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Date: 4th March 2021

# Certification

This is to certify that the **Tamil Nadu Physical Education & Sports University** has successfully completed **Energy, Environment and Green Audit** as per **NAAC criterion 7** located at Melakottaiyur, Chennai.

Audit Month: February 2021

Period of study: 2019-20 & 2020-21

N Pradeep Kumar

Associate Vice President – Certification, Tamil Nadu Region

# GREEN AUDIT REPORT

**For**

# TAMIL NADU PHYSICAL EDUCATION AND SPORTS UNIVERSITY

## Melakottaiyur, Chennai.


**By**

**TÜV INDIA PRIVATE LIMITED,**
**TÜV NORD GROUP**
**2nd floor, Dhun Building, 827,**
**Anna Salai, Mount Road, Chennai – 600 002**

**March 2021**

## ACKNOWLEDGEMENT

**TUV India Pvt Ltd** wishes to thank all the staff and Management of **Tamil Nadu Physical Education and Sports University (TNPESU),** Chennai Management & Technical Team for the kind cooperation and assistance extended to our Auditors during the course of the Green audit.

**Auditors**

S Prabhu Kiran

Prakash G

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# 1. EXECUTIVE SUMMARY

Green Audit of Tamil Nadu Physical Education and Sports University was carried out by TUV India Pvt Ltd team during Feb 2021.

The approach taken in this facility included different tools such as preparation of questionnaire, physical inspection of the campus, observation and review of the documentation, interviewing key persons and associated systems & equipment, including the electrical, lighting & AC systems, and operational & maintenance procedures. Sample measurements were taken using various instruments like ALM Power Analyzer, clamp meter, Infrared Thermometer, Lux meter, Humidity meter, $CO_2$ meter, etc. Operational Data were also collected from the past records. The study covered the following areas to summarize the present status of environment management in the campus:

- Water management
- Energy Conservation
- Waste management
- Green area management

The report accounts for the energy consumption patterns of the Tamil Nadu Physical Education and Sports University based on actual assessment. The report compiles a list of possible actions to conserve and efficiently access the available scarce resources and their saving potential was also identified.

The overall annual energy consumption is 21,82,442 kWh/annum. The annual greenhouse gas emissions equivalent for electricity is **1855 tons of $CO_2$** (0.85kg of $CO_2$ emits /kWh of unit generation).

Total Global Warming Impact in CO2 Equivalent

| S.No | GHG source | Tonnes of CO2 Equivalent |
|---|---|---|
| 1 | Road Transport | 1.77 |
| 2 | Electricity | 1855 |
| 3 | HVAC System | 1.2 |
| 4 | DG Operation | 2.24 |
| **Total GHG Emission** | | **1860.21** |

Overall 31% **i.e. 6,77.081.6 kWh** unit's savings identified on above mentioned categories with average payback of **53 months** and reduced annual greenhouse gas emissions equivalent to **575.5 tons of $CO_2$.**

## 2. List of Performance Improvement Measures at Tamil Nadu Physical Education and Sport University, Chennai.

| S No | ECM Description | Annual Energy savings kWh | Annual savings, Lacs. | Cost of Measure, Lac. | Payback Months |
|---|---|---|---|---|---|
| 1 | PIM 1: Water saving through the efficient dual flush water closet | 1281.6 L/Annum | 0.11 | 0.05 | 6 |
| 2 | PIM 2: Tube light lamps to be changed with appropriate LED lamps to reduce power consumption | 2520 | 0.25 | 0.5 | 24 |
| 3 | PIM 3: Replacing old celling fan to Super fans | 16,128 | 1.64 | 4.8 | 35 |
| 4 | PIM 4: Install Solar PV in roof top to reduce overall power consumption | 6,57,100 | 67 | 300 | 53 |
| **Total** | | **6,77,081.6** | **69** | **305.35** | **53** |

## 3. PROJECT BACKGROUND

The Tamil Nadu Physical Education and Sports University (TNPESU) is India's first state university for Physical Education and Sports located at Melakottaiyur, Chennai. It was established by an Act of the Government of Tamil Nadu in 2004. The University is UGC approved and offers regular and distance learning UG, PG, Diploma, Certificate and PG Diploma programmes in the fields of Physical Education, Yoga, Exercise Physiology, Bio-Mechanics, Sports Management, Sports Psychology and Sociology, Advanced Sports Training and Sports Technology. Tamil Nadu Physical Education and Sports University has a "B++" grade accreditation by the National Assessment and Accreditation Council [NAAC]. Tamil Nadu Physical Education and Sports University has an area of 125 acres which is spread in the outer of Chennai city.

**Tamil Nadu Physical Education and Sport University major facilities: -**

- Indoor & Outdoor stadium
- Health Centre
- Food Court
- Recreational Center
- Sports Pavilion and Gymnasium

## 4. GREEN AUDIT

The main objective of the green audit is to promote the Environment Management and Conservation in the College Campus. The purpose of the audit is to identify, quantify, describe and prioritize framework of Environment Sustainability in compliance with the applicable regulations, policies and standards.

The main objectives of carrying out Green Audit are:

- To introduce and aware students to real concerns of environment and its sustainability
- To secure the environment and cut down the threats posed to human health by analyzing the pattern and extent of resource use on the campus.
- To establish a baseline data to assess future sustainability by avoiding the interruptions in environment that are more difficult to handle and their corrections requires high cost.

Green Audit also includes the preliminary analysis and more detailed energy calculations-financial analysis of proposed Performance Improvement Measures (PIM). The financial analysis provides the facility team the understanding of the financial benefits in implementing specific Performance Improvement Measures. Utility bills were collected for three months' period to allow the auditor to evaluate the facility's energy/demand rate structures and energy usage profiles. A detailed financial analysis is performed for each measure based on implementation cost estimates; site-specific operating cost savings, and the customer's investment criteria. Sufficient detail is provided to justify project implementation.

## 5. ELECTRICAL SYSTEM

The electrical power is availed from Telangana Southern Power Distribution Company Limited (TSSPDCL). The power is distributed through LT panel located in the Facility Area. The power is distributed to the college through transformer of loading position 11KV/433V, 315kVA distribution transformer.

There is 1 No. of 45 kVA & 1 Nos. of 160 kVA DG set for the backup to handle any grid power interruption.

HT 11/433V

TR#1 315kVA

DG-1
63 kVA

- Administrative Block
- Academic Block
- Gents Hostel
- Ladies Hostel
- Gents Mess Hall
- Ladies Mess Hall
- Electric Panel Room 1
- Electric Panel Room 2
- Vice Chancellors Quarters
- Registrars Quarters
- Assistant Professors Quarters
- Office Assistants Quarters
- Indoor Stadium
- Sports Hostel

## 5.1 ELECTRICAL BILL ANALYSIS

The Energy bill data were analyzed from Jan 2020 to Dec 2020, the total electricity bill for the year 2020 is Rs.21,82,442 and energy unit consumption is 2,19,190 kWh.

| Month | Energy Consumption kWh | Energy Cost Rs | Unit Cost Rs/kWh |
|---|---|---|---|
| Jan-20 | 29,630 | 2,54,219 | 8.58 |
| Feb-20 | 23,147 | 2,13,051 | 9.20 |
| Mar-20 | 21,979 | 2,05,635 | 9.36 |
| Apr-20 | 11,098 | 1,36,540 | 12.30 |
| May-20 | 14,638 | 1,59,019 | 10.86 |
| Jun-20 | 14,800 | 1,60,048 | 10.81 |
| Jul-20 | 13,937 | 1,54,568 | 11.09 |
| Aug-20 | 16,138 | 1,68,544 | 10.44 |
| Sep-20 | 18,948 | 1,84,108 | 9.72 |
| Oct-20 | 18,974 | 1,86,603 | 9.83 |
| Nov-20 | 15,920 | 1,67,160 | 10.50 |
| Dec-20 | 19,981 | 1,92,947 | 9.66 |
| **Total** | **219,190** | **21,82,442** | **10.20** |

***Table: Energy Bill Analysis Jan'20 to Dec'20***

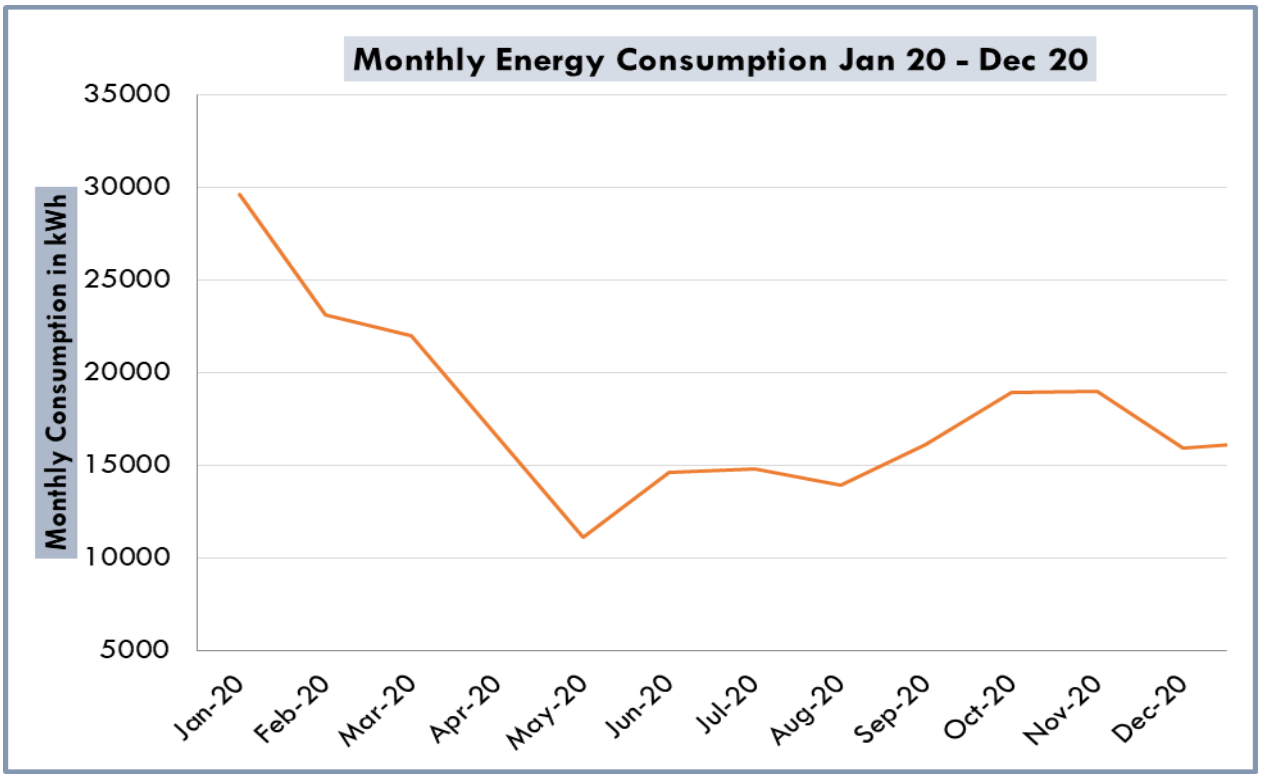


*Chart: kWh Consumption analysis – During Jan 2020 energy consumption is high*

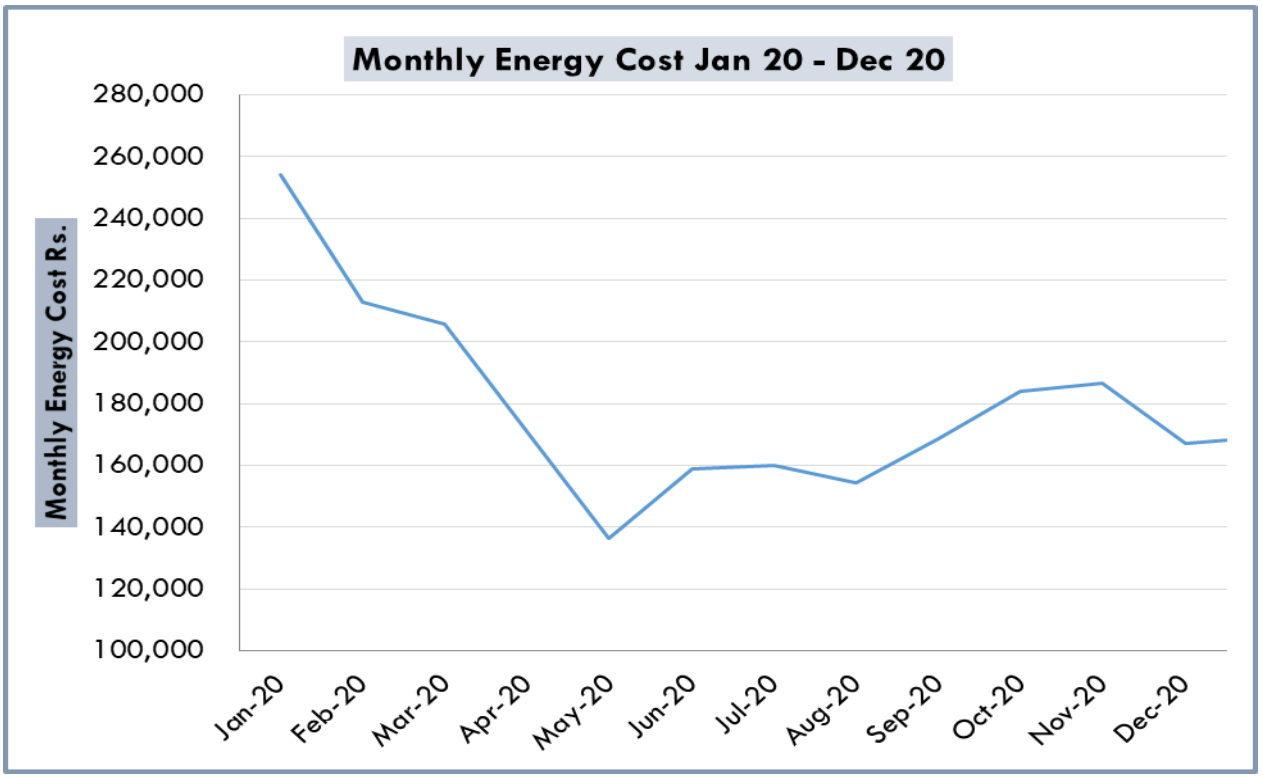

*Chart: Monthly Energy Cost Analysis – During Jan 2020 energy cost is high*

## 5.2 Unit Cost Analysis

The Energy bill data from Jan 2020 to Dec 2020 were analyzed. Per unit cost for the period of study was calculated to be Rs 10.20/kWh.

| Month | Energy Consumption kWh | Energy Cost Rs | Unit Cost Rs/kWh |
|---|---|---|---|
| Jan-20 | 29,630 | 2,54,219 | 8.58 |
| Feb-20 | 23,147 | 2,13,051 | 9.20 |
| Mar-20 | 21,979 | 2,05,635 | 9.36 |
| Apr-20 | 11,098 | 1,36,540 | 12.30 |
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| **Total** | **219,190** | **21,82,442** | **10.20** |

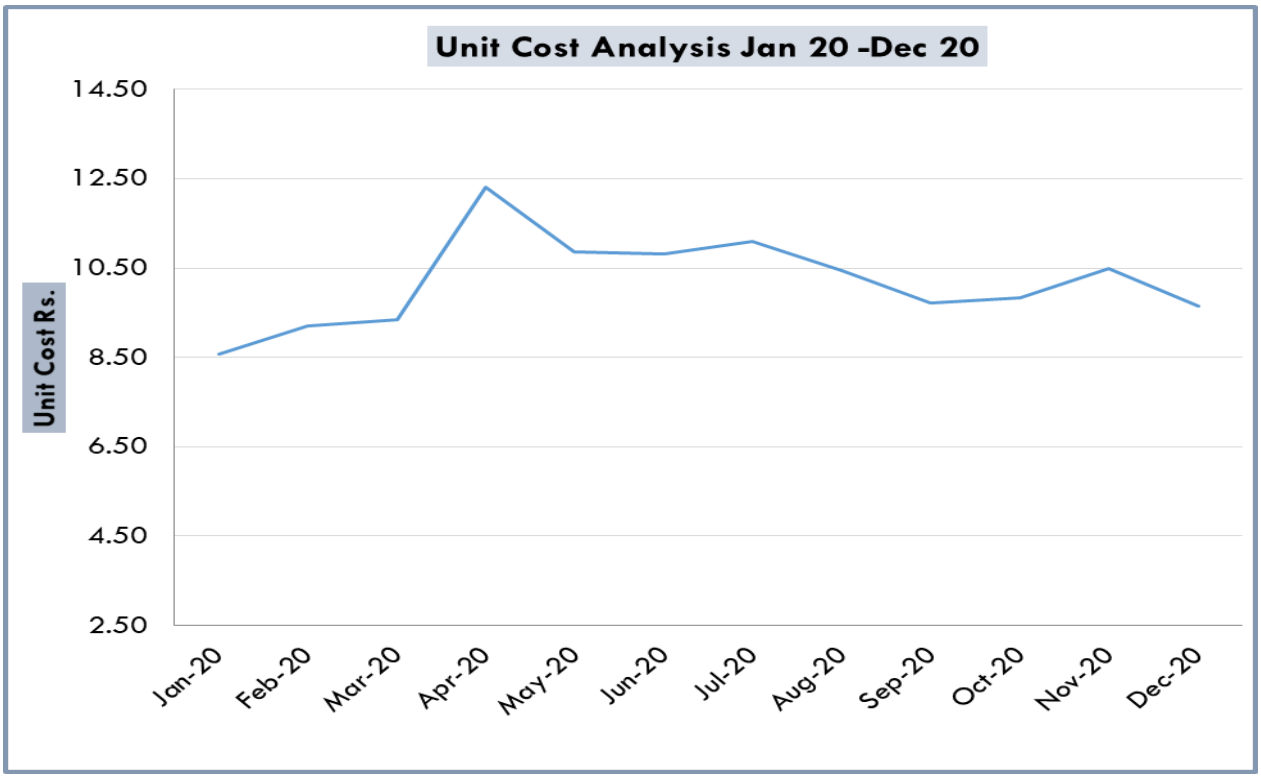



***Chart: Monthly Unit Cost – During Apr 2020 Unit Cost Rate is high.***

## 5.3 LIGHTING ANALYSIS

Good lighting is necessary to enable work to be done well and in comfort. A facility with bad lighting is an inefficient one, though it may look attractive. Poor lighting can be combated by good eyesight and by keenness on work but at the eventual expenses of efficiency, wellbeing and comfort. Hence, the designer of the building should pay sufficient attention to the need for good lighting.

The lighting details of the facility were studied. The various type of light fitting used are 15W LED, 20W LED, 30W LED & 36W TL lamps.

## 5.4 LIGHTING ANALYSIS

| S. No | Description | LUX Level | Baseline Lux Level as per NBC | Remarks |
|---|---|---|---|---|
| 1 | Principal Room | 170, 195, 210, 280,324 | 300 | Ok |
| 2 | Library Hall | 200, 260, 230, 162,290,332 | 300 | Ok |
| 3 | Auditorium | 117, 135, 180, 190, 210, 340 | 300 | Ok |
| 4 | Server Room | 120, 140, 280,320 | 200 | Ok |
| 5 | Gents Mess Hall | 210,280,320,440 | 200 | Ok |
| 6 | Ladies Mess Hall | 230,260,310,460 | 200 | Ok |
| 7 | Gents Hostel Room | 210,280,260,320 | 50 | Ok |
| 8 | Ladies Hostel Room | 265, 285, 330 | 50 | Ok |
| 11 | Lecture Hall 1 | 250,320,380 | 300 | Ok |
| 12 | Lecture Hall 2 | 230,260,340 | 300 | Ok |
| 13 | Lecture Hall 3 | 220,250,330 | 300 | Ok |
| 14 | Lecture Hall 4 | 250,275,315 | 300 | Ok |
| 15 | Lecture Hall 5 | 235,285,350 | 300 | Ok |
| 16 | Lecture Hall 6 | 270,290,340 | 300 | Ok |

**Comments:**

Lux level is measured during day light availability and it is very good level compared to NBC standards.

## 5.5 LIGHTING POWER DENSITY

| S No | Description | Fixture Details | Fixture Wattage | No. of fixtures | Total Wattage | Area Sq.ft | Actual LPD W/sq.ft | ASHRAE LPD W/sq.ft |
|---|---|---|---|---|---|---|---|---|
| 1 | Gents Mess Hall | 36 W TL | 36 | 15 | 540 | 2064 | 0.26 | 1.21 |
| 2 | Ladies Mess Hall | 36 W TL | 36 | 15 | 540 | 1160 | 0.47 | 1.21 |
| 3 | Library Reading Hall | 36 W TL | 36 | 48 | 1728 | 2760 | 0.63 | 0.93 |
| 4 | Ladies Hostel room 1 | 36 W TL | 36 | 15 | 540 | 1456 | 0.37 | 1.21 |
| 5 | Ladies Hostel room 2 | 36 W TL | 36 | 15 | 540 | 1456 | 0.37 | 1.21 |
| 6 | Ladies Hostel room 3 | 36 W TL | 36 | 15 | 540 | 1456 | 0.37 | 1.21 |
| 7 | Gents Hostel Room 1 | 36 W TL | 36 | 15 | 540 | 1456 | 0.37 | 1.21 |
| 8 | Gents Hostel Room 2 | 36 W TL | 36 | 15 | 540 | 1456 | 0.37 | 1.21 |
| 9 | Gents Hostel Room 3 | 36 W TL | 36 | 15 | 540 | 1456 | 0.37 | 1.21 |
| 10 | Class Room G15 | 20 W LED | 20 | 12 | 240 | 520 | 0.46 | 1.24 |
| 11 | Class Room G16 | 20 W LED | 20 | 12 | 240 | 520 | 0.46 | 1.24 |
| 12 | Class Room G17 | 20 W LED | 20 | 12 | 240 | 520 | 0.46 | 1.24 |
| 13 | Class Room G18 | 20 W LED | 20 | 12 | 240 | 520 | 0.46 | 1.24 |
| 14 | Academic Block Lobby 1 | 36 W TL | 36 | 4 | 144 | 220 | 0.65 | 0.9 |
| 15 | Academic Block Lobby 2 | 36 W TL | 36 | 4 | 144 | 220 | 0.65 | 0.9 |
| 16 | Admin Block Lobby | 36 W TL | 36 | 2 | 72 | 140 | 0.51 | 0.9 |

**Comments:**

LPD is within in the ASHRAE limit. We recommended to replace the 36 W TL to 20 W LED for better energy savings.

# 6. HEATING VENTILATING & AIR CONDITIONING (HVAC)

In College campus for human thermal comfort, sum of 152 TR capacities of split units installed, in Library computer lab, Admin Block and Academic Block are installed in the campus to meet the cooling requirement. Along with this, for ventilation in the facility, ceiling and exhaust fans are installed.

## 6.1 PERFORMANCE ANALYSIS OF SPLIT UNITS

| **Admin Block Server Room AC 1** | | |
|---|---|---|
| **Description** | **Name Plate Details** | |
| Make | Voltas | |
| Motor Power, kW | 1.77 | |
| Rated Current, A | 7.9 | |
| Refrigerant & Charge | R-22, 1.13 kg | |
| Capacity, TR | 2 | |
| Star Rated | 5 Star | |
| Inside Air Flow, CMH | 1080 | |
| **Performance Analysis** | | |
| **Description** | **Actual** | **Units** |
| Motor running current | 5.8 | A |
| Voltage | 227.2 | V |
| PF | 0.91 | |
| Motor power | 1.51 | kW |
| Supply air quantity | 110 | CFM |
| Supply air temperature | 19.3 | °C |
| Relative humidity | 62 | % |
| Return air temperature | 21.8 | °C |
| $CO_2$ Level | 765 | PPM |

**Comments:**

Power consumption is within the design limit and $CO_2$ level is within limits.

| Admin Block Server Room AC 2 | | |
|---|---|---|
| **Description** | **Name Plate Details** | |
| Make | Voltas | |
| Motor Power, kW | 1.77 | |
| Rated Current, A | 7.9 | |
| Refrigerant & Charge | R-22, 1.13 kg | |
| Capacity, TR | 2 | |
| Star Rated | 5 Star | |
| Inside Air Flow, CMH | 1080 | |
| **Performance Analysis** | | |
| **Description** | **Actual** | **Units** |
| Motor running current | 5.6 | A |
| Voltage | 221.9 | V |
| PF | 0.9 | |
| Motor power | 1.48 | kW |
| Supply air quantity | 105 | CFM |
| Supply air temperature | 21.1 | °C |
| Relative humidity | 61 | % |
| Return air temperature | 22.7 | °C |
| $CO_2$ Level | 756 | PPM |

**Comments:**

Power consumption is within the design limit and $CO_2$ level is within limits.

| Academic Block Health Care Room AC 1 | | |
|---|---|---|
| **Description** | **Name Plate Details** | |
| Make | LLOYD | |
| Motor Power, kW | 1.59 | |
| Rated Current, A | 7.0 | |
| Refrigerant & Charge | R-22, 1.08 kg | |
| Capacity, TR | 1.5 | |
| Star Rated | 3 Star | |
| **Performance Analysis** | | |
| **Description** | **Actual** | **Units** |
| Motor running current | 6.7 | A |
| Voltage | 223.7 | V |
| PF | 0.9 | |
| Motor power | 1.5 | kW |
| Supply air quantity | 96 | CFM |
| Supply air temperature | 21.5 | °C |
| Relative humidity | 65 | % |
| Return air temperature | 22.9 | °C |
| $CO_2$ Level | 670 | PPM |

**Comments:**

Power consumption is within the design limit and $CO_2$ level is within limits.

## 6.2 INDOOR AIR QUALITY

Indoor air quality (IAQ) is a term which refers to the air quality within and around buildings and structures, especially as it relates to the health and comfort of building occupants. IAQ can be affected by various gases, volatile organic compounds etc. Source control, filtration and the use of ventilation to dilute contaminants are the primary methods for improving indoor air quality in most buildings. Determination of IAQ involves the collection of air samples at various locations of the building.

During the course of audit, the Indoor air quality survey was carried out at various locations in the building.

| S.No | Area | Temperature | $CO_2$ ppm | Relative Humidity % |
|---|---|---|---|---|
| 1 | Auditorium | 21.6 | 640 | 61 |
| 2 | Library Computer Lab - 1 | 23.4 | 810 | 60 |
| 3 | Health Care room | 20.8 | 670 | 65 |
| 4 | Admin Block Server room | 19.9 | 765 | 61 |

**Comments:**

On an overall observation, the occupant comfort temperature shall be maintained at 24◦C, & Humidity needs to be maintained at < 60%. CO2 level is good.

# 7 WATER

Drinking Water for the entire college is taken from quarry and it treated by proper RO system. RO water system are installed in each block to meet the drinking water requirement. For flushing, irrigation and cleaning purpose water is taken from the same quarry, water is pumped to the raw water sump then the OHT at terrace levels.

## 7.1 PERFORMANCE ANALYSIS OF WATER FAUCETS

Water flow is measured in faucets of College toilets wash basin, urinals & water closets.

| S. No. | Description | NBC Baseline (LPM) | Actual (LPM) |
|---|---|---|---|
| 1 | First floor gents toilet wash basin 1 | 1.5 | 7.1 |
| 2 | First floor gents toilet wash basin 2 | 1.5 | 6.8 |
| 3 | Ground Floor ladies toilet tap 1 | 3 | 17.0 |
| 4 | Ground Floor ladies toilet tap 2 | 3 | 18.9 |
| 5 | Wash basin tap 1 | 1.5 | 11.0 |
| 6 | Wash basin tap 2 | 1.5 | 13.0 |
| 7 | Water Closets | 6 | 6.0 |
| 8 | Academic Block first floor Wash basin tap 1 | 1.5 | 7.5 |
| 9 | Academic Block first floor water closet 1 | 6 | 6.0 |
| 10 | Academic Block first floor water closet 2 | 6 | 6.0 |
| 11 | Admin Block ground floor Wash basin tap 1 | 1.5 | 5.5 |
| 12 | Admin Block ground floor water closet 1 | 6 | 6.0 |

***Comments: Water flow in the faucets and tap are high in above highlighted area comparing to the NBC standard. The baseline standards are as per the NBC 2016 part no: 9 section 1 table – 2.***

## 7.2 PERFORMANCE ANALYSIS OF DOMESTIC WATER PUMPS

**Water Pump-1**

| Description | Bore Well Water Pump -1 |
|---|---|
| Installed motor power, kW | 3.75 |
| No. of Phase | 3 |
| **Description** | **Readings** |
| Voltage, V | 404.8 |
| Current, A | 4.8 |
| Power Factor, PF | 0.943 |
| Power consumption, kW | 3.17 |

**Comments:**

Power consumption is within the design limit. Water meter shall be installed in outlet of the quarry motor pipe to measure the water consumption from the quarry and consumption in each block. Quarry water Consumption Record shall be maintained on daily, monthly basis to arrive at the water balancing.

**Sump Water Pump-1**

| Description | Sump Water Pump -1 |
|---|---|
| Make | C R I |
| Capacity, $m^3/hr$ | 9 |
| Motor current, A | 3.0 |
| Motor RPM | 2880 |
| Installed motor power, kW | 1.1 |
| Head, m | 32 |
| **Description** | **Readings** |
| Voltage, V | 421 |
| Current, A | 2.1 |
| Power Factor, PF | 0.787 |
| Power consumption, kW | 0.9 |

**Comments:**

Power consumption is within the design limit. Water meter shall be installed at the overhead tank outlet to measure the water consumption from the terrace tank. Water Consumption Record shall be maintained on daily, monthly basis to arrive at the Water balancing.

**Sump Water Pump -2**

| Description | Sump Water Pump -1 |
|---|---|
| Make | C R I |
| Capacity, $m^3/hr$ | 9 |
| Motor current, A | 3.0 |
| Motor RPM | 2880 |
| Installed motor power, kW | 1.1 |
| Head, m | 32 |
| **Description** | **Readings** |
| Voltage, V | 421 |
| Current, A | 2.8 |
| Power Factor, PF | 0.823 |
| Power consumption, kW | 1.69 |

**Comments:**

Power consumption is within the design limit. Water meter shall be installed at the overhead tank outlet to measure the water consumption from the terrace tank. Water Consumption Record shall be maintained on daily, monthly basis to arrive at the Water balancing.

## 7.3 WATER NEUTRALITY

Presently quarry water is used to meet the entire buildings water requirement.

**Strategies for Water Neutrality: -**

a. **Low flow aerators.**

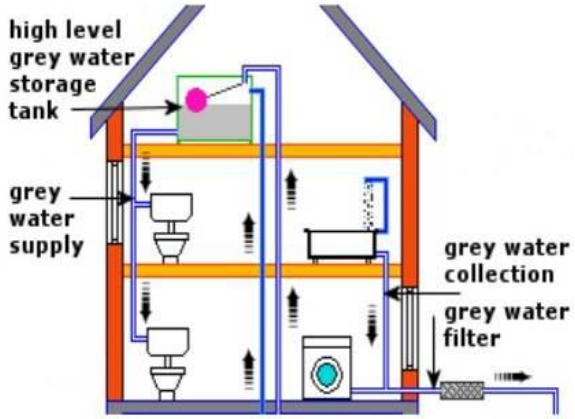
To reduce the fresh water consumption, by installing the aerators for faucets in all common area restrooms, landscape irrigation, canteen etc. This measure reduces the water consumption by 40% from the baseline of NBC.

**b. Sewage Treatment Plant**

To reduce the potable water consumption by installing the sewage treatment plant (STP). In the college campus 2 hostel blocks are there and totally per day water consumption is 120 KL per day. So the waste water generation will be around 120 KL per day. So the recommended STP plant size will be 120 KLD. This treated water will be used for landscape irrigation & toilet flushing purpose.

**c. Dual Plumbing System.**

To reduce the potable water consumption by installing the dual flush system (3/6 LPF). To further reduce the fresh water consumption, use the STP treated water as mentioned above.




**d. Native Plant Species.**

For landscape irrigation, fresh potable water is being used. To reduce water consumption for landscape, in some places drip irrigation method is being used. However, in some places hose pipe irrigation is being used and this result in more water consumption. It is recommended to install drip irrigation for all shrubs & tree type species and sprinkler irrigation for turf area. To reduce the water consumption by replacing the drought tolerant/xeriscape species.

## 7.4 WATER QUALITY ANALYSIS

In College campus, drinking water is taken from tanker lorry (Costly) and municipal corporation water. Normally, for drinking water daily consumption of lorry water - 8000 liters and municipal water - 250 liters, so totally 8250 liters per day is consumed. For landscape irrigation, floor cleaning & toilet flushing water is taken from two bore well and the total dissolved solid (TDS) level is given below.

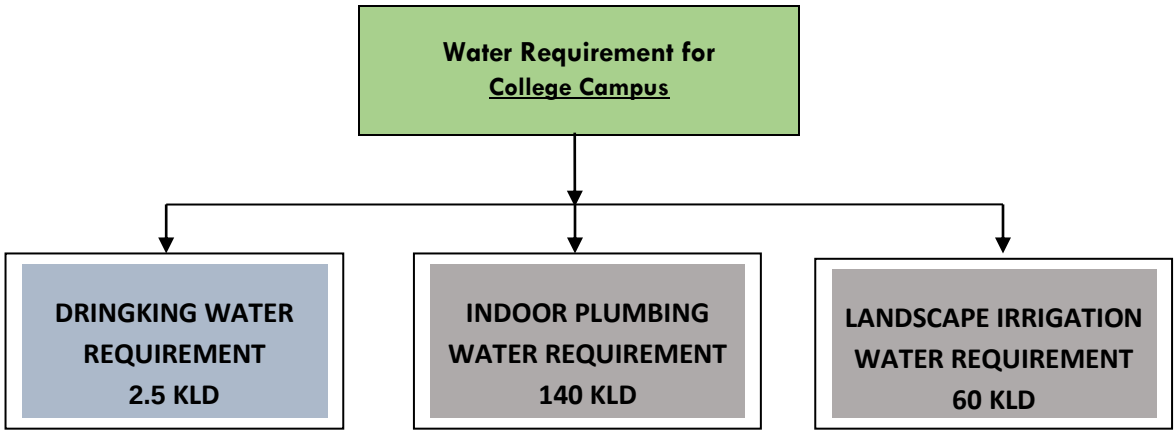
| Location | Water TDS level | Temperature in ° C |
|---|---|---|
| Quarry Water | 640 | 31.4 |
| Ground Floor Water Cooler | 260 | 27.6 |
| Second Floor Water Cooler | 253 | 25.6 |

**Comments:**

As per the WHO recommended drinking water TDS level is < 300. In our campus drinking water TDS level is within the limit. For quarry, water treatment system is required to reduce the TDS level.

## 7.5 WATER BALANCE CHART

Source of drinking water is from the quarry water, to underground reservoir, it is transferred to Overhead tank and supplying the water with the help RO systems. And same quarry water is in usage to meet the landscape irrigation, cleaning & toilet purpose. There is no sewage plant installed in this plant, sewage is connected through the municipal sewerage line.




## 7.6 RAINWATER HARVESTING SYSTEM

In college campus rainwater is collected and recharge the ground with the help of a quarry water reservoir and Melakottaiyur Lake and the lake and reservoir is located near to the college campus. Rainwater trenches are built according to the slope of the surface level and it connect the roof and non-roof rainwater to rainwater harvesting system.


## 8 WASTE MANAGEMENT SYSTEM

In college campus, separate dry waste and wet waste type of waste collection bins are provided for collection of waste. All waste generated from the building operation was analyzed. A waste audit was performed on 28/02/2021 at Tamil Nadu Physical Education and Sports University, Chennai to identify opportunities to divert waste streams from landfills and to determine further source reduction opportunities.

**Waste Treatment:**

Different types of waste are collected from the hostel mess & other places are sent to Municipal. In the college campus is the common solid waste management center for segregation and effective management of waste generated in the college premises. The unit has specific sections where solid waste is segregated as 'wet' and 'dry'. The dry waste such as plastics, papers, cartons, e-waste and scrap are separated and sent to 'recycle vendor' for recycling. The organic waste such as dried leaves and kitchen refuse from the canteen are used for composting.

| Month | Cardboard Waste, Kg | Paper Waste, Kg | Plastic Waste, Kg | Bottle Kg | Total Waste, Kg |
|---|---|---|---|---|---|
| **Mar-19** | - | 338 | - | - | **338** |
| **Apr-19** | - | 338 | - | - | **338** |
| **May-19** | - | 2082 | - | - | **2082** |
| **Jun-19** | - | 1106 | - | - | **1106** |
| **Sep-19** | 133 | 6697 | 108 | 16 | **6954** |

| | | | | | |
|---|---|---|---|---|---|
| **Oct-19** | 42 | 3651 | 71 | 20 | **3784** |
| **Nov-19** | 57 | 108 | 29 | - | **194** |
| **Dec-19** | 131 | 87 | 92 | 30 | **340** |
| **Jan-20** | 133 | 19 | 41 | - | **193** |
| **Feb-20** | 90 | 164 | 99 | 54 | **407** |
| **Mar-20** | 27 | 61 | 46 | - | **134** |
| **Jan-21** | 41 | 7 | 105 | - | **153** |
| **Feb-21** | 3802 | 3070 | 126 | 9 | **7007** |

**Waste Audit Procedure:**

- Waste auditing was carried out by sorting and measuring the building's waste over a given time period, i.e. 24 hours' time. And Audit team selected a time period of 16th Feb 2021.
- The Audit Team was equipped with all necessary safety and personal protective devices including safety glasses, respirator masks, coveralls and gloves.
- The Audit team has taken the waste audit form and marked the following types:
    - Papers
    - Tissue paper
    - Pet bottles
    - Plastic covers
    - Printed hard paper
    - Food waste
- Each waste type was separated and measured for the weight through a weighing scale. The values were entered in the waste audit form and compared against the total weight of all wastes.

# 9 GREEN HOUSE GAS EMISSION

Climate change resulting from human activities is now recognised as one of the most pressing environmental issues facing the world's population. In addressing this problem, governments, the international community and industry are moving to control emissions of greenhouse gases (GHGs), setting targets such as those agreed at the Kyoto Conference in 1997. These moves will continue in the future and, inevitably, businesses and other organizations will increasingly have to account for and report on GHG emissions.

In the college campus total occupants is 847 (approx..) and 367 students are stay in the college hostel and we consider the total travel distance per day is 20 km(approx..) and GHG emission for per kilo meter is 0.000185 $tCO_2$ / Km. So per day $CO_2$ emission level is 1.77 $tCO_2$ for travelling. The total energy unit consumption is 21,82,442 kWh per year and CO2 emission factor for electricity is 0.85. It is equivalent to 1855 tons of CO2. For HVAC system installed capacity is 152 TR and charged refrigerant quantity is 60.5 GWP tons and standard refrigerant gas leakage is 2%, It is equivalent to 1.2 tons of CO2. For Diesel operated 63 KVA DG is installed in site and one-year fuel consumption is 839 liters and CO2 emission factor for diesel is 0.00268 tCO2/liter. So one year CO2 emission from DG is 2.24 tCO2.

Total Global Warming Impact in CO2 Equivalent

| S No | GHG source | Tonnes of CO2 Equivalent |
|---|---|---|
| 1 | Road Transport | 1.77 |
| 2 | Electricity | 1855 |
| 3 | HVAC System | 1.2 |
| 4 | DG Operation | 2.24 |
| **Total GHG Emission** | | **1860.21** |

## 10 SITE OBSERVATION REPORT

| Site Observation Report (SOR) | | | |
|---|---|---|---|
| **Report No.** | C&A/SOR/01 | **Date** | 28.02.2021 |
| **Location** | College Campus | | |
| **Observation Images** | | | |


| **Description** |
|---|
| Treated drinking water is provided for the whole campus. |
| **Potential Sustainability Measures** |
| Purified drinking water dispenser is kept at each floor level. |

| Site Observation Report (SOR) | | | |
|---|---|---|---|
| **Report No.** | C&A/SOR/02 | **Date** | 28.02.2021 |
| **Location** | Hostel Mess | | |

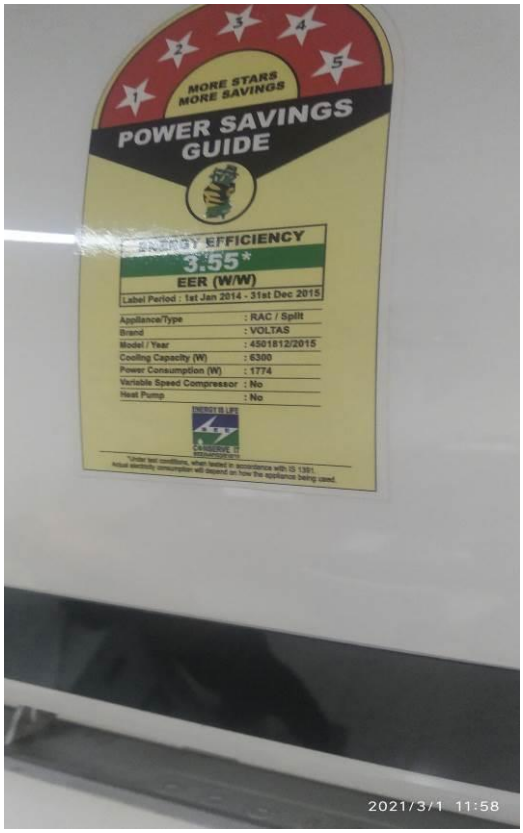
**Observation Images**


**Description**

In hostel canteen 20 m3 bio gas plant is installed.

| |
|---|
| **Potential Sustainability Measures** |
| It is recommended to use the cattle dung use in the bio gas plant. |

| **Site Observation Report (SOR)** | | | |
|---|---|---|---|
| **Report No.** | C&A/SOR/03 | **Date** | 28.02.2021 |
| **Location** | HVAC System | | |
| **Observation Images** | | | |



| Description |
|---|
| High Efficient AC System. |

| Potential Sustainability Measures |
|---|
| It reduces the power consumption and it is highly efficient. |

| Site Observation Report (SOR) | | | |
|---|---|---|---|
| **Report No.** | C&A/SOR/04 | **Date** | 28.02.2021 |
| **Location** | Dust Bin | | |

**Observation Images**

| Description |
|---|
| Different type waste collection bins are kept for the collection of waste. |

| Potential Sustainability Measures |
|---|
| This measure helps in reducing the segregation of waste at source. |

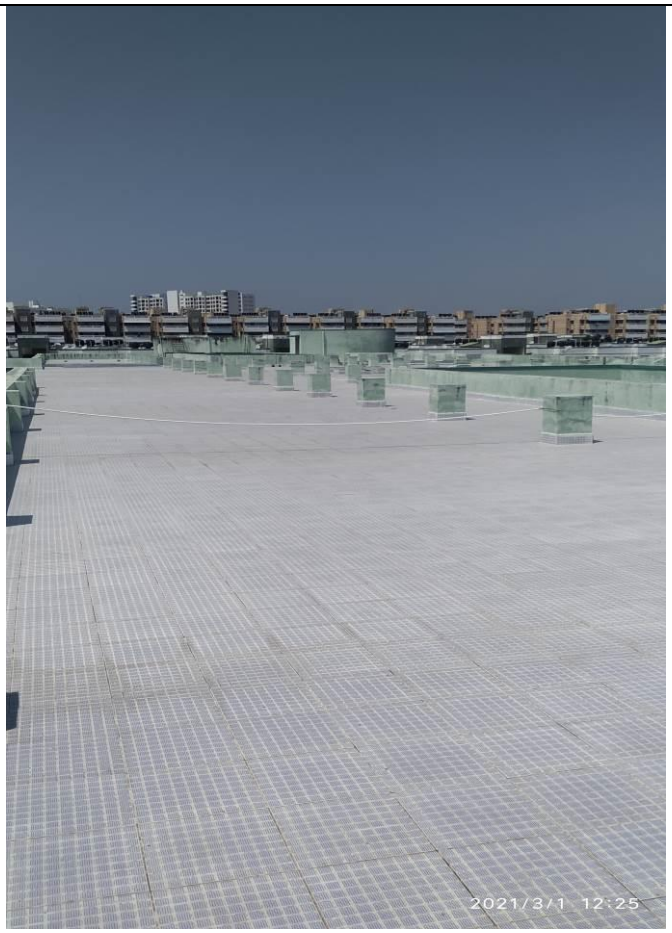
| Site Observation Report (SOR) | | | |
|---|---|---|---|
| **Report No.** | C&A/SOR/05 | **Date** | 28.02.2021 |
| **Location** | Hostel Mess | | |

**Observation Images**


| Description |
|---|

| |
|---|
| Good ventilation and Day light is available in the hostel mess |
| **Potential Sustainability Measures** |
| In the hostel mess good daylight and ventilation are available, it gives good atmosphere to the students have their food. |

| **Site Observation Report (SOR)** | | | |
|---|---|---|---|
| **Report No.** | C&A/SOR/06 | **Date** | 28.02.2021 |
| **Location** | Academic Block Terrace | | |
| **Observation Images** | | | |
| | | | |




| Description |
| --- |
| Cooling tiles are installed in the academic block terrace area |

| Potential Sustainability Measures |
| --- |
| This helps in reducing the HVAC consumptions and maintain the good thermal comfort. |

| Site Observation Report (SOR) | | | |
| --- | --- | --- | --- |
| **Report No.** | C&A/SOR/07 | **Date** | 28.02.2021 |

| | |
|---|---|
| **Location** | Rest Room |
| **Observation Images** | |


| |
|---|
| **Description** |
| In rest rooms water urinals are installed. |
| **Potential Sustainability Measures** |
| To reduce water consumption, these urinals shall be replaced with Water less urinals. |

| **Site Observation Report (SOR)** | | | |
|---|---|---|---|
| **Report No.** | C&A/SOR/08 | **Date** | 28.02.2021 |

| Location | Roof Top Solar PV |
|---|---|

**Observation Images**

**Description**

Work Order is released for Roof top solar PV.

**Potential Sustainability Measures**

20kVA solar photovoltaic energy plant is going to install in the roof top and it is connecting with net metering.

# 11 PERFORMANCE IMPROVEMENT MEASURES (PIM'S)

### PIM 1: Water saving through the efficient dual flush water closet

| | |
|---|---|
| Annual Water Savings | 1281.6 L/annum |
| Recurring Annual Savings Potential | Rs. 0.11 Lakhs |
| One-time Cost of Implementation | Rs.0.05 Lakhs |
| Payback period | 6 Months |

**Present System:**

Presently average water flow in the faucets is 8 LPM it is high compared to the NBC Standards. This leads to lot of water consumption.

**Proposed System:**

It is recommended to install low flow aerator based faucets in the flow rate of 2.4 LPM as per the standards in common/lavatory rooms. This saves huge of water consumption.

| Description | Value | Units | Formula |
|---|---|---|---|
| Average measured flow | 8 | LPM | A |
| Average usage per day | 60 | min/day | B |
| No of taps | 60 | Nos. | C |
| Annual water consumption | 8,640 | KL/yr | D =(AxBxCx300)/1000 |
| Water consumption cost (Approx..) | 9 | Rs/KL | E |
| Present Water Consumption cost | 77,760 | Rs/Yr | F=ExD |
| After installing aerators 70% water reduction | 2.4 | LPM | G |
| Annual water Savings | 7358.4 | KL/yr | H =((A-G)xBxCx365))/1000 |
| Annual Saving, Rs | 0.11 | Lakhs | I=HxE |
| Investment, Rs | 0.05 | Lakhs | J |
| Payback period | 6 | Months | K=J/Ix12 |

## PIM 2: Tube light lamps to be changed with appropriate LED lamps to reduce power consumption

| | |
|---|---|
| Annual Energy Savings | 2520 kWh/annum |
| Recurring Annual Savings Potential | Rs. 0.25 Lacs |
| One-time Cost of Implementation | Rs. 0.5 Lacs |
| Payback period | 24 months |

### Present System

During the survey, it is observed that some class room and exterior lights are 36W tube lamps are installed with electronic/electromagnetic ballast. These lamps are outdated and power consumption is higher with low lumens output.

### Proposed System

It is recommended to replace 15W LED lamps. It gives more lumens and reduces power consumption.

| Description | Value | Units | Formula |
|---|---|---|---|
| Total power consumption in Exterior Lighting | 1 | kW | A |
| Present Annual Operating Hours | 4,200 | hrs | B |
| Present Annual Energy Consumption | 4,200 | kWh | C=AxB |
| Proposed Power consumption after installing LED lamps (considering 40% reduction) | 0.4 | kW | D = (A-(A*40%)) |
| Proposed Energy Consumption | 1680 | kWh | E=DxB |
| Proposed Energy savings in Units | 2520 | kWh | F=C-D |
| Power cost | 10.2 | Rs/kWh | G |
| Annual Power cost savings | 0.25 | Rs | H =FXG |
| One-time cost of implementation | 0.5 | Rs | I |
| Payback period | 24 | Months | J=I/H x12 |

## PIM 3: Replacing old celling fan to Super fans

| | |
|---|---|
| Annual Energy Savings | 16,128 kWh/annum |
| Recurring Annual Savings Potential | Rs. 1.64 Lakhs |
| One-time Cost of Implementation | Rs. 4.8 Lakhs |
| Payback period | 35 Months |

**Present System:**

Presently there is old model high energy consumption fans are installed at campus; it is consuming more energy.

**Proposed System:**

It is recommended to install super fans to reduce the power consumption and armature coil failure.

| Description | Value | Units | Formula |
|---|---|---|---|
| Annual Energy Consumption | 53760 | kWh/yr | A |
| Proposed Fan Annual Energy Consumption | 30 | % | B |
| Annual Energy Savings | 16128 | kWh/yr | C =BX10% |
| Unit power cost | 10.2 | Rs/kWh | D |
| Annual Cost Savings | 1.64 | Rs Lakhs | E |
| One time implementation cost | 4.8 | Rs lakhs | F |
| Payback | 35 | Months | G=F/E x 12 |

## PIM 4: Install Solar PV in roof top to reduce overall power consumption

| | |
|---|---|
| Annual Energy Savings | 657, 000 kWh/annum |
| Recurring Annual Savings Potential | Rs 67 Lakhs |
| One-time Cost of Implementation | Rs 300.0 Lakhs |
| Payback period | 53 Months |

**Present System:**

Presently TNEB power supply is catering to whole building facility, this leads the power consumption.

**Proposed System:**

To avoid the TNEB power consumption, this can be avoided by installing Solar PV on Roof Top

| Description | Value | Units | Formula |
|---|---|---|---|
| Area of the roof required for PV | 40000 | Sq.ft | A |
| Area required for 1 kW PV | 100 | sq.ft | B |
| Potential of PV panels | 400 | kW | C |
| Average Units generation per kW panel | 1,800.0 | kWh/day | E = C X 4.5 kWh |
| Annual Energy Generation | 657,000 | kWh | F = E X 365 |
| Unit power cost | 10.2 | Rs/kWh | G |
| Annual Cost Savings | 67 | Rs Lakhs | H |
| One time implementation | 300 | Rs lakhs | I |
| Payback | 53 | Months | J=I/H x 12 |

# 12 GOOD PRACTICES AT TAMIL NADU PHYSICAL EDUCATION & SPORTS UNIVERSITY CAMPUS

During Conserve's Audit, it is observed that M/s Tamil Nadu Physical Education and Sport University has already adopted the following Performance Improvement Measures in its facility;

## 12.1 LED Lights in Building facility

LED street light is installed in the college campus is a good replacement of Energy. It reduces the EB energy consumption.

## 12.2 Solar PV System

Solar PV is installed in the roof top of 20kW is a good replacement of Energy. It reduces the EB energy consumption.

## 12.3 Bio Gas

Food Waste is converted to bio gas; it is a good example of waste to Energy. It is reducing the hostel mess LPG consumption.

## 12.4 Green Campus

The college total site is 125 acers and more than 100 acer is complete green vegetation is retained.

## 12.5 Shuttle Service

College is operating a shuttle service for students and it is connecting Tambaram bus depot to college. It reduces the overall CO2 footprint to a great extent with avoiding individual transport.