# ENERGY AUDIT REPORT

# (2022-2023)

*SAVE ENERGY SAVE EARTH*

DVR & Dr. HS
MIC College of Technology
ISO 9001:2015 Certified Institute
(Approved by AICTE & Permanently Affiliated to JNTUK, Kakinada)
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AUTONOMOUS
Accredited by NAAC With Grade A

## ENERGY AUDIT COMMITTEE MEMBERS

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| 9 | Mr. S. Vamsi Krishna<br>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

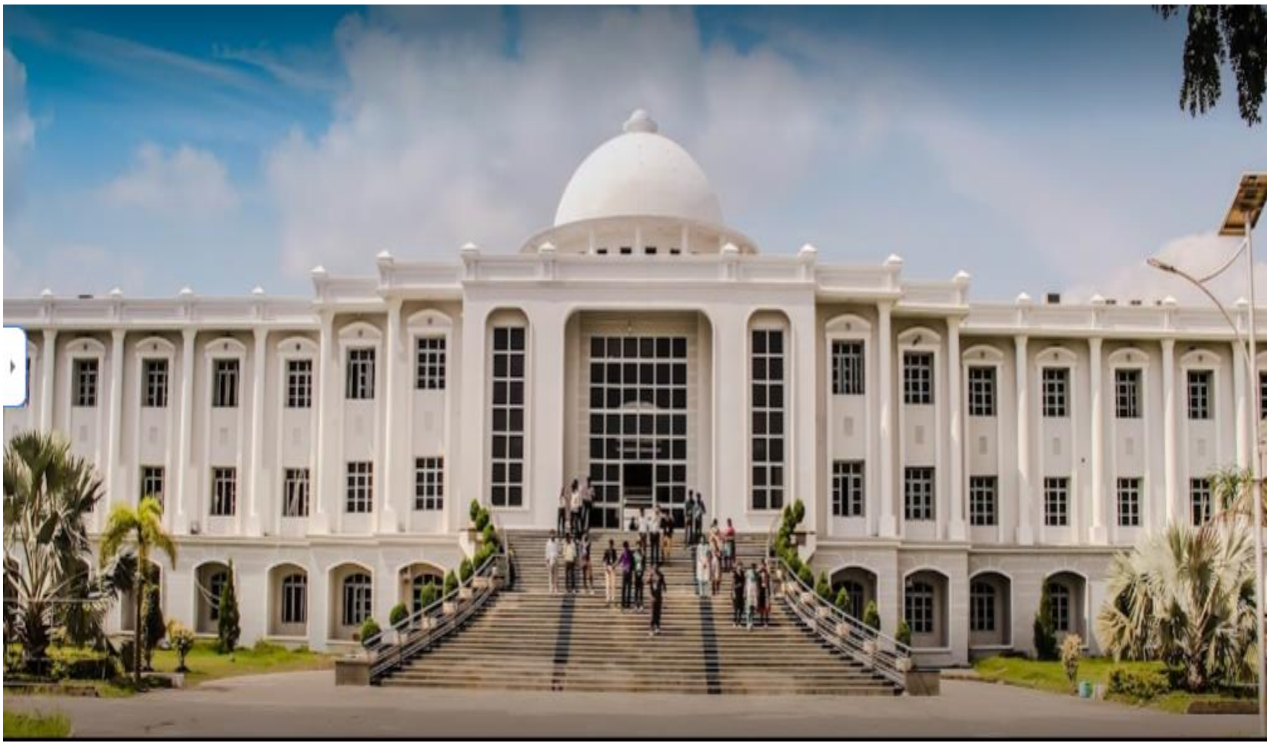
vi). Creating awareness among the stakeholders on energy conservation and utilization.

## 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.



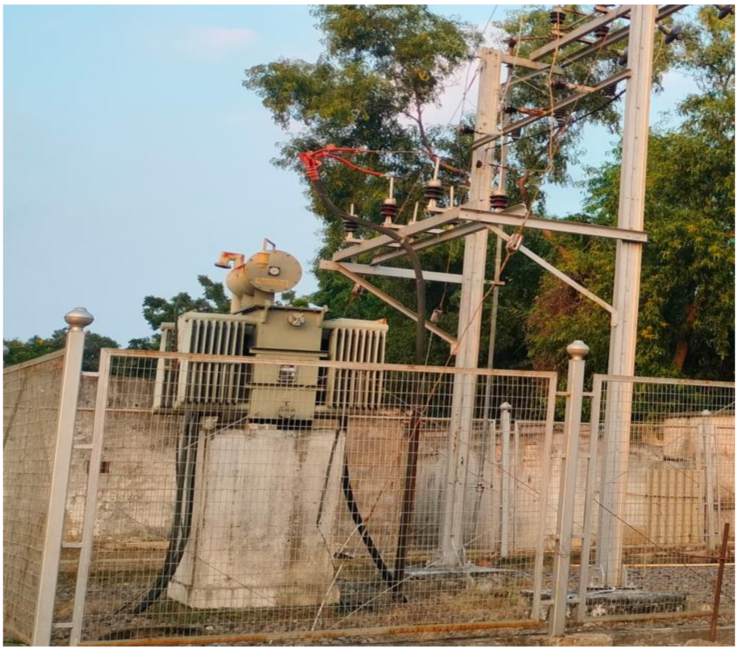
## 3.Sources of energy:

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.

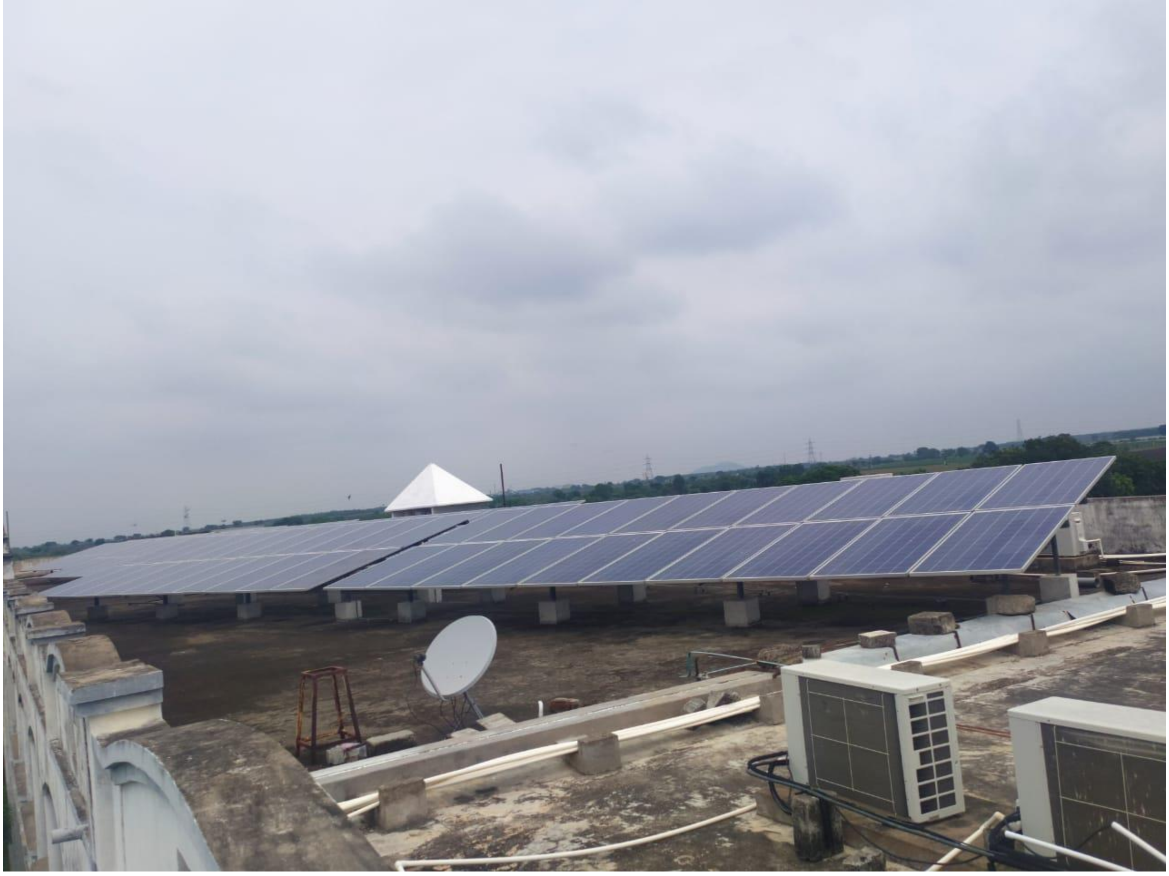


## b. 100 kWp On-Grid Roof Top Solar Power System

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

Thisprojectisinstalledunder the Program of **N e w & Renewable Energy Development Corporation of Andhra Pradesh Ltd (NREDCAP)**.ThetotalprojectcostisRs.**50Lakhs**. MinistryofNewandRenewableEnergy(MNRE),GovernmentofIndia,NewDelhiprovidedasubsidy of30%.

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.

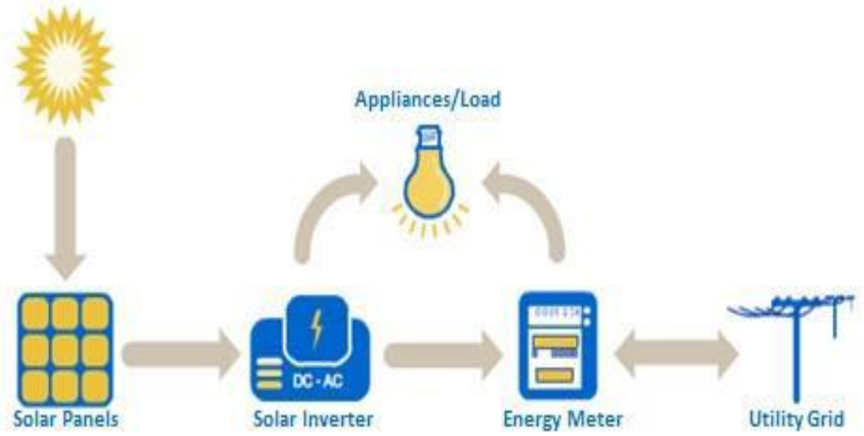


## SystemSpecifications:

| | |
|---|---|
| Total Installed Capacity | 100 kWp |
| PVModules | 330Wp(304no's) |
| CellTechnology | Polycrystalline |
| Modulessupplier | Green Secure Energy Pvt Ltd |
| Mounting | Fixed Tilt (45°South & North Facing) |
| Invertersrating | 50KVA (2 no's) |
| InverterMake | Polycab Company |
| LightningArresters | 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.

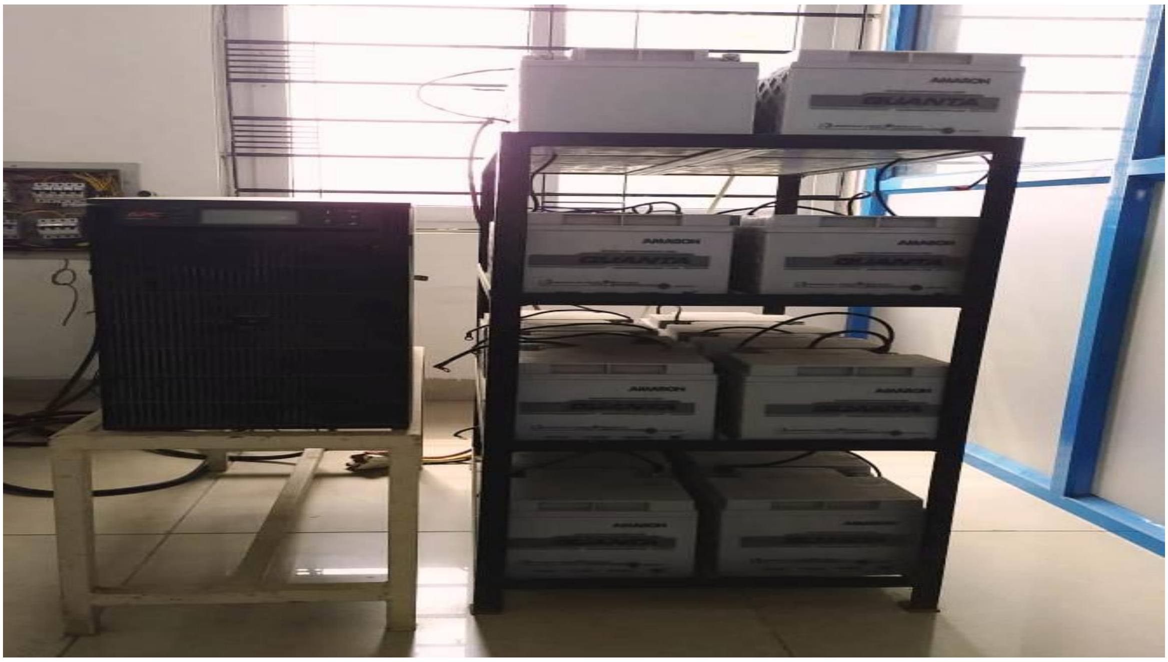
# 4.Power Backup:

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:**

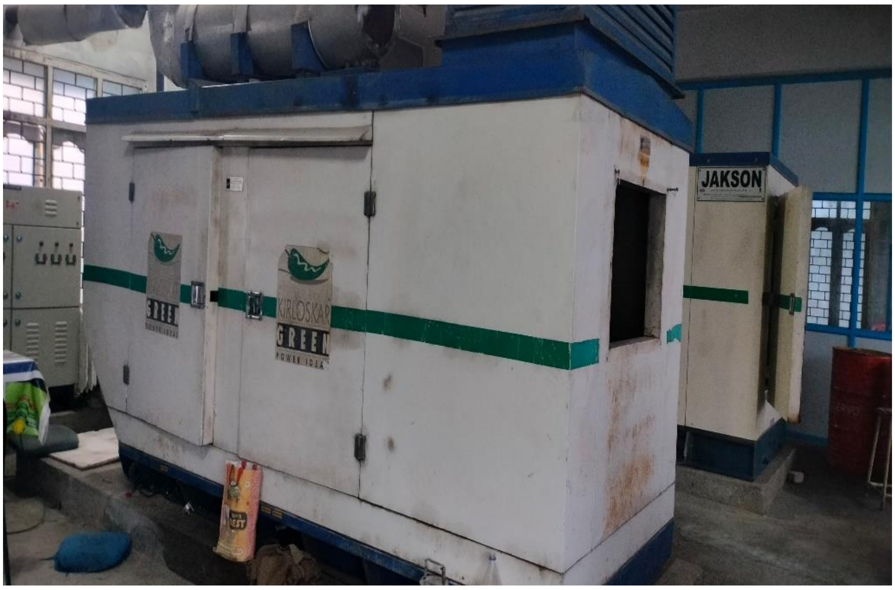
| S.No | UPS Capacity & Make | No of Batteries, Make & Capacity |
|---|---|---|
| 1 | 20kVA, APC | 32 Batteries, AMARON, Each battery 12V,26AH |
| 2 | 20kVA, APC | 32+4 Batteries, AMARON(32), Excide(4) , Each battery 12V,65AH |
| 3 | 20kVA, APC | 32 Batteries, AMARON-28, Exide power safe Plus-4 |

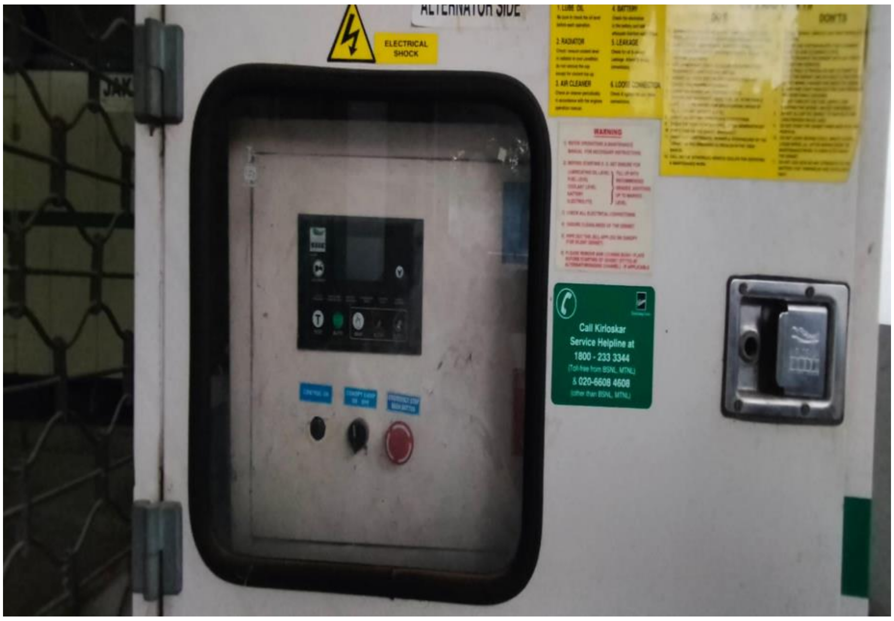
| | | |
|---|---|---|
| | | Each battery 12V,65AH |
| 4 | 20kVA, APC | 32 Batteries, AMARON,<br>Each battery 12V,26AH |
| 5 | 20kVA, APC | 32 Batteries, AMARON,<br>Each battery 12V,26AH |
| 6 | 20kVA, APC | 32 Batteries, Rocket,<br>Each battery 12V,42AH |
| 7 | 20kVA, APC<br>(Extra UPS) | - |
| 8 | 3kVA , APC | 6 Batteries, Excide Power Safe Plus.<br>Each battery 12V,26AH |
| 9 | 10kVA,APC | 16 Batteries, Excide Power safe Plus .12V,26AH |
| 10 | 3kVA,APC | 6 Batteries, AMARON 12V,32AH |
| 11 | 20kVA, APC | 32 Batteries, AMARON,<br>Each battery 12V,26AH |
| 12 | 20kVA, Numaric | 16 Batteries, AMARON, Each battery 12V, 65AH.<br>15 Batteries, Excide Power safe Plus .Each Battery 12V,26AH |
| 13 | 20kVA, APC | 32 Batteries, AMARON,<br>Each battery 12V,42AH |
| 14 | 20kVA,Numaric | **3 Batteries**, AMARON,<br>Each battery 12V,65AH |
| 15 | 20kVA, APC | 32 Batteries, AMARON,<br>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 | 210 | 140 | 170 | 310 | 250 | 60 | 5 | **1145** | 40 | 45800 |
| LIGHT CFL | 0 | 0 | 9 | 0 | 2 | 1 | 1 | **13** | 25 | 325 |
| LIGHT LED | 230 | 260 | 130 | 103 | 7 | 200 | 90 | **1020** | 15 | 15300 |
| FAN - CEILING | 190 | 205 | 165 | 205 | 200 | 166 | 4 | **1135** | 80 | 90800 |
| FAN - EXHAUST | 8 | 14 | 6 | 8 | 25 | 13 | 0 | **74** | 25 | 1850 |
| UPS | 4 | 10 | 5 | 3 | 2 | 2 | 1 | **27** | 800 | 21600 |
| AC 1.5T | 10 | 28 | 4 | 5 | 0 | 28 | 0 | **75** | 1700 | 127500 |
| AC 2T | 15 | 6 | 6 | 7 | 0 | 0 | 0 | **34** | 2000 | 68000 |
| COMPUTERS | 470 | 155 | 190 | 210 | 1 | 1 | 0 | **1027** | 300 | 308100 |
| PRINTERS | 6 | 15 | 2 | 2 | 0 | 2 | 0 | **27** | 50 | 1350 |
| PROJECTORS | 8 | 8 | 3 | 4 | 0 | 1 | 0 | **24** | 150 | 3600 |
| WATER COOLERS | 4 | 2 | 4 | 4 | 1 | 2 | 0 | **17** | 100 | 1700 |
| Immersion water heaters | | | | | 5 | 5 | | **10** | 1000 | 10000 |
| | | | | | | **TOTAL POWER COSUMPTION** | | | | **6,95,925** |

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 = **1145**
- Electrical Energy Saved = 36 kWh x 1145 = **41,220 kWh / year.**

**Summary:**

Total Investment =1145x Rs.219 = **Rs. 2,50,755/-**

Total Yearly Saving = 1145x 275.4 =**Rs. 3,15,333 / year**

**Payback:**

(2,50,755/3,15,333) = 0.79 years = **around 9.5 months**

2. **Replace the Induction motor ceiling fans with BLDC motor fans**

The 80 W regular fans can be replaced with the BLDC motor fans of 28 W rating. These changes can be made at every place since the energy saving is very high. There is a negligible amount of heating of the motor and the life of a BLDC fan is also expected to be much higher than ordinary fans.

**Following calculations are done for 6 hours working:**

- Power consumption of an Induction motor fan = **80 W/ Fan.**
- Power consumption of a BLDC motor fan = **28 W/ Fan.**
- Savings in power = **52 W/ Fan.**
- Operating hours = 6 hr/day x 300 = **1,800 h/year.**
- Total power usage of Induction fan over an year = 80 W × 1800 h/year = **144 kWh/year/Fan**
- Total power usage of BLDC Motor fan over an year = 28 W × 1800 h/year = **50.4 kWh/year/Fan**
- BLDC Fan Yearly savings = 1,800 x 52 W = **93.6 kWh/year/Fan.**
- Average Cost of electricity = **Rs. 7.65 / kWh.**
- Saving = 93.6 kWh x 7.65 = **Rs. 716.04 / year / Fan.**
- Approximate investment on single BLDC Fan = **Rs. 3,500.**
- Number of ceiling fans to be replaced = **1135**
- Electrical Energy Saved = 93.6 kWh x 1135 = **1,06,236 kWh / year.**

**Summary:**

Total Investment =1135x Rs.3500 = **Rs. 39,72,500/-**

Total Yearly Saving = 1135x 716.04 =**Rs. 8,12,705.4 / year**

**Payback:**

(39,72,500/8,12,705.4) = 4.88 years = **around 4 years and 10 months**

**3. 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 =**10**
- Electrical Energy Saved = 1,800 kWh x 10 = **18,000 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 = 10 x 13770 =**Rs. 1,37,700 /-**

**Payback:**

(2,00,000 /1,37,700) = 1.45 years = **around 1 year and 5 months**

4. **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 = **13**
- Electrical Energy Saved = 27 kWh x 13 = **351 kWh / year.**

**Summary:**

Total Investment =13 x Rs.212 = **Rs. 2,756/-**

Total Yearly Saving = 13 x 206.55 =**Rs. 2,685.15 / year**

**Payback:**

(2,756/2,685.15) = 1.03 years = **around 13 months**

## 7.<u>RECOMMENDATIONS/ SUGGESTIONS:</u>

**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.
- Standard Operation Procedures (SOPs) should be prepared and followed for green purchasing. Equipment with star rating, using eco-friendly materials; with safe disposal policy to be preferred. Policy of returning equipment at the end of life span to the supplier to be preferred.
- 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.

### Lighting

- Get into the habit of turning lights off when you leave a room. Saving Energy 0.5 %
- Use task lighting (table and desktop lamps) instead of room lighting.
- Take advantage of daylight
- Compact fluorescent bulbs (CFL):
  1. CFL use 75% less energy than Normal bulbs.
  2. CFL are four times more energy efficient than Normal bulbs.
  3. CFL can last up to ten times longer than a normal bulb.
- Use electronic chokes, in place of conventional copper chokes.
- Get into the habit of turning lights off when you leave a room.
- Use only one bulb for light fittings with more than one light bulb, or replace additional bulbs with a lower wattage version.

• Use energy-saving light bulbs that can last up to ten times longer than a normal bulb and use significantly less energy. A single 20 to 25 watt energy-saving bulb provides as much light as a 100-watt ordinary bulb.

• Use tungsten halogen bulbs for spotlight

• Fit external lights with a motion sensor.

## Air Condition Unit

• Replace air conditioner filters every month.

• Turn off central air conditioning 30 minutes before leaving your home.

• Consider using ceiling or portable fans to circulate and cool the air.

• Try increasing your air conditioner temperature. Even 1 degree higher could mean significant savings, and you will probably not notice the difference.

• Keep central air conditioner usage to a minimum or even turn the unit off if you plan to go away.

• Consider installing a programmable thermostat. Just set the times and temperatures to match your schedule and you will save money and be comfortably cool when you return back.

• Replace air conditioner filters every month.

• Buy the proper size equipment to meet your family's needs an oversized air conditioner unit will waste energy.

• If you have a furnace, replace it at the same time as your air conditioner system. Why? Because it is your furnace fan that blows cool air around your home, and a newer furnace fan provides improved air circulation all year round, plus saves energy costs.

## Computer / Laptop

• Buy a laptop instead of a desktop

• If you buy a desktop, get an LCD screen instead of an outdated CRT.

• Use sleep-mode when not in use helps cut energy costs by approx 40%

Turn off the monitor; this device alone uses more than half the system's energy.

• Screen savers save computer screens, not energy.

• Laser printers use more electricity than inkjet printers.

• There is a wrong notion that fan at more speed would consume more current.

• Fan running at slow speed would waste energy as heat in the regulator.

- The ordinary regulator would take 20 watts extra at low speed.
- The energy loss can be compensated by using electronic regulator.

## Insulate the ceiling/roof:

- They use two to 10 times less electricity for the same functionality, and are mostly higher quality products that last longer than the less efficient ones. In short, efficient appliances save you lots of energy and money.
- Efficiency rating are mandatory on most appliances. Look Energy Star label is used.
- The label gives you information on the annual electricity consumption.
- Average consumption of electric appliances in different regions in the world, compared with the high efficient models on the market.
- Educate everyone in the home, including children and domestic helpers.

## Pumps

- Operate pumping near best efficiency point.
- Modify pumping to minimize throttling.
- Adapt to wide load variation with variable speed drives or sequenced control of
- smaller offices.
- 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.

## 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.
- Demand efficiency restoration after motor rewinding.