has provided a high speed internet laboratory for the students. There is huge collection of books and journals which are subscribed regularly. The college has started the post graduate courses like Pharmaceutics and Pharmaceutical analysis & quality assurance in pharmacy (M. Pharmacy) in the year of 2008 and 2009. The college has started the Pharm. D Course from the year 2010 -11. The college name has been changed to Aditya Pharmacy College in the year of 2015.



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

Under Graduate Courses : B.PHARMACY

Post Graduate Courses : PHARM. D, and M. PHARMACY

No. of students – studying all branches and classes during 2023-2024 :

S. No	Course	No. of Students
1	B.PHARMACY	411
2	PHARM.D	156
3	M.PHARMACY	5
Total		572

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 entire campus covering for all colleges of the group institutions.

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 set



1.5 Methodology Adopted for conducting the Energy Audit study

KR Energy Consulting has conducted Energy audit field studies at the institute during April 2024. 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.

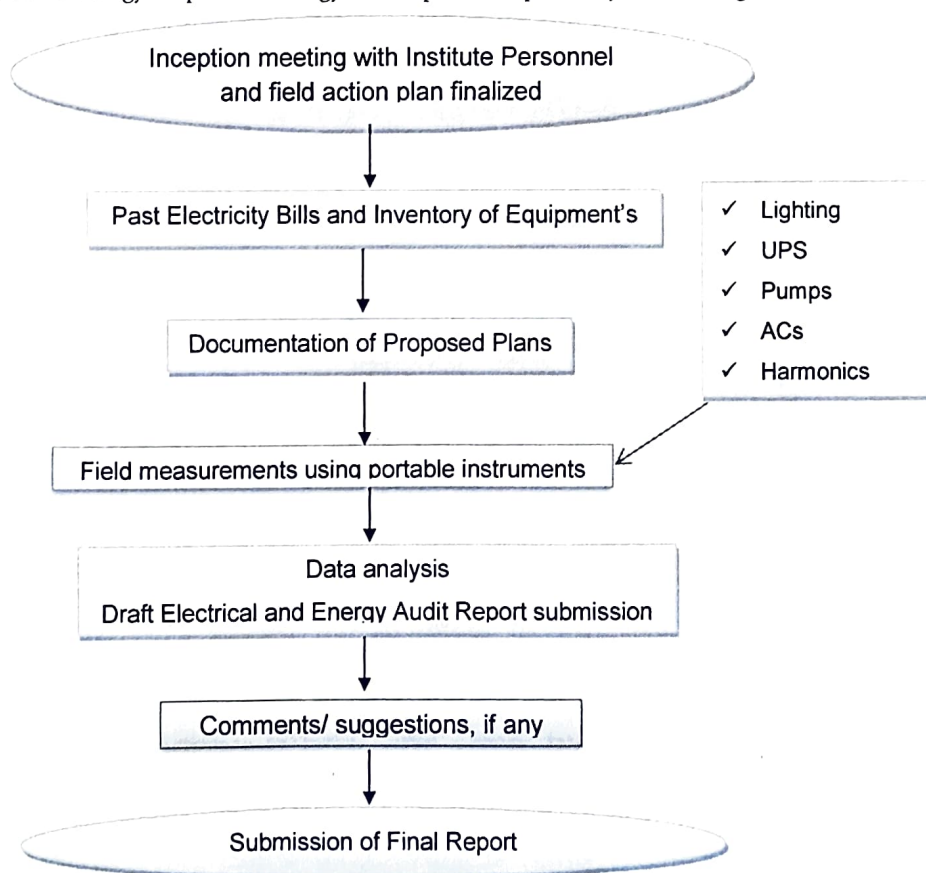


Figure 1: Approach/ methodology adopted for conducting Energy Audit of Aditya Pharmacy College, Surampalem, ADB Road, East Godavari District, Andhra Pradesh State



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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




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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 hotel utilities 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 entire campus.

Data on monthly billed units, solar energy consumed units and bill amount for period year from May 2023 to April 2024 is collected, analyzed, and presented in Table 2.1 below:

Table 2.1: Month-wise solar and grid electricity consumption (May 2023 to April 2024)

S.NO	Month	Grid Import Units/Power Import Units	Bill Units	College Solar Consumption
1	April-24	60572	37535	49637
2	March-24	51959	30347	45516
3	February-24	42452	21051	34507
4	January-24	26881	10028	29484
5	December-23	39103	28779	31964
6	November-23	45882	34295	34589
7	October-23	10252	6031	58242
8	September-23	45634	34247	33876
9	August-23	46821	37393	40917
10	July-23	46066	41564	30663
11	June-23	43181	33923	36251
12	May-2023	27118	20040	33395
Total		485921	333413	459041




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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)
(May 2023 to April 2024)

S. No	Details	Value
1	Solar generated units, kWh	801595
2	Solar college consumed units, kWh	459041
3	Solar export units, kWh	134680
4	Power import units, kWh	485721
5	Bill units, kWh	335233
6	Bill amount, Rs.	3901785
7	Net bill after adjustment, Rs.	9,15,213
8	College used amount, Rs. lakhs	86.28
9	Solar saving amount, Rs. lakhs	46.25

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.9.00 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

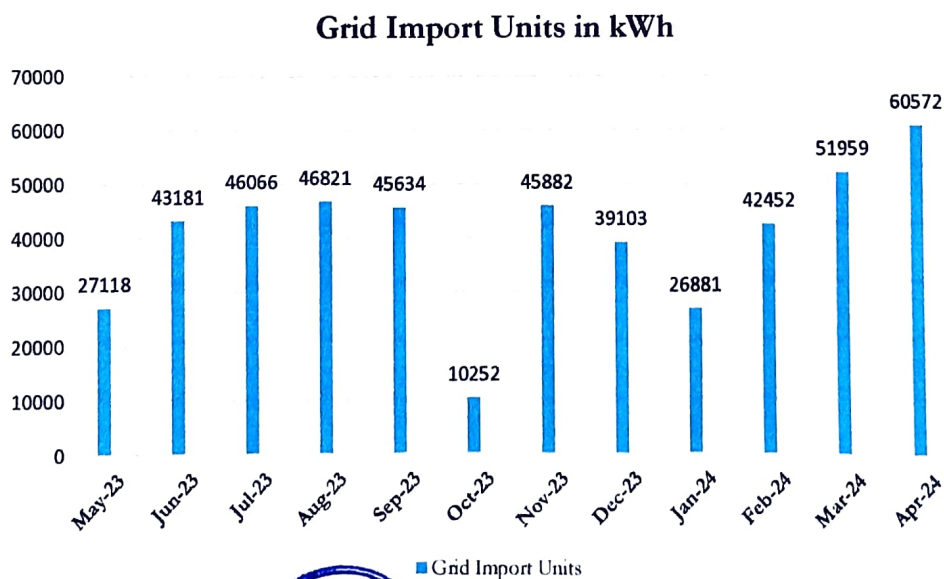


Fig 2.2: Monthly College Solar Consumption

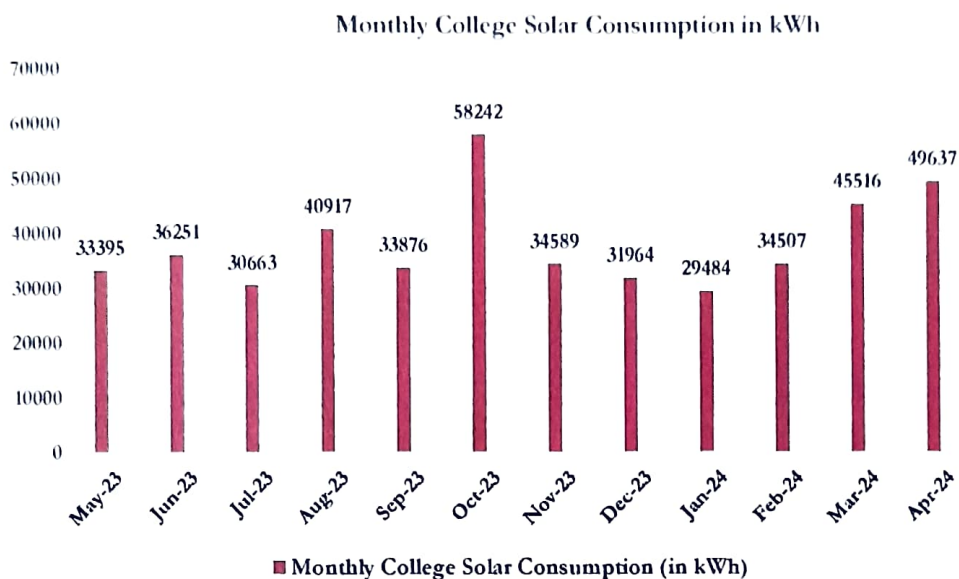
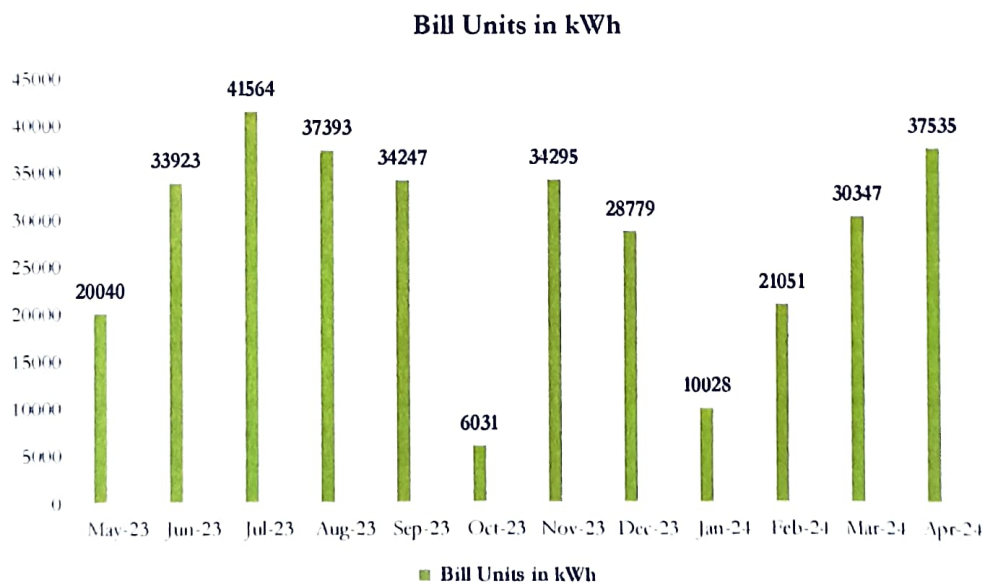


Fig 2.3: Monthly Grid Units



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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 Pharmacy College during
(May 2023 – April 2024)

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	801595
4	Solar college consumed units, kWh	459041
5	Solar export units, kWh	134680
6	Power import units, kWh	485721
7	Bill units, kWh	335233
8	Bill amount, Rs.	3901785
9	Net bill after adjustment, Rs.	3901785
10	College used amount, Rs. lakhs	86.28
11	Solar saving amount, Rs. lakhs	46.25

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 2023 to December 2023, the solar power is used for captive requirement for the campus, and the power is also exported to grid during holidays. Due to solar power plant, about 574 tons of CO₂ 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.



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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	0.43% to 1.0% Voltage Harmonics within the limits	3.0% to 10.5% 5 th Harmonic - 5% 7 th Harmonic - 5.4% 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 three DG sets for total campus load 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



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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

The college has 280 fans of 50 Watt for class rooms, staff rooms, corridors, and other locations. The total connected load of the fans is 14 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 is 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) m ³ /min/Watt	Cost (Rs)
5 Star	215-225	50-53	>=4	1,850-2,200

A few good brands of 5-star-rated Fans are Ortem, Relaxo, Orient, Usha, Crompton Greaves, Bajaj, and Havells. These fans normally come with a two-year warranty.

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



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- 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.



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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.

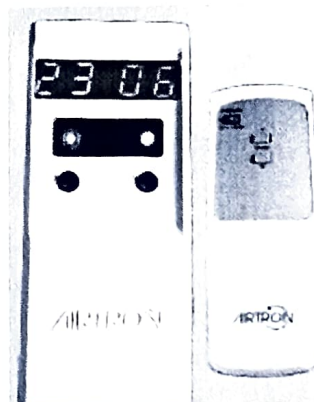
(b) Recommendations

(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%



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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.



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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 college 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
1	LED tube lights	20	223	4.460
2	CFLs	10	53	0.53
	Total		276	4.99

Majority of the tube lights LED tube lights in the institution, and some are CFLs. The total connected load of lighting is 4.99 kW. It is suggested to replace the CFLs with LEDs bulbs or lights. The cost benefit analysis is furnished below:

Table 4.2: Cost benefit Analysis of replacing CFLs with LEDs.

Description	Unit	CFLS
Total number of CFLs	Nos.	10
Wattage	W	10
No. of hours of operation/ day	Hours/day	6
No. of days per annum	Days/year	250
Annual Energy Consumption	kWh/year	150
Power saving due to LEDs @50%	kWh/year	75
Annual monetary savings(@Rs.10.0 per kWh)	Rs.	750
Investment for LED 5W light (@Rs.100/- per bulb or light)	Rs.	1,000
Payback period	Months	16



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CHAPTER 5

Miscellaneous

5.1 Pumps-Observations & recommendations

There 8 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 40 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	3.7
Efficiency	%	40
Efficiency of 5 star rated pump	%	60
Savings	%	33
Power savings	kW	1.2
No. of hours of operation/ day	Hours/ day	4
No. of days per annum	Days/ year	300
Power saving due to Energy efficient 5 star rated Pumps	kWh/ year	1440
Annual monetary savings	Rs	14, 440
(@Rs.10 per unit)		
Investment for pump	Rs	40, 000
Payback	Months	32

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



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

- 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 pos



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