ENERGY AUDIT REPORT

(2019-2020)

SAVE ENERGY SAVE EARTH

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AUTONOMOUS
NBA-Accredited
B.Tech (CSE|ECE|ME)
Accredited by
NAAC
With Grade A

ENERGY AUDIT COMMITTEE MEMBERS

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2	Mr. P. Pradeep Associate Professor, EEE	Convener	
3	Mr. R. V. Ranjith Kumar Assistant Professor, ME	Member	
4	Mr. K. Prasad Assistant Professor, C.E	Member	
5	Mr. P.N.V Kishore Assistant Professor, B.E.D	Member	
6	A.V. Ravi kumar Assistant Professor, EEE	Member	
7	Mrs. V. Lakshmi Chethana Assistant Professor, CSE	Member	
8	Mr. K. Veenanand Assistant Professor, ECE	Member	
9	Mr. S. Vamsi krishna Electrical Maintenance	Member	

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1.Introduction:

Energy audit is the verification, monitoring, and analysis of how energy is used, including the submission of a technical report with recommendations for increasing energy efficiency with a cost-benefit analysis and an action plan to reduce energy consumption.

A systematic study or survey to identify how energy is being used in a building or plant, and identify energy savings opportunities is done and reducing energy usage by using appropriate audit techniques and an action plan is proposed in this report.

The main Objectives of an Energy Audit are:

i). Review of energy saving opportunities and measures implemented in the audit sites and identification of additional various energy conservation measures and saving opportunities.

ii). Implementation of alternative energy resources for energy saving opportunities and decision making in the field of energy management.

iii). Providing a technical information on how to build an energy balance as well as guidance to be sought for particular applications.

iv). Detailed analysis on the calculation of energy consumption, analysis of latest electricity bill of the campus

v). Use of incandescent (tungsten) bulb and CFL bulbs, fans, air conditioners, cooling apparatus, heaters, computers, photo copiers, inverter, generators and laboratory equipment and instruments installed in the organization

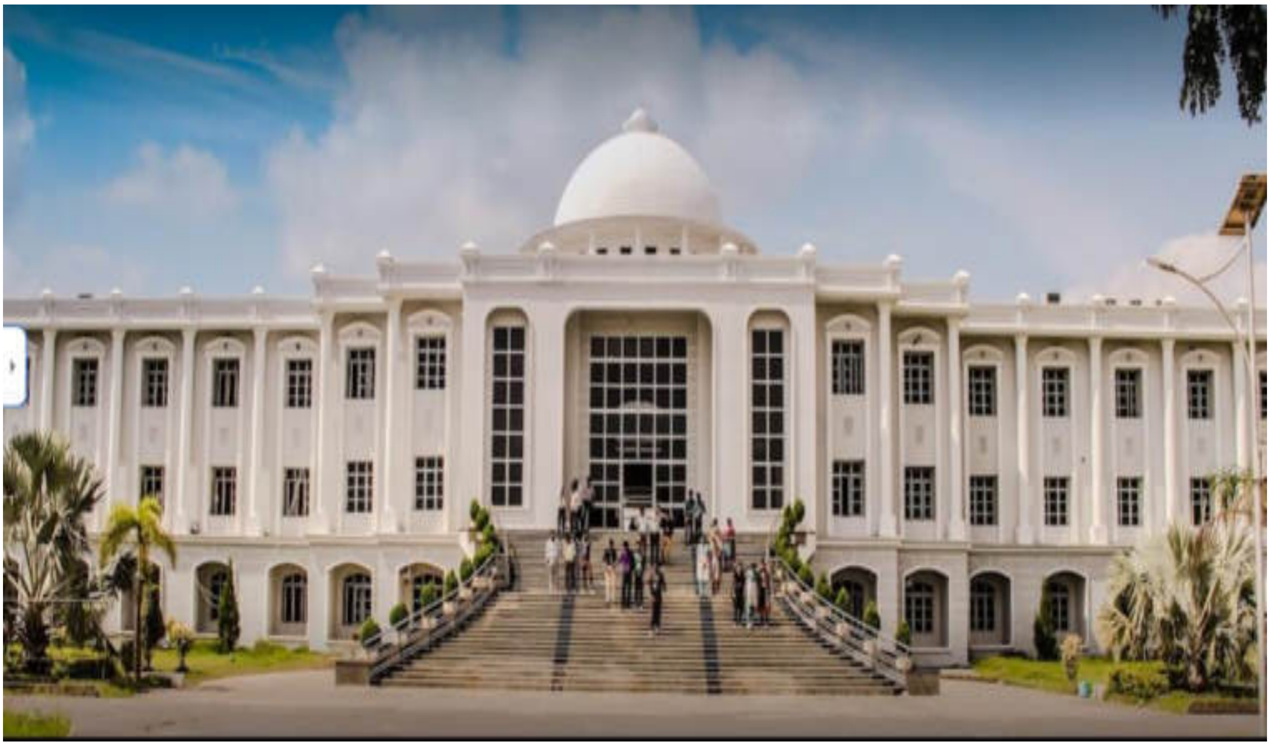
vi). Creating awareness among the stakeholders on energy conservation and utilization.

2.About the college:

MIC Odyssey began in 2002 in Kanchikacherla, a village that boasts of idyllic beauty and serene atmosphere suited for scholastic pursuits. Right from its inception, the College has crossed new vistas making inroads into Quality Education under the dynamic stewardship of our Visionary Chairman Dr. MV Ramana Rao, M.E., Ph.D., CEO & MD MIC Electronics Ltd., Hyderabad.

MIC's tryst with destiny began in 2002 with three branches of B.Tech., (ECE, CSE, and EEE). In 2004, the Mechanical Engineering branch in B. Tech., MCA & MBA courses were added. The College was granted permission to run M.Tech., in Machine Design, PE&D, VLSI&ES, and CSE in 2012. APSCHE approved diploma courses in 2012-13 with two branches: EEE and ME. In 2013-14, two more branches in diploma viz., CE and ECE were approved. In 2013, permission was accorded for B. Tech., in the Civil Engineering branch and 2017, for B.Tech., in Information Technology.

The College was approved by the All India Council for Technical Education (AICTE), New Delhi, and is permanently affiliated with the JNTUK, Kakinada .



3.Sources of energy:

The major sources of energy for the college include

a. Electrical grid power supply connection

The institute have a Three Phase, 11 KV/433 V, 50 HZ distribution transformer supplied by APSPDCL.This is frequently serviced and well maintained for efficient and uninterrupted supply.

This transformer is installed in an isolated area inside the campus and is fully fenced for safety and protection.

b. 100 kWp On-Grid Roof Top Solar Power System

The institute also has **100 kWp On-Grid Roof Top Solar Power System.**

This project is installed under the Program of **New & Renewable Energy Development Corporation of Andhra Pradesh Ltd (NREDCAP)**. The total project cost is Rs. **50Lakhs**. Ministry of New and Renewable Energy (MNRE), Government of India, New Delhi provided a subsidy of 30%.

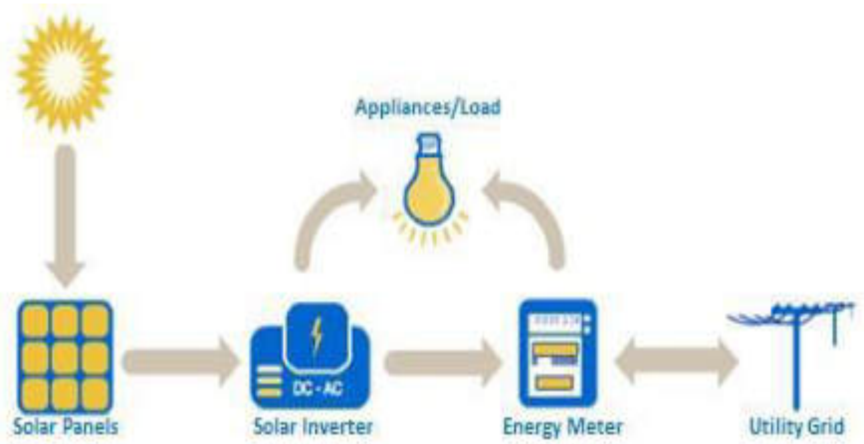
Harnessing the Solar has always been the one of its key drivers at DVR & Dr.HS MIC College of Technology in its Go Green initiatives with the installation of rooftop solar photovoltaic plant. In its pursuit to become energy efficient, DVR & Dr.HS MIC College of Technology, Kanchikacherla, Krishna Dist, Andhrapradesh formally commissioned a total of 100 kWp Solar PV Plant in the year of 2019.

System Specifications:

Total Installed Capacity	100 kWp
PV Modules	330Wp (304no's)
Cell Technology	Polycrystalline
Modules supplier	Green Secure Energy Pvt Ltd
Mounting	Fixed Tilt (45° South & North Facing)
Inverters rating	50KVA (2 no's)
Inverter Make	Polycab Company
Lightning Arresters	1
Earth Pits	4
Installed Year	2019

Description of Roof Top Solar System:

In grid connected rooftop or small solar photovoltaic (SPV) system, the DC power generated from solar panel is converted to AC power using power conditioning unit/Inverter and is fed to the grid.



Main components of a Grid Connected Rooftop Solar PV system:

Solar PV Modules/Solar Panels

Inverter

Module mounting structure

Bi-direction Meters

Balance of System

Solar PV Modules/Solar Panels – The Solar PV modules/Solar Panels convert solar energy to DC (direct current) electrical energy. They are available in different technologies such as crystalline silicon, thin film silicon, etc. Crystalline Silicon Solar PV panels are most commonly used in solar rooftop system. Multiple panels are connected together to form arrays as per the desired capacity of the system.

Inverter – Inverter converts variable DC output of Solar PV panels into AC power. Inverter also synchronizes with the grid so that generated power from the module can be injected into the grid.

Module mounting structure – The module mounting structure, is the support structure that holds the Solar PV panels in place for full system life and is exposed to all weather conditions. These are normally fixed at particular angle and orientation in case of solar rooftop system. But these can also be of type that tracks the Sun, called as trackers.

Bi-direction Meters – Meters are used to record the generation or consumption of electricity. Bi-direction is used to keep track of the electricity that solar PV system injects to utility grid and the electricity that is drawn from the utility grid.

Balance of System – These consist of cables, switchboards, junction boxes, earthling system, circuit breaker, fuses, lightning protection system, etc.

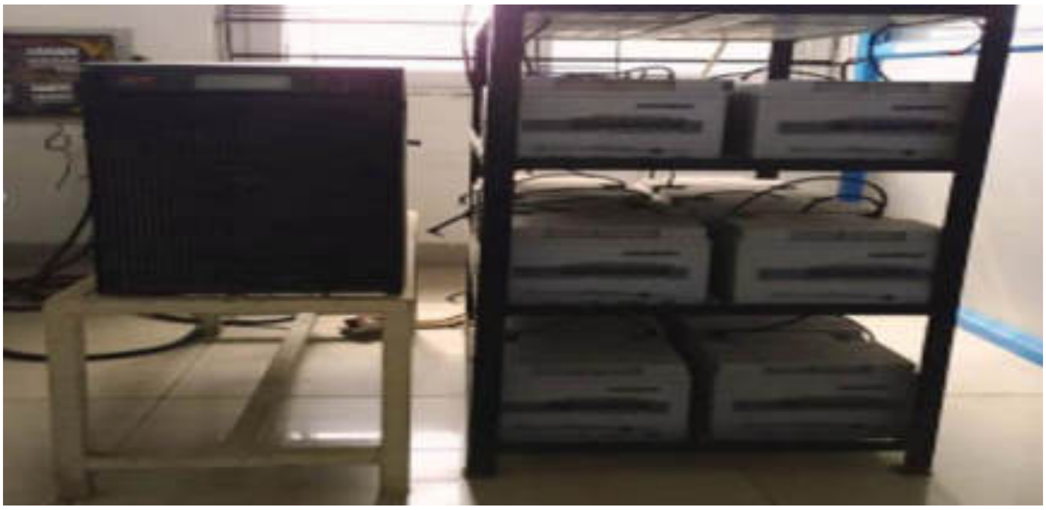
4.Power Backup:

Institute has the facility of power backup system in case of failure of electricity. The power backup system include

a. UPS and battery banks

UPS & Battery Banks are provided in all the Computer labs, Library, Exam cell etc.

Generator facility is provided to each and every corner of the college which includes Laboratories, Class rooms, Library, Canteen, Hostel etc.



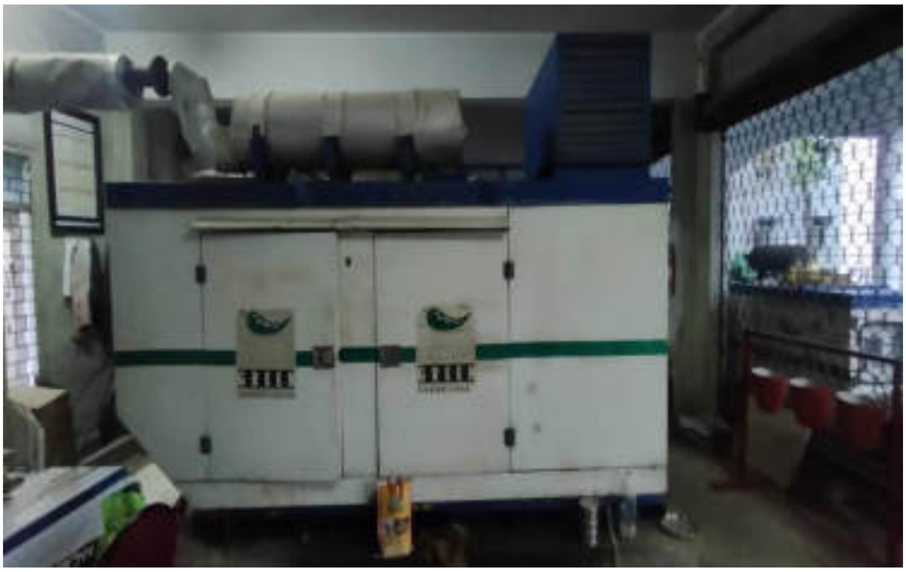
UPS & Battery bank details:

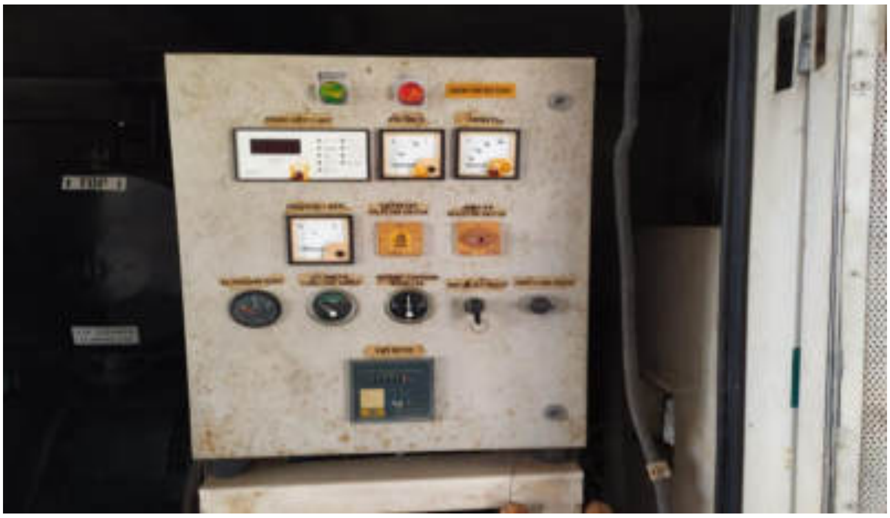
S.No	UPS Capacity & Make	No of Batteries, Make & Capacity
1	20kVA, APC	32 Batteries, AMARON, Each battery 12V,26AH
2	20kVA, APC	32+4 Batteries, AMARON(32), Excide(4) , Each battery 12V,65AH
3	20kVA, APC	32 Batteries, AMARON-28, Exide power safe Plus-4

		Each battery 12V,65AH
4	20kVA, APC	32 Batteries, AMARON, Each battery 12V,26AH
5	20kVA, APC	32 Batteries, AMARON, Each battery 12V,26AH
6	20kVA, APC	32 Batteries, Rocket, Each battery 12V,42AH
7	3kVA , APC	6 Batteries, Excide Power Safe Plus. Each battery 12V,26AH
8	10kVA,APC	16 Batteries, Excide Power safe Plus .12V,26AH
9	3kVA,APC	6 Batteries, AMARON 12V,32AH
10	20kVA, Numaric	16 Batteries, AMARON, Each battery 12V, 65AH. 15 Batteries, Excide Power safe Plus .Each Battery 12V,26AH
11	20kVA, APC	32 Batteries, AMARON, Each battery 12V,42AH

b. Diesel generators

The Institute has 2 Diesel Generators with a rating of 200 KVA & 125 KVA with Automatic Changeover for Uninterrupted Supply.
The generator is frequently serviced and well maintained by the maintenance team for efficient working.





5.Energy consumption:

The power requirement of various electrical devices in the institute is as follows

Table 5.1

BLOCK NAME	BLOCK I (MAIN BLOCK-GROUND FLOOR)	BLOCK II (MAIN BLOCK-FIRST FLOOR)	BLOCK III (MAIN BLOCK-SECOND FLOOR)	BLOCK IV (BED Dept. ,MECH LABS)	BLOCK V (GIRLS HOSTEL)	BLOCK VI (BOYS HOSTEL , CANTEEN&AUDITORIUM)	OTHERS	TOTAL	Power Rating (W)	Power consumption (W)
LIGHT TUBE	224	165	185	345	269	73	7	**1268**	40	50720
LIGHT CFL	0	0	9	0	2	0	1	**10**	25	250
LIGHT LED	195	233	115	85	3	167	65	**833**	15	12495
FAN - CEILING	132	153	120	170	177	143	1	**758**	80	60640
FAN - EXHAUST	6	12	4	6	21	9	0	**58**	25	1450
UPS	3	8	4	2	1	1	0	**19**	800	15200
AC 1.5T	7	25	2	2	0	25	0	**61**	1700	103700
AC 2T	14	5	5	7	0	0	0	**31**	2000	62000
COMPUTERS	440	130	150	170	1	1	0	**892**	300	267600
PRINTERS	5	13	1	1	0	1	0	**21**	50	1050
PROJECTORS	7	5	2	3	0	1	0	**18**	150	2700
WATER COOLERS	3	1	3	4	1	2	0	**13**	100	1300
Immersion water heaters					12	12	0	**24**	1000	24000
						TOTAL POWER COSUMPTION				**6,03,105**

Table 5.1 shows the power consumption of various major electrical devices in the campus. The complete campus is divided into six blocks and the area other than these six blocks is shown as others in the table.

6.Energy conservation measures:

Existing power saving methods:

1. Turn off electrical appliances when not in use.
2. Solar water heaters are installed on the Girls and Boys hostel.
3. Power factor improvement devices are installed in the campus.
4. 100 KWP solar roof top is installed in the campus.
5. Common switch for each floor.

Energy saving methods to be implemented:

The following energy saving methods may be implemented in the campus.

1. **Replace the Fluorescent Tube Lights (FTL) with LED Tube Lights.**

The 40 W FTLs can be replaced with the LED tube lights 20 W. These changes can be made at the places where the usage is higher. Usually minimum of 1 year warranty is given and approximate burning hours is 40,000. (15 years considering 6 hours per day running).

Following calculations are done for 6 hours working:

- Power consumption by 36 W FTL with conventional choke = **40 W/ Tube Light.**
- Equivalent LED tube light = **20 W/ Tube Light.**
- Savings in power = **20 W/ Tube Light.**
- Operating hours = 6 hr/day x 300 = **1,800 h/year.**
- Total power usage of FTL over an year = 40 W × 1800 h/year = **72 kWh/year/Tube Light**
- Total power usage of LED Tube light over an year = 20 W × 1800 h/year = **36 kWh/year/Tube Light**
- Tube Light Yearly savings = 1,800 x 20W = **36 kWh/year/Tube Light.**
- Average Cost of electricity = **Rs. 7.65 / kWh.**
- Saving = 36 kWh x 7.65 = **Rs. 275.4 / year / Tube light.**
- Approximate investment on single LED Tube lights = **Rs. 219** (Panasonic LED 20W Batten, 1 pc).
- Number of Tube Lights to be replaced = **1268**
- Electrical Energy Saved = 36 kWh x 1268 = **45648kWh / year.**

Summary:

Total Investment =1268x Rs.219 = **Rs. 2,77,692/-**

Total Yearly Saving = 1268 x 275.4 =**Rs. 3,49,207 / year**

Payback:

(2,77,692/3,49,207) = 0.79 years = **around 9.5 months**

2. Installing Solar Water Heaters to replace the Immersion water heater

Solar energy is the most useful and abundant source of Green energy. It is a conventional energy resource and emits zero pollution. Solar water heaters transforms solar energy into heat energy by absorbing the radiation of the sunlight. These solar water heaters consumes 0 watts and power saving will be very high.

Following calculations are done for 6 hours working:

- Power consumption of an immersion water heater = **1000 W/ Unit.**
- Power consumption of a Solar water heater= **0 W/ Unit.**
- Savings in power = **1000 W/ Unit.**
- Operating hours = 6 hr/day x 300 = **1,800 h/year.**
- Total power usage of immersion water heater over a year = 1000 W × 1800 h/year = **1,800 kWh/year/Unit.**
- Total power usage of Solar water heater over a year = 0 W × 1800 h/year = **0 kWh/year**
- Solar Water Heaters yearly savings = 1,800 x1000 W = **1,800 kWh/year/Unit.**
- Average Cost of electricity = **Rs. 7.65 / kWh.**
- Saving = 1800 kWh x 7.65 = **Rs. 13,770 / year / Unit**
- Approximate investment of Solar Water heater = **Rs. 50,000/-**
- Number of immersed water heaters to be replaced =**24**
- Electrical Energy Saved = 1,800 kWh x 24 = **43,200 kWh / year.**

Summary:

Total Investment = 4 x Rs.50,000 = **Rs.2,00,000/-**

(Here we don't need to install the Solar water heaters of the same number of immersed water heaters because the quantity of hot water the solar water heater can generate is much greater than the immersed water heaters)

Total Yearly Saving = 24 x 13770 =**Rs. 3,30,480 /-**

Payback:

(2,00,000 /3,30,480) = 0.605 years = **around 7 months**

3. **Replace the CFL Lights with LED Lights.**

The 25 W CFL lights can be replaced with the LED lights of 10 W. These changes can be made at the places where the required intensity of lighting is low.

Following calculations are done for 6 hours working:

- Power consumption by CFL lights = **25 W/ Light.**
- Equivalent LED light = 1**0 W/ Light.**
- Savings in power = **15 W/ Light.**
- Operating hours = 6 hr/day x 300 = **1,800 h/year.**
- Total power usage of CFL lights over an year = 25 W × 1800 h/year = **45 kWh/year/Light**
- Total power usage of LED light over an year = 10 W × 1800 h/year = **18 kWh/year/Light**
- Tube Light Yearly savings = 1,800 x 20W = **27 kWh/year/Light.**
- Average Cost of electricity = **Rs. 7.65 / kWh.**
- Saving = 27 kWh x 7.65 = **Rs. 206.55 / year / Light.**
- Approximate investment on single LED lights = **Rs. 212** (Eveready LED 10W Bulb, 1 pc).
- Number of Tube Lights to be replaced = **10**
- Electrical Energy Saved = 27 kWh x 10 = **270 kWh / year.**

Summary:

Total Investment =10 x Rs.212 = **Rs. 2,120/-**

Total Yearly Saving = 10 x 206.55 =**Rs. 2065.5 / year**

Payback: (2120/2065.5) = 1.02 years = **around 13 months**

7.RECOMMENDATIONS/ SUGGESTIONS:

For Improving Energy Consumption:

- Every classroom and lab with central switch board can have a diagram linking location of a tube light, fan etc. with corresponding switch. This will ensure that correct fitting is switched on/ off and can save time & unnecessary operation.
- Installation of automatic lights with sensors can be considered.
- Conduct energy audit every year and determine the lux levels within College. Energy audit can help in reduction in number of light fittings/ energy usage in the College.
- For purchasing new electronic appliances, star rating provided by Bureau of Energy Efficiency (BEE) should be considered. The equipment which has maximum star ratings could be purchased, which will consume less energy, ensure environmental sustainability and also operate at low cost.
- Usage of light reflectors is recommended as the reflectors can spread light to relatively large areas. Notices/ signages can be put up/ displayed near switches and on notice boards, informing students and staff to switch off all electricals when not in use.
- Control sensors can help to reduce consumption by automatically dimming lights when people are not around, and keeping blinds open to use natural light & reduce energy consumption.
- **Raise awareness**: Encourage students to help in monitoring energy consumption & implement corrective actions, Integrate energy education into classroom learning
- **Housekeeping:**

  Curtains – Always keep curtains closed on windows to prevent direct sunlight inside the room to avoid heating of cooled air. This reduces A.C. load significantly.
- **Better Practices for A.C.:**

  The institute has both split and window type A.C.s which makes a very large part of total energy consumption of the campus. But at many places it was found that AC is not used with best recommended practices. Even simple things such as insulation, damaged windows, poor insulation curtains, etc can effect the power consumption.

Summarized below are some guidelines for most efficient use if A.C.s:

1. **Proper insulation** – Good quality insulation must be maintained in the air-conditioned rooms by keeping all doors and windows closed properly so as to prevent cool air go out and hot air come in.
2. **Operating** – The A.C. should be switched on 15 minutes before actual use and should be switched off before leaving the room.

- **Pumps**
  1. Operate pumping near best efficiency point.
  2. Modify pumping to minimize throttling.
  3. Stop running both pumps -- add an auto-start for an on-line spare or add a booster pump in the problem area.
  4. Use booster pumps for small loads requiring higher pressures.
  5. Increase fluid temperature differentials to reduce pumping rates.
  6. Repair seals and packing to minimize water waste.
- **Motors**
  1. Properly size to the load for optimum efficiency.
  2. Check alignment.
  3. Provide proper ventilation
  4. Check for under-voltage and over-voltage conditions.
  5. Balance the three-phase power supply.
  6. Demand efficiency restoration after motor rewinding.

- All Class Rooms and labs to have Display Messages regarding optimum use of electrical appliances in the room like lights, fans, computers and projectors. Save electricity. Display the stickers of save electricity, save nature everywhere in the campus. So that all stakeholders encouraged to save the electricity.
- Use **motion sensor** in corridors, passage, library, class rooms and toilets.

- Most of the time, all the tube lights in a class room are kept ON, even though, there is sufficient light level near the window opening. In such cases, the light row near the window may be kept OFF.
- All projectors to be kept OFF or in idle mode if there will be no presentation slides. All computers to have power saving settings to turn off monitors and hard discs, say after10 minutes/30 minutes.
- Lights in toilet area may be kept OFF during daytime.
- Use Automatic Power Factor Correction (APFC) Panel for PF improvement.
- Need to replace ordinary refrigerator by BEE power saver refrigerator if possible.

COMPUTERS

- Configure your monitor to turn off after 10 minutes of inactivity, your hardware to turn off 20 minutes after your inactivity. Place your PC in a standby mode when you leave office for more than 2hrs.
- Do not use screensaver as energy saver as they cause monitor to continue operating at full power.
- Do not turn on your comp in the morning until you actually need it.
- There is a common misconception that pc's and monitors purchased with energy star logo are efficient, in reality they are built in energy conservation features but PC can't take full advantage of it.

USE OF MASTER SWITCH ON EACH FLOOR

- Installation of master switch can make it easy for a person to switch off all appliances of a room in case someone forgets to switch off while leaving the room.

UPS SYSTEMS

- Optimizing the number of ups by disconnecting additional ups and improving load and existing working ups.