Energy Audit Report of

Lokmanya Tilak Jankalyan Shikshan Sanstha's

Lokmanya Tilak College of Engineering

Sector-4, Vikas Nagar, Koparkhairane, Navi Mumbai

(Approved by AICTE, Affiliated to University of Mumbai, & Accredited by NAAC)

Prepared by

Senergy Consultants Pvt Ltd
Mumbai

March 2018

Index

SENERGY Consultants (P) Ltd
ISO 9001:2015

Ref: SCPL-CE-868-150318
Date: March 15, 2018

Certificate

This is to certify that Green Audit was carried out at Lokmanya Tilak Jankalyan Shikashan Sanstha's, Lokmanya Tilak College of Engineering, Sector 4, Vikas Nagar, Koparkhairane, Navi Mumbai 400709 during the month of March 2018.

The scope, coverage, findings and recommendations are submitted vide our report SCPL-PR-868-150318 dated March 15, 2018.

For **SENERGY CONSULTANTS PVT LTD**

Ravindra Datar
Accredited Energy Auditor – AEA 0161

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Ravindra Datar
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1. Introduction

1.1 Background of the study:

The fundamental purpose of the energy audit is not only to identify the potential saving areas but also to establish energy monitoring and control system to reap the gains on sustainable basis. It is with this purpose that Lokmanya Tilak College of Engineering (Navi Mumbai, Maharashtra) assigned M/s Senergy Consultant Private Limited, Mumbai to carry out Energy Audit of their campus.

This energy audit report presents the analysis of the data collected, observations made at the facility and is governed by the objectives, scope of work, methodology etc. discussed in the ensuing paragraphs.

Objective:

The basic objectives of the Energy Audit Study are to

- Identify key result areas for energy saving along with their broad Cost Benefit Analysis.
- Suggest energy monitoring and control mechanism to realize the savings on the sustainable basis.

Methodology:

Prior to start of the Audit session, submitted a list of data required along with the execution plan.

The visit was undertaken in the Second week of March 2018. The field training was given to the members about data collection. The team members were also trained in December 2017, about operation and handling of the instruments used in the energy auditing.

The prime objectives of these visits were:

- To hold discussions with key personnel, to understand Energy consumption pattern, to get acquainted with the efforts already put in for energy conservation
- To collect historic data regarding energy consumption and maintenance practices.
- To undertake requisite field trials and to make observation.

Instruments

The following instruments were utilized for measurement during the energy audit study.

1. Power meter
2. Hygro-temperature meter
3. Anemometers
4. AC power meter
5. Lux meter
6. Air Quality meter

Acknowledgment:

We wish to record our gratitude to the management of LTCE for awarding this assignment. We extend our thanks to the Principal Dr. Vivek Sunnapwar, and Vice Principal Dr. Subhash K shinde, for initiating the work. We are also thankful to the maintenance team for extending all possible help and co-operation from their side.

2. Executive Summary

Energy Audit was undertaken at Lokmanya Tilak Jankalyan Shikshan Sanstha's Lokmanya Tilak College of Engineering during the month of AY 2017-2018.The organization is very keen to optimize energy cost wherever possible, even though its contribution to overall operating cost is not very significant.

Major Potential:

The energy conservation potential has been identified in the following areas

Energy Saving Potential

Sr No	Description
1	Replacement of old air conditioners by energy efficient air conditioners
2	Replacing Tube lights (TL) by LED lights
3	Replacing the old fans by energy efficient fans
4	Replacing LCD computer displays by LED displays

3. Computers

3.1 Brief Description:

In the college, there are LED computers displays.

The consumption of LCD and LED monitors is 30W and 26W respectively. The LCD dispays to be replaced by LED dispays.

General Suggestions:

1. An efficient power management system may be incorporated to

a. Switch off the display if not in use.

b. Put the computer in Sleep mode / switching off the machines, if not used for prolonged period.

2. Optimize brightness of the screen.

3. Discourage use of screen savers, which has similar power consumption

4. Air Conditioning System

4.1 Brief Description:

Air conditioning system is basically provided to maintain comfortable ambience inside the premises by maintaining the temperature (and relative humidity, at times) at appropriate levels. The performance of human being is optimal at the temperature of 24 ± 2 ^{o}C and at relative humidity (RH) of 60 ± 5%.

The warmer and humid air from the premises is drawn and fed to the Air Conditioning System by a circulating fan. This air is chilled in an evaporator by vaporizing the refrigerant and is distributed throughout the conditioned area. The refrigerant is pressurized by a compressor and subsequently s cooled and condensed by an air cooled condenser. The compressor and condenser are placed in an outdoor unit, located on the external side of the premise. While the circulating fan and evaporator is placed in an indoor unit located inside the premises.

4.2 Performance Evaluation:

The Air Conditioning effect (TR) and specific power consumption can be computed as under

AC Effect (TR) = Air flow rate x Specific gravity of air x (Enthalpy of supply air - Enthalpy of return air) / 3000

Specific Power (kWh/TR) = Power Consumption / AC Effect

The performance of the various machines was evaluated, the details of which are as under.

The performance as well as chilling (or Air Conditioning) effect delivered by the air conditioner (represented as TR - Ton of Refrigeration) is computed by measuring

- Air Velocity along with the cross-sectional area of flow to determine flow rate and subsequently mass flow rate.
- Temperature and relative humidity of the air at the inlet of the evaporator coil to determine enthalpy of the air.
- Temperature and relative humidity of the air at the outlet of the evaporator coil to determine enthalpy of the air.
- Power drawn by the air conditioning unit

The chilling effect can be computed as under,

1. Flow Rate of Air (kg/hr)

= Average Air velocity (M/s) x Cross sectional area of the air flow (Sq M) X Specific gravity of air

2. Chilling or Air Conditioning Effect (TR)

= Air flow rate (kg/hr) x Enthalpy difference between the air at inlet and outlet of the evaporator coil (kJ/kg) / (4.18 x 3024)

3. Chilling or Air Conditioning Effect (kW)

= Air flow rate (kg/hr) x Enthalpy difference between the air at inlet and outlet of the evaporator coil (kJ/kg) / 3600

= 3.5112 x Chilling Effect (TR)

4. Specific Power Consumption (kWh/TR) =

Power consumption (kW) / Air Chilling Effect (TR)

Energy Efficiency Ratio - EER (W of cooling / W of input power)

= Power consumption (kW) / Air Chilling Effect (kW)

= 3.5112 / Specific Power consumption (kW/TR)

Performance improvement:

The specific power consumption of many of the air conditioning units is higher than the general norm of 1.2 KWH/TR or EER of around 3.0.

The saving potential works out to about 20% in the overall consumption of the air conditioners as can be seen from the table above.

The performance of air condition can deteriorate due to

- Lower suction pressure and consequently temperature due to constrains on the evaporator. Generally, 1 ^{o}C drop in condensing temperature increases the specific power consumption by 4 to 5%. The constraints on the evaporator include

o Clogging of the filters

o Choking of fins

o Damages to the fins

o Deposition of dust on the external surface of the coil

o Scaling on the internal or external surface of the coil

o Depositions inside the coil o Inadequate surface areas due to improper design

- Higher discharge pressure and consequently temperature due to constrains on the condenser. Generally, 1 ^{o}C rise in condensing temperature increases the specific power consumption by 3 to 4%. The constraints on the condenser include

o Clogging of the fins o Damages to the fins

o Deposition of dust on the external surface of the coil

o Scaling on the internal or external surface of the coil

o Depositions inside the coil o Inadequate surface areas due to improper design

- Deteriorations in the fan (for the indoor as well outdoor unit) performance

o Damages to the fan blade o Deposition of dust on the fan surface o Damages to bearings, shaft, etc.

o Inadequate capacity due to improper design

- Improper location of the outdoor unit

o Direct exposure to sunlight o Inaccessible to maintenance / servicing

o Restriction on cooling air circulation

- Improper quantity of refrigerant.
- Mechanical constrains on the refrigeration compressor

O Damages to bearings, shaft, etc.

O Increases in internal clearances

o Drop in volumetric efficiency

The working and non-working air conditioners are to be replaced by 5 STAR rated air conditioners.

Observations

The window air conditioners need to be replaced by energy efficient air conditioners.

The non-star rated air conditioners to be replaced by star rated air conditioners.

5. Illumination

5.1 Brief Description:

The detail list of light fitting is as under. Most fittings are with electronic ballast and at very few locations magnetic ballast fittings are used.

The failed tube lights are replaced by energy efficient tube lights.

Electronic Ballast:

The conventional ballast may be replaced with electronic ballast. The magnetic ballast generally consumes 15 W of power; while the electronic ballast consumes just about 3 W and delivers 10% more light output. However, these ballasts are usually tuned to save about 15 W of power while providing slightly lower light output (about 5%).

Thus, energy saving of over 30% can be realized by replacing conventional ballast by electronic ballast. The expected annual savings shall be around Rs 500/- per tube light; while the cost of installing a ballast shall be Rs 250/-

LED Lamps:

A 15 W LED lamp can provide similar illumination level to that of 36 W TFL. It is thus possible to save about 21 W of power by replacing a 36 W TFL (with conventional ballast) with 15 W LED (with electronic starter). Thus, energy saving of over 60% can be realized by replacing TFL with LED lamp.

6. Ceiling Fans

6.1 Brief Description:

Non energy efficient ceiling fans are fitted and found working. The rating is 45W. For comparison purpose 32W rating is considered.

6.2 Economics:

Replacing old fans with new energy efficient fans can be considered. These fans save energy while delivering similar air flows.

The cost of energy efficient fan is considered as Rs. 3000 per unit and consumption 32W.

The investment is high and the payback period is not much attractive in such cases.

7. Miscellaneous Consumers

7.1 Brief Description:

The other consumers include lifts, centrifugal pumps, machine tools in the work shop and machine shop, xerox machines, printers and computers.

The consumption measurement of above equipment was not possible due to unavoidable circumstances.

8. Renewable Energy

8.1 Solar Plant:

The Solar photovoltaic system has not been installed in the campus. It also saves the electricity consumption and government give subsidy for solar plant installation.

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SENERGY Consultants (P) Ltd
IAS ACCREDITED Management Systems Certification Body MSCB-119
ISO 9001:2015

Ref: SCPL-CE-868-200319
Date: March 20, 2019

Certificate

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4	Replacing LCD computer displays by LED displays
5	Installation of Roof top solar system

3. Computer System

3.1 Brief Description:

In the college, there are LED computers displays.

The consumption of LCD and LED monitors is 30W and 26W respectively. The LCD dispays to be replaced by LED dispays.

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The working and non-working air conditioners are to be replaced by 5 STAR rated air conditioners.

Observations

The window air conditioners need to be replaced by energy efficient air conditioners.

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5. Lighting System

5.1 Brief Description:

The detail list of light fitting is as under. Most fittings are with electronic ballast and at very few locations magnetic ballast fittings are used.

The failed tube lights are replaced by energy efficient tube lights.

Electronic Ballast:

The conventional ballast may be replaced with electronic ballast. The magnetic ballast generally consumes 15 W of power; while the electronic ballast consumes just about 3 W and delivers 10% more light output. However, these ballasts are usually tuned to save about 15 W of power while providing slightly lower light output (about 5%).

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8. Renewable Energy

Solar Plant:

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Report

On

Green, Energy & Environment Audit

For

Lokmanya Tilak College of Engineering
Navi Mumbai 400709

Prepared

By

Senergy Consultants Pvt Ltd
Navi Mumbai 400 088

March 2020

Helping You to Conserve Energy

Contents

SENERGY Consultants (P) Ltd
IAS ACCREDITED Management Systems Certification Body MSCB-119
ISO 9001:2015

Ref: SCPL-CE-868-030320
Date: March 3, 2020

Certificate

This is to certify that Green Audit was carried out at Lokmanya Tilak Jankalyan Shikashan Sanstha's, Lokmanya Tilak College of Engineering, Sector 4, Vikas Nagar, Koparkhairane, Navi Mumbai 400709 during the month of March 2020.

The scope, coverage, findings and recommendations are submitted vide our report SCPL-PR-868-030319 dated March 3, 2020.

For **SENERGY CONSULTANTS PVT LTD**

Ravindra Datar
Accredited Energy Auditor – AEA 0161

SENERGY Consultants (P) Ltd
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ISO 9001:2015

Ref: SCPL-CE-868-030320
Date: March 3, 2020

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Ravindra Datar
Accredited Energy Auditor – AEA 0161

I
Introduction

Green, Energy & Environment Audit was undertaken at Lokmanya Tilak College of Engineering (Navi Mumbai 400709) during the month of December 2021.

This Audit Report presents qualitative and quantitative data collection and observations made at the facility and is governed by the objectives, scope of work, methodology etc. discussed in the ensuing paragraphs.

Due to Covid-19 pandemic it was difficult to carry out detailed data collection, measurements. Therefore, the report is prepared based on the walk-in audit at the premises.

Team:

The team members of the audit study.

- Mr Ravindra Datar
- Mr Nitesh Kharche
- Mr Chirag Patel

Acknowledgment:

We wish to express our gratitude towards Principal Dr. Vivek Sunnapwar, and Vice Principal Dr. Subhash K shinde for having given us the opportunity for conducting the study and the support provided during the study.

We are also thankful to the entire team comprising of the following members for extending the necessary help and co-operation from their side.

- Dr Santosh D Dalvi (Associate Professor, LTCE).
- Mr. More (Facility Manager)
- Mr. Ghanshyam (Facility Supervisor)

II
Executive Summary

The premises were evaluated against the various criterions laid down by the National Assessment and Accreditation Council (NAAC). The major observations are.

Air Quality & Ventilation:

- The classrooms and other area are well ventilated to ensure proper air quality.
- The fans are appropriately installed to ensure proper air circulation.
- The outdoor and few indoor plants have also been provided to improve the environment.
- The air-conditioned rooms are provided with proper ventilation and fresh air.

Lighting System:

- The usage of natural light is optimized through well designed structure and windows.
- The light fittings are provided with high efficiency LED lamps.

Green Campus Initiative:

- The plastic usage is restricted inside the campus; the usage may be completely banned.
- The campus is surrounded with a lot of greenery, trees, and proper landscaping.
- The college has various committees to create awareness on Waste & E-waste management and other initiatives
- The student participation is encouraged in such activities through student clubs and groups.

Environment & Energy Initiative:

- Tree Plantation drive was undertaken by students and staff members.

Water Quality & Conservation:

- The water is supplied by the Municipal Corporation, which is a common practice in Mumbai, Thane & Navi Mumbai.
- Harvested rain water is used for gardening.
- Water purifiers & coolers are provided at individual floors and convenient locations.
- The distribution network and piping are more or less satisfactory and adequate.

Waste Management:

- College is looking at environmental issues very seriously and taking all possible steps towards sustainability.
- The waste is segregated and treated / handled accordingly.
- The canteen kitchen waste, garden waste and dry waste is disposed through Municipal System

Infrastructure usage:

- The on-campus movement is distributed with multiple entrances as well as staircases.
- There are ramps and lifts at key locations.
- A special assistance is provided to address the needs of differently abled persons.
- The fire extinguishers are provided at key areas.
- The draining system for washrooms is efficient and effective.
- There were no seepages observed in the building premises.

Green IT culture:

- The Energy efficient computers have been procured.
- The electronic communication is encouraged and practiced to minimize usage of papers.
- Most of the papers are reused for doubled sided printing to further minimize usage of paper.

Renewable Energy:

- The present Solar Photovoltaic System is functional and efficient with NET metering facility.

III
Electrical System

Air Conditioning Units:

The air conditioners are provided in the principal cabin, Office and Accounts dept, computer laboratories, HoD cabins, conference rooms, seminar halls and auditoriums.

Observations & Suggestions:

- Most of the Air Conditioners units are energy efficient with 3-star rating.
- The Air Conditioners are operated as required with manual control.
- The rooms are well ventilated and provided with fans at appropriate location for proper air circulation.
- The temperature is maintained at 23 to 25 ^{o}C, which is within the recommended values.

Lamps:

The LED's are fitted in the classrooms, laboratories.

Observations & Suggestions:

- Almost all the light fitting are provided with high efficiency LED lamps; the others being replaced shortly.
- The usage of natural light is optimized through well designed structure and windows.
- It is suggested to automate switching of lamps in the common areas and rest rooms with sensor based control.

Fans:

The ceiling fans are fitted in the classrooms, laboratories.

Observations & Suggestions:

- The fans may be progressively replaced with energy efficient BLDC fans, especially during replacements and new purchases.

Computers:

Almost all the computers are with energy efficient LCD / LED monitors.

The battery / power management system may be incorporated for more efficient operation.

General Observations & Suggestions:

- The rooms are well ventilated and provided with fans at appropriate location for proper air circulation.
- The gadgets are services properly and maintained in good condition.

Electricity Bills:

The details of the electricity bill is as under.

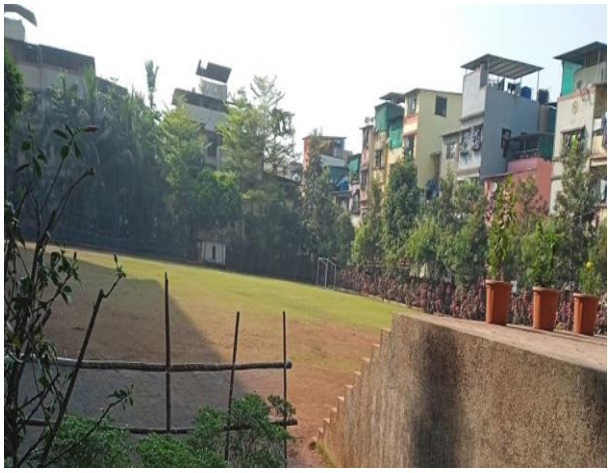
Consumer Name:	Lokmanya Tilak College of Engineering
Utility Provider:	MAHADISCOM
Consumer No:	000439028440
Meter No:	055-X1115106
Tariff Category:	146 HT-VIII B

General Observations & Suggestions:

- The average cost of power is 8.90; which is in the normal range.
- The average power factor is 0.92
- The average consumption is 2000 kWh/month after commissioning the roof top solar plant.

IV
Environmental System

Ventilation & Air Quality:



- Several indoor & outdoor plants have been installed to improve air quality.
- The air ventilation is adequate.
- The air-conditioned rooms are provided with proper ventilation and fresh air.
- It has been a general practice to switch off the fans & lights in an unoccupied area.

Natural Lighting:

- The usage of natural light is optimized.

V
Water Management

The water supplied by the municipal corporation is used for drinking and other requirements. The incoming water from the municipal corporation is metered.

Observations & Suggestions:

- The water conservation practices are followed in the college.

Water Purifiers & Coolers:

The water purifiers and coolers are provided at on individual floors, the details are as under.

Sr No	Location	Purifier	Cooler
A and C Building			
1	First Floor	1	1
2	Second Floor	1	1
3	Third Floor	1	1
4	Fourth Floor	1	1
5	Fifth Floor	1	1
6	Ground Floor (C building)	1	1

Water Distribution System:

The distribution network and piping are more or less satisfactory and adequate.

Rainwater Harvesting:

The Rain Water Harvesting System with ground water recharge is practiced.

VI
Waste Generation & Management

Solid Waste:

- College is looking at environmental issues very seriously and taking all possible steps towards sustainability.
- The waste is segregated and treated / handled accordingly.
- The canteen kitchen waste and garden waste may be converted into the compost in the composting bins.
- The dry waste is disposed through Municipal System.

VII
Infrastructure & Safety

Observations:

- The premises are provided with multiple staircases with necessary entrances to ensure quick and effective movement in normal as well as emergency conditions.
- The separate parking areas for 4 wheelers and 2 wheelers, bicycles are provided in the premises.
- The students and many of the faculty members avail public transport system which is very convenient due to proximity to railway station and bus services.

Draining system:

- The drains from the washrooms are connected to the municipal drainage, which is a common practice in the colleges in and around Navi Mumbai.

Seepage in the building:

- The premise was visually inspected for seepages. No seepages were observed in any of the places.

Firefighting & fire escape system:

There are efficient fire extinguishers in the premises; which are checked / refilled as per the stipulated frequency. The details of the fire extinguishers is as under.

Sr No	Location	Type	Quantity
A and C Building			
1	First Floor	ABC	1
2	Second Floor	ABC	1
3	Third Floor	ABC	1
4	Fourth Floor	ABC	1
5	Fifth Floor	ABC	1
6	Sisth Floor (C building)	ABC	1

The premise is provided with multiple staircases with requisite entrances to ensure quick and effective movement in emergency conditions.

The elevators and ramps are provided for ease of movement.


LIFT CAR-1
LIFT CAR-2
Burn Calories, Not Electricity.
Take the Stairs!

VIII
Green Culture

Computers:

The college is starting new branches of engineering like Computer Science and Engineering (AI & ML), Computer Science and Engineering (ioT & CSBT) and Computer Science and Engineering (DS). Energy efficient new computers will be purchased.

Paper-less communication:

The major internal as well as external communication is through ERP system.

IX
Renewable Energy

Solar Photovoltaic:

The present Solar Photovoltaic System is functional and efficient with NET metering facility.

Report

On

Green, Energy & Environment Audit

For

Lokmanya Tilak College of Engineering
Navi Mumbai 400709

Prepared

By

Senergy Consultants Pvt Ltd
Navi Mumbai 400 088

December 2021

Helping You to Conserve Energy

Contents

SENERGY Consultants (P) Ltd
IAS ACCREDITED Management Systems Certification Body MSCB-119
ISO 9001:2015

Ref: SCPL-CE-868-171221
Date: December 17, 2021

Certificate

This is to certify that Green Audit was carried out at Lokmanya Tilak Jankalyan Shikashan Sanstha's, Lokmanya Tilak College of Engineering, Sector 4, Vikas Nagar, Koparkhairane, Navi Mumbai 400709 during the month of December 2021.

The scope, coverage, findings and recommendations are submitted vide our report SCPL-PR-868-171221 dated December 17, 2021.

For **SENERGY CONSULTANTS PVT LTD**

Ravindra Datar
Accredited Energy Auditor – AEA 0161

SENERGY Consultants (P) Ltd
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For **SENERGY CONSULTANTS PVT LTD**

Ravindra Datar
Accredited Energy Auditor – AEA 0161

I
Introduction

Green, Energy & Environment Audit was undertaken at Lokmanya Tilak College of Engineering (Navi Mumbai 400709) during the month of December 2021.

This Audit Report presents qualitative and quantitative data collection and observations made at the facility and is governed by the objectives, scope of work, methodology etc. discussed in the ensuing paragraphs.

Due to Covid-19 pandemic it was difficult to carry out detailed data collection, measurements. Therefore, the report is prepared based on the walk-in audit at the premises.

Team:

The team members of the audit study.

- Mr Ravindra Datar
- Mr Tushar Kamble

Acknowledgment:

We wish to express our gratitude towards Principal Dr. Vivek Sunnapwar, and Vice Principal Dr. Subhash K shinde for having given us the opportunity for conducting the study and the support provided during the study.

We are also thankful to the entire team comprising of the following members for extending the necessary help and co-operation from their side.

- Dr Santosh D Dalvi (Associate Professor, LTCE).
- Mr. More (Facility Manager)
- Mr. Ghanshyam (Facility Supervisor)

II
Executive Summary

The premises were evaluated against the various criterions laid down by the National Assessment and Accreditation Council (NAAC). The major observations are.

Air Quality & Ventilation:

- The classrooms and other area are well ventilated to ensure proper air quality.
- The fans are appropriately installed to ensure proper air circulation.
- The outdoor and few indoor plants have also been provided to improve the environment.
- The air-conditioned rooms are provided with proper ventilation and fresh air.

Lighting System:

- The usage of natural light is optimized through well designed structure and windows.
- The light fittings are provided with high efficiency LED lamps.

Green Campus Initiative:

- The plastic usage is restricted inside the campus; the usage may be completely banned.
- The campus is surrounded with a lot of greenery, trees, and proper landscaping.
- The college has various committees to create awareness on Waste & E-waste management and other initiatives
- The student participation is encouraged in such activities through student clubs and groups.

Environment & Energy Initiative:

- Tree Plantation drive was undertaken by students and staff members.

Water Quality & Conservation:

- The water is supplied by the Municipal Corporation, which is a common practice in Mumbai, Thane & Navi Mumbai.
- Harvested rain water is used for gardening.
- Water purifiers & coolers are provided at individual floors and convenient locations.
- The distribution network and piping are more or less satisfactory and adequate.

Waste Management:

- College is looking at environmental issues very seriously and taking all possible steps towards sustainability.
- The waste is segregated and treated / handled accordingly.
- The canteen kitchen waste, garden waste and dry waste is disposed through Municipal System

Infrastructure usage:

- The on-campus movement is distributed with multiple entrances as well as staircases.
- There are ramps and lifts at key locations.
- A special assistance is provided to address the needs of differently abled persons.
- The fire extinguishers are provided at key areas.
- The draining system for washrooms is efficient and effective.
- There were no seepages observed in the building premises.

Green IT culture:

- The Energy efficient computers have been procured.
- The electronic communication is encouraged and practiced to minimize usage of papers.
- Most of the papers are reused for doubled sided printing to further minimize usage of paper.

Renewable Energy:

- The present Solar Photovoltaic System is functional and efficient with NET metering facility.

III
Electrical System

Air Conditioning Units:

The air conditioners are provided in the principal cabin, Office and Accounts dept, computer laboratories, HoD cabins, conference rooms, seminar halls and auditoriums.

Observations & Suggestions:

- Most of the Air Conditioners units are energy efficient with 3-star rating.
- The Air Conditioners are operated as required with manual control.
- The rooms are well ventilated and provided with fans at appropriate location for proper air circulation.
- The temperature is maintained at 23 to 25 ^{o}C, which is within the recommended values.

Lamps:

The LED's are fitted in the classrooms, laboratories.

Observations & Suggestions:

- Almost all the light fitting are provided with high efficiency LED lamps; the others being replaced shortly.
- The usage of natural light is optimized through well designed structure and windows.
- It is suggested to automate switching of lamps in the common areas and rest rooms with sensor based control.

Fans:

The ceiling fans are fitted in the classrooms, laboratories.

Observations & Suggestions:

- The fans may be progressively replaced with energy efficient BLDC fans, especially during replacements and new purchases.

Computers:

Almost all the computers are with energy efficient LCD / LED monitors.

The battery / power management system may be incorporated for more efficient operation.

General Observations & Suggestions:

- The rooms are well ventilated and provided with fans at appropriate location for proper air circulation.
- The gadgets are services properly and maintained in good condition.

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The details of the electricity bill is as under.

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Utility Provider:	MAHADISCOM
Consumer No:	000439028440
Meter No:	055-X1115106
Tariff Category:	146 HT-VIII B

General Observations & Suggestions:

- The average cost of power is 8.96; which is in the normal range.
- The average power factor is 0.910
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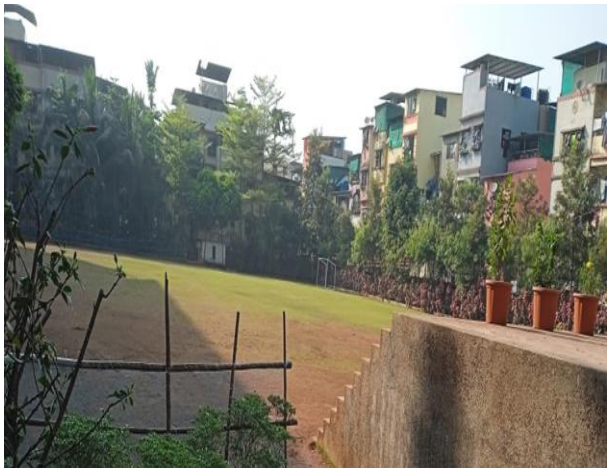
Environmental System

Ventilation & Air Quality:



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Observations:

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- The students and many of the faculty members avail public transport system which is very convenient due to proximity to railway station and bus services.

Draining system:

- The drains from the washrooms are connected to the municipal drainage, which is a common practice in the colleges in and around Navi Mumbai.

Seepage in the building:

- The premise was visually inspected for seepages. No seepages were observed in any of the places.

Firefighting & fire escape system:

There are efficient fire extinguishers in the premises; which are checked / refilled as per the stipulated frequency. The details of the fire extinguishers is as under.

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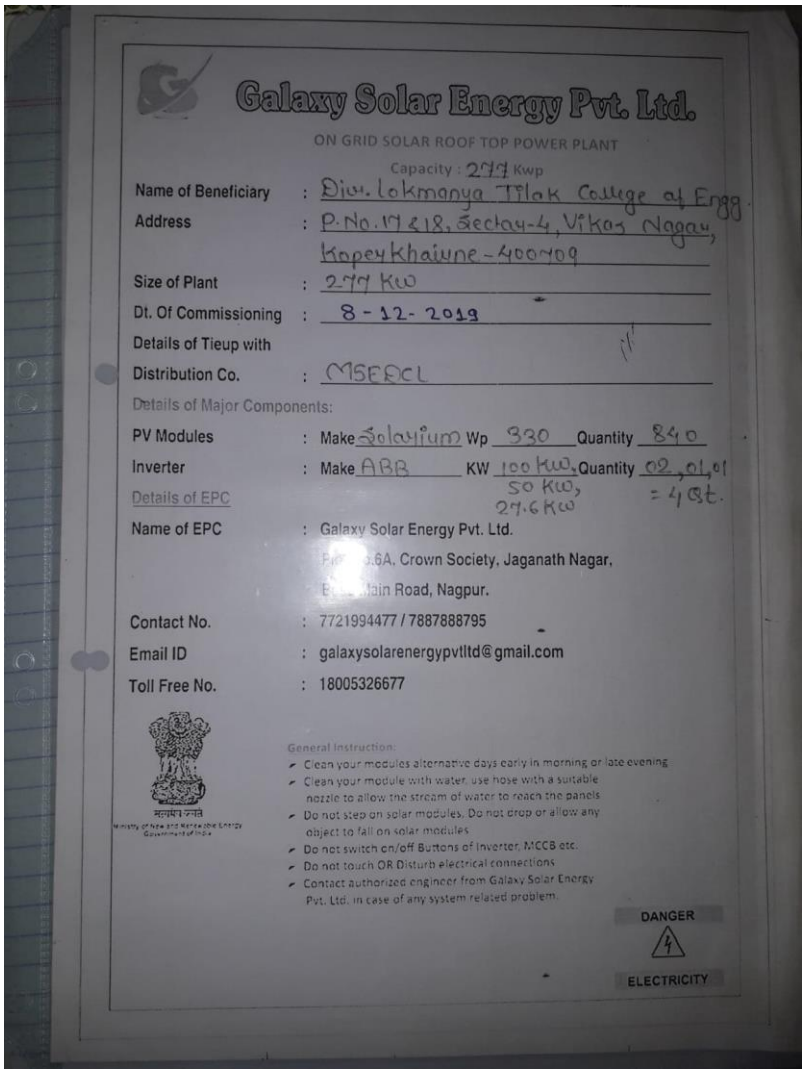
Renewable Energy

Solar Photovoltaic:

The present Solar Photovoltaic System is functional and efficient with NET metering facility.



Galaxy Solar Energy Pvt. Ltd.

ON GRID SOLAR ROOF TOP POWER PLANT

Capacity : 277 Kwp

Name of Beneficiary : Div. Lokmanya Tilak College of Engg

Address : P.No.17&18, Sector-4, Vikas Nagar, Kopar Khairane - 400709

Size of Plant : 277 KW

Dt. Of Commissioning : 8-12-2019

Details of Tieup with

Distribution Co. : MSEDCL

Details of Major Components:

PV Modules : Make Solarium Wp 330 Quantity 840

Inverter : Make ABB KW 100 KW, 50 KW, 27.6 KW Quantity 02, 01, 01 = 4 Nos.

Details of EPC

Name of EPC : Galaxy Solar Energy Pvt. Ltd.

6A, Crown Society, Jaganath Nagar,

Main Road, Nagpur.

Contact No. : 7721994477 / 7887888795

Email ID : galaxysolarenergypvtltd@gmail.com

Toll Free No. : 18005326677

General Instruction:

- Clean your modules alternative days early in morning or late evening
- Clean your module with water, use hose with a suitable nozzle to allow the stream of water to reach the panels
- Do not step on solar modules. Do not drop or allow any object to fall on solar modules
- Do not switch on/off Buttons of Inverter, MCCB etc.
- Do not touch OR Disturb electrical connections
- Contact authorized engineer from Galaxy Solar Energy Pvt. Ltd. in case of any system related problem.

DANGER

ELECTRICITY

Report

On

Green, Energy & Environment Audit

For

Lokmanya Tilak College of Engineering
Navi Mumbai 400709

Prepared

By

Senergy Consultants Pvt Ltd
Navi Mumbai 400 088

June 2022

Contents

SENERGY Consultants (P) Ltd
IAS ACCREDITED Management Systems Certification Body MSCB-119
ISO 9001:2015

Ref: SCPL-CE-868-220622
Date: June 22, 2022

Certificate

This is to certify that Green Audit was carried out at Lokmanya Tilak Jankalyan Shikashan Sanstha's, Lokmanya Tilak College of Engineering, Sector 4, Vikas Nagar, Koparkhairane, Navi Mumbai 400709 during the month of June 2022.

The scope, coverage, findings and recommendations are submitted vide our report SCPL-PR-868-220622 dated June 22, 2022.

For **SENERGY CONSULTANTS PVT LTD**

Ravindra Datar
Accredited Energy Auditor – AEA 0161

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For **SENERGY CONSULTANTS PVT LTD**

Ravindra Datar
Accredited Energy Auditor – AEA 0161

I
Introduction

Green, Energy & Environment Audit was undertaken at Lokmanya Tilak College of Engineering (Navi Mumbai 400709) during the month of June 2022.

The organization is very keen to promote green culture wherever possible, as a commitment towards better environment and conservation of energy. A lot of efforts have already been put up to bring down the carbon footprint. To further optimize consumption and identify saving opportunities, M/s Senergy Consultants was assigned to carry out Green Energy & Environment Audit of the premises.

This Audit Report presents the analysis of the data collected, observations made at the facility and is governed by the objectives, scope of work, methodology etc. discussed in the ensuing paragraphs.

Team:

The team members of the audit study.

- Mr Ravindra Datar
- Mr Siddhesh Pagare

Acknowledgment:

We wish to express our gratitude towards Principal Dr. Vivek Sunnapwar, and Vice Principal Dr. Subhash K shinde for having given us the opportunity for conducting the study and the support provided during the study.

We are also thankful to the entire team comprising of the following members for extending the necessary help and co-operation from their side.

- Mr Gholap (Electrician, LTCE)
- Mr Ninad Totre (Assistant Professor, LTCE).

II
Executive Summary

The premises were evaluated against the various criterions laid down by the National Assessment and Accreditation Council (NAAC). The major observations are.

Air Quality & Ventilation:

- The classrooms and other area are well ventilated to ensure proper air quality.
- The fans are appropriately installed to ensure proper air circulation.
- The outdoor and few indoor plants have also been provided to improve the environment.
- The air conditioned rooms are provided with proper ventilation and fresh air.

Lighting System:

- The usage of natural light is optimized through well designed structure and windows.
- Almost all the light fitting are provided with high efficiency LED lamps.
- It is suggested to automate switching of lamps in the common areas and rest rooms with sensor based control.

Green Campus Initiative:

- The plastic usage is restricted inside the campus; the usage may be completely banned.
- The campus is surrounded with a lot of greenery, trees, and proper landscaping.
- The college has various committees to create awareness on Waste & E-waste management and other initiatives
- The student participation is encouraged in such activities through student clubs and groups.

Environment & Energy Initiative:

- Tree Plantation drive was undertaken by students and staff members.

Water Quality & Conservation:

- The water is supplied by the Municipal Corporation, which is a common practice in Mumbai, Thane & Navi Mumbai.
- Harvested rain water is used for gardening.
- Water purifiers & coolers are provided at individual floors and convenient locations.
- The distribution network and piping are more or less satisfactory and adequate.

Waste Management:

- College is looking at environmental issues very seriously and taking all possible steps towards sustainability.
- The waste is segregated and treated / handled accordingly.
- The canteen kitchen waste, garden waste and dry waste is disposed through Municipal System

Air Conditioning System:

- The Air Conditioners are operated as required with manual control. The operation is minimal consequently automation may not be economical.
- The room temperature is maintained at 23 to 25 ^{o}C, which is well within the recommended values.
- The Air Conditioners are serviced regularly and properly maintained.
- Most of the Air Conditioners units are energy efficient with 3 star rating.

Infrastructure usage:

- The on-campus movement is distributed with multiple entrances as well as staircases.
- There are ramps and lifts at key locations.
- A special assistance is provided to address the needs of differently abled persons.
- The fire extinguishers are provided at key areas.
- The draining system for washrooms is efficient and effective.
- There were no seepages observed in the building premises.

Green IT culture:

- The Energy efficient computers have been procured.
- The electronic communication is encouraged and practiced to minimize usage of papers.
- Most of the papers are reused for doubled sided printing to further minimize usage of paper.

Renewable Energy:

- The present Solar Photovoltaic System is functional and efficient with NET metering facility.

III
Electrical System

Gadget

Air Conditioning Units:

The air conditioners are provided in the principal cabin, Office and Accounts dept, computer laboratories, HoD cabins, conference rooms, seminar halls and auditoriums.

Observations & Suggestions:

- Most of the Air Conditioners units are energy efficient with 3-star rating.
- The Air Conditioners are operated as required with manual control.
- The rooms are well ventilated and provided with fans at appropriate location for proper air circulation.
- The temperature is maintained at 23 to 25 ^{o}C, which is within the recommended values.

The few window air-conditioners in HoD cabins are old age and consuming more power. These window air conditioners need to be replaced by energy efficient split air conditioners.

Lamps:

The LED's are fitted in the classrooms, laboratories.

Observations & Suggestions:

- Almost all the light fitting are provided with high efficiency LED lamps; the others being replaced shortly.
- The usage of natural light is optimized through well designed structure and windows.
- It is suggested to automate switching of lamps in the common areas and rest rooms with sensor-based control.

Fans:

The ceiling fans are fitted in the classrooms, laboratories.

Observations & Suggestions:

- The fans may be progressively replaced with energy efficient BLDC fans, especially during replacements and new purchases.

Computers:

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Environmental System

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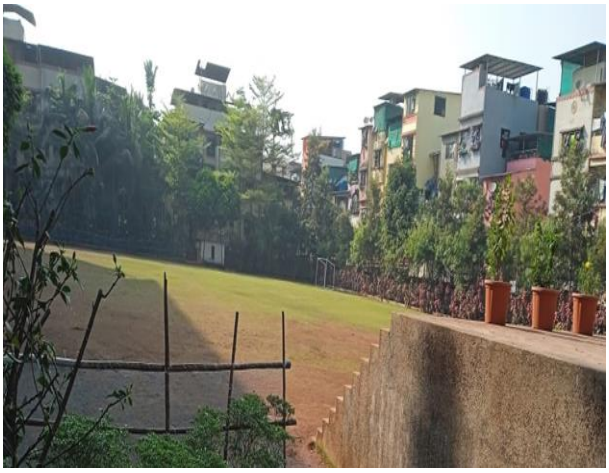


- Several indoor & outdoor plants have been installed to improve air quality.
- The air ventilation is adequate.
- The air-conditioned rooms are provided with proper ventilation and fresh air.
- It has been a general practice to switch off the fans & lights in an unoccupied area.

Indoor & Outdoor Plants:

SR NO	PLANT SPECIES	LOCATION	NO
1	GUAVA	NEAR GENERATOR	1
2	SILK OAK	BEHIND GENERATOR	13
3	CAMILIA	BEHIND GENERATOR	4
4	ACATYPHA RED	NEAR GENERATOR	27
5	CORDYLINE FRUTICOSA	NEAR GENERATOR	1
6	EUPHORBIA CANARIENSIS	NEAR GENERATOR	1
7	FOXTAIL PALM	NEAR GENERATOR	9
8	WEST INDIAN JASMINE	NEAR GENERATOR	29
9	PHILIPINE JASMINE	NEAR GENERATOR	90
10	DOIYANTHES	NEAR STAGE	1
11	WEST INDIAN LANTANA	NEAR STAGE	12
12	WHITE BUTTERFLY GINGERS	NEAR STAIRS	4
13	EOUNYMUS JAPONICUS	NEAR STAIRS	14
14	ACALYPHA WILKEIANA	NEAR STAIRS	9
15	TRIPHASIA TRIFOLIA	BEHIND THE STAGE	77
16	TELOSMA CORDATA	GARDEN	1
17	BASIL	GARDEN	7
18	MANGO	GARDEN	9
19	ROYSTONEA REGIA	GARDEN	25
20	DRAGON TREE	GARDEN OUTSIDE	20
21	HIDDEN VALLEY	OUTSIDE GARDEN	5
22	ATINIA VETIGATA	OUTSIDE GARDEN	3
23	CHEMBARATI HIBICUS	OUTSIDE GARDEN	11
24	PALM	OUTSIDE GARDEN	13
25	ASHOKA	OUTSIDE GARDEN	6
26	DRACEANA	OUTSIDE GARDEN	17
27	NIGHT BLOOMIN JASMINE	OUTSIDE GARDEN	1
28	ARALIA VENEGATED	OUTSIDE GARDEN	1
29	CHLERO VENEGATED	OUTSIDE GARDEN	1
30	SPIDER PLANT	OUTSIDE GARDEN	7
31	THRYALLIS	OUTSIDE GARDEN	17
32	ILEX CRENATA	OUTSIDE GARDEN	57
33	FIRE BUSH	OUTSIDE GARDEN	8
34	BARLERIA	OUTSIDE GARDEN	13
35	BUDDHAS LAMP	OUTSIDE GARDEN	1
36	TAMARIND	BEHIND OFFICE	1
37	ARECA PALM	BEHIND OFFICE	15
38	FLORA	BEHIND OFFICE	4
39	LUCKY BAMBOO	BEHIND OFFICE	7
40	SHELL GINGER	BEHIND OFFICE	8
41	BROADLEEF LADY PLANT	BEHIND OFFICE	
42	FOXTAIL	BEHIND OFFICE	18

43	COLEANDER	BEHIND OFFICE	7
44	CROTON YELLOW APPLE LEAF PLANT	BEHIND OFFICE	10
45	CABBAGE PALM	BEHIND OFFICE	
46	DWARF UMBRELLA TREE	BEHIND OFFICE	
47	COCONUT TREE	BEHIND OFFICE	25
48	CANNA COCCINEA	BEHIND OFFICE	3
49	ANADENANTHERA	BETWEEN TWO BUILDING	1

Natural Lighting:

- The usage of natural light is optimized.

V
Water Management

The water supplied by the municipal corporation is used for drinking and other requirements. The incoming water from the municipal corporation is metered.

Observations & Suggestions:

- The water conservation practices are followed in the college.

Water Purifiers & Coolers:

The water purifiers and coolers are provided at on individual floors, the details are as under.

Sr No	Location	Purifier	Cooler
A and C Building			
1	First Floor	1	1
2	Second Floor	1	1
3	Third Floor	1	1
4	Fourth Floor	1	1
5	Fifth Floor	1	1
6	Ground Floor (C building)	1	1

Water Distribution System:

The distribution network and piping are more or less satisfactory and adequate.

Rainwater Harvesting:

The Rain Water Harvesting System with ground water recharge is practiced.

VI
Waste Generation & Management

Solid Waste:

- College is looking at environmental issues very seriously and taking all possible steps towards sustainability.
- The waste is segregated and treated / handled accordingly.
- The canteen kitchen waste and garden waste may be converted into the compost in the composting bins.
- The dry waste is disposed through Municipal System.

VII
Infrastructure & Safety

Observations:

- The premises are provided with multiple staircases with necessary entrances to ensure quick and effective movement in normal as well as emergency conditions.
- The separate parking areas for 4 wheelers and 2 wheelers, bicycles are provided in the premises.
- The students and many of the faculty members avail public transport system which is very convenient due to proximity to railway station and bus services.

Draining system:

- The drains from the washrooms are connected to the municipal drainage, which is a common practice in the colleges in and around Navi Mumbai.

Seepage in the building:

- The premise was visually inspected for seepages. No seepages were observed in any of the places.

Firefighting & fire escape system:

There are efficient fire extinguishers in the premises; which are checked / refilled as per the stipulated frequency. The details of the fire extinguishers is as under.

Sr No	Location	Type	Quantity
A and C Building			
1	First Floor	ABC	1
2	Second Floor	ABC	1
3	Third Floor	ABC	1
4	Fourth Floor	ABC	1
5	Fifth Floor	ABC	1
6	Sisth Floor (C building)	ABC	1

The premise is provided with multiple staircases with requisite entrances to ensure quick and effective movement in emergency conditions.

The elevators and ramps are provided for ease of movement.

Parking:

There are separate parking spaces for four and two wheelers.

VIII
Green Culture

Computers:

Observations & Suggestions:

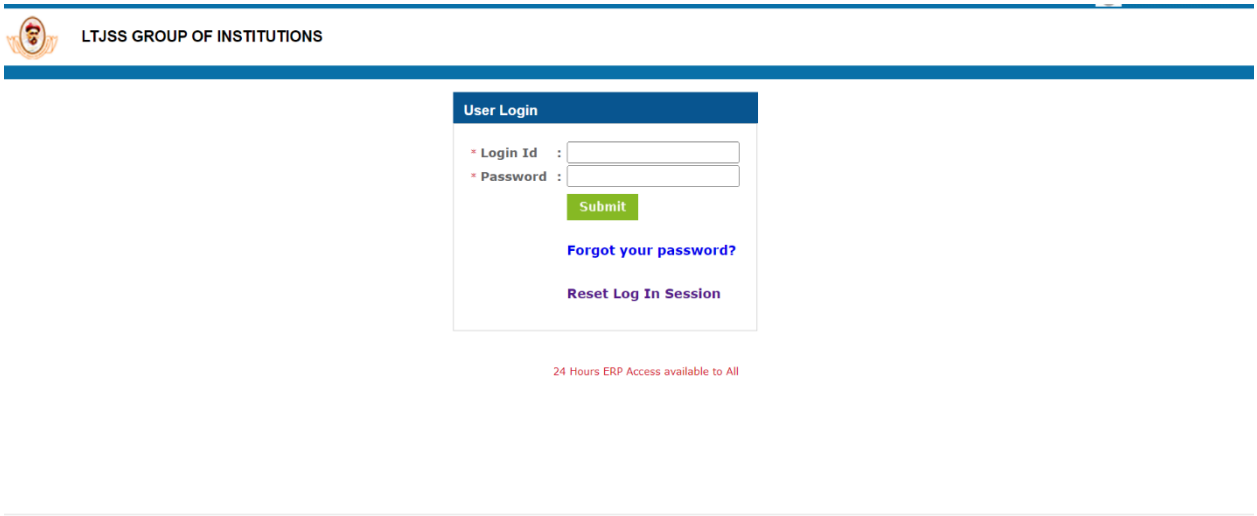
- The LED / LCD monitors has been procured, which are energy efficient.
- These monitors are not only energy efficient but also generate minimal heat and cut down on air conditioning load.

The following steps may be initiated to further enhance efficiency of the systems.

1. An efficient power management system may be incorporated to
    a. Switch off the display if not in use.
    b. Put the computer in Sleep mode / switching off the machines, if not used for prolonged period.
2. Optimize brightness of the screen.
3. Discourage use of screen savers, which has similar power consumption.

Paper-less communication:

The major internal as well as external communication is through electronic medium.



Re-using one sided paper for printing:

It was observed that two side printing / printing on the back side of used paper in more than 80% of the cases.

IX
Renewable Energy

Solar Photovoltaic:

The present Solar Photovoltaic System is functional and efficient with NET metering facility.

Solar Thermal:

There is no application of solar thermal system and does not find attractive in this case.

VIVEK KRISHNARAO SUNNAPWAR

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Biogas Plant:

There is no possibility of installing biogas plant for cooking as the quantity of plate waste is negligible.