7.4.4 Policy development for clean energy technology

INDEX

S. No.	Details	Page No.
1.	Discussion on Green Energy Policy Development along with TANGEDCO	3
2.	Biogas Plant	5
2.1	Biogas plant details	5
2.2	Stages of bio digestion	6
2.3	Installation of Biogas unit and pipe connections	7
2.4	Biogas plant – Suitable organic wastes	10
3.	Facilities for Alternate Energy Sources and Energy Conservation	13
3.1	Solar Energy	13
3.2	Sensor based Energy Conservation	18
3.3	LED Lamps	25
3.4	Power Efficient Equipments	30

1. DISCUSSION ON GREEN ENERGY POLICY DEVELOPMENT ALONG WITH TANGEDCO

A meeting on Insights of Energy Conservation was organized by the Tamil Nadu Generation and Distribution Corporation Limited (TANGEDCO) at Kumaran Hall, Kovaipudur. Er. M. Subramanian, Superintending Engineer - CEDC, TANGEDCO, Coimbatore, along with other TANGEDCO officials, was present at the meeting.

Our respected Principal, Dr. K. Porkumaran, addressed the gathering and highlighted the following key aspects of energy conservation:

1. **Sustainable and Secure Future**
   - Importance of energy conservation for a sustainable and secure future.
   - Need to avoid energy wastage in daily activities.

2. **Efficient Energy Usage**
   - Efficient use of electrical appliances and technologies.
   - Adoption of renewable and green energy sources.

3. **Role of Students and Society**
   - Role of students and society in building a sustainable future.
   - Responsibility of students, as future engineers, in promoting efficient energy usage.

4. **Community Awareness and Participation**
   - Importance of community awareness and public participation in energy conservation initiatives.
   - Appreciation of the active involvement of SKCET EEE students in spreading energy conservation awareness beyond the campus.

5. **Department's Commitment to Sustainable Energy Solutions**
   - Highlighted the Department's commitment to sustainable energy solutions.
   - Receipt of an R&D grant of ₹1.26 Crores for the project at Palamalai, aimed at providing electricity access in Tribal Welfare areas through Renewable Energy Innovation.


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2. BIOGAS PLANT

Biogas is an alternate source of energy generated through the anaerobic digestion of organic waste. The primary objective of the plant is to convert the organic waste collected on the premises into a useful energy resource. This alternate source contributes to the reduction of the carbon footprint and of LPG consumption, thereby promoting a greener environment.

A biogas plant has been installed on the campus for the efficient utilization of organic waste. Its primary application is the production of cooking gas as an alternative to LPG. Vegetable waste, garden waste and food waste are used as input to the biogas plant. The stored organic waste is deposited in the biogas digester; after a series of biochemical reactions, biogas is formed and is finally used for cooking in the Hall of Residence for Men.



Biogas Digester with 2 Cubic Meters Capacity and Gas 1 Kg/Day

2.1 Biogas Plant Details

Plant capacity (digester)	: 2 m³ FRP Biogas plant
Plant location	: Behind HoR Men's Dining Hall
Project	: Food waste to Cooking Gas
Plant capacity (input)	: 10 kg of solid bio waste per day
Biogas generated	: 2 Cubic meters
Cooking gas equivalent	: Max. 1 kg / day
Organic fertilizer	: 25 Litres / day
Burning time	: 1½ to 2 hours (double burner)

Benefit of 2 Cubic Meter Biogas Plant

1 Cubic meter biogas	: 0.4 kg LPG
1 kg LPG	: Rs. 100 (19 kg commercial LPG cylinder = Rs. 1,950)
LPG saving per day	: 1 × 100 = Rs. 100/-
Saving per month	: 30 × 100 = Rs. 3,000/-
Saving per year	: 3,000 × 12 = Rs. 36,000/-



Plant Capacity of Cooking Gas: 1 kg per day

With an input of 10 kg of food waste, 2 cubic meters of biogas is generated. Cooking gas of about 1 kg/day is generated and utilized. Organic fertilizer of about 25 litres/day is obtained as an additional by-product of the biogas digester and is utilized for farms.

The biogas produced is effectively used on the campus, which reduces the cost of liquid petroleum gas. A record of organic waste and food waste is maintained so as to generate biogas for consistent utilization.

2.2 Stages of Bio Digestion

The system consists of the following stages:

Stage 1: Feeding at the inlet pre-digester

The inlet pre-digester is connected to the anaerobic digester. Feeding is carried out through the inlet, and the feed enters the digester directly, where anaerobic digestion takes place.

Stage 2: Treatment inside the digestion chamber

The digester consists mainly of a digestion chamber and a pressure dome gas holder. The feed enters the digester, where anaerobic digestion (in the absence of oxygen) takes place. The size of the digester is designed on the basis of the type and quantity of waste. Only the waste that completes its Hydraulic Retention Time (HRT) leaves the digester as slurry. As part of the digestion process, methane gas is formed and is collected in the gas holder.

Stage 3: Slurry pumping at the outlet tank

The digester is connected to an outlet tank in which the slurry is collected. The slurry can be used directly, connected to drainage, or used as manure for the garden.

2.3 Installation of Biogas Unit and Pipe Connections



1. Pit excavation



2. Unloaded Biogas unit



3. Lowering of Biogas unit into pit



4. Installation into ground



5. Biogas plant full setup



6. Biogas pipeline connection (from plant to kitchen)



7. Gas stove in HoR Men's kitchen burning the biogas generated from the plant

2.4 Biogas Plant – Suitable Organic Wastes

The following guidelines on the organic wastes suitable for the biogas plant are furnished by the plant supplier, Britt Envirotech, Coimbatore.

Materials not to be put in (those that prevent biogas formation)

- Lemon and its skin, pickles
- Orange, mosambi, citron
- Dry tamarind, gooseberry, lemon rice, tamarind rice
- Soap and cleaning detergent powder, shampoo
- Cool drinks and acid contents

Products to be avoided (those that do not produce biogas)

- Bone, fish thorn, banana leaf, banana stalk
- Peel of onion, ginger and garlic
- Coconut shell, egg shell, crab shell
- Seeds, peanut skin, drumstick residue
- Paper, plastic, glass, rubber materials
- Plants and leaves
- Greens, spinach, coriander leaves and curry leaves

Products that produce biogas

- Waste or leftover meals, gravy, curry, etc.
- Sour curd, fermented milk
- Leftover flours
- Chopped vegetable waste
- Fish, shrimp (prawn) and non-vegetarian items
- Bakery waste
- Coconut water, rotten coconut
- Steamed cereals
- Rotten vegetables and fruits
- Dropped flowers and sliced water hyacinth (Agaya Thamarai)
- Infusions of rice and cereals
- Washed water of rice, pulses, fish and non-vegetarian items

Products that can generate more biogas (must be given once weekly)

- Fish waste and shrimp (prawn) waste
- Skin of jack fruit and its waste
- Cabbage
- Rice infusions, rice washing water, flour and flour products

- Sliced water hyacinth (Agaya Thamarai)

Things to notice

- If water is found stagnant in the gas pipe, it should be removed.
- Along with the solid waste, add water at two times its volume (the water may be the washed waste water of rice, pulses, fish, meat, etc.).

Further enquiries: Mr. Winston M. (9042 701 701); Mr. Muruganandhu K. (9043 701 701) – Britt Envirotech, Coimbatore.

The supplier's guidelines in Tamil are reproduced below.

BRITT ENVIROTECH

போடகூடாத பொருட்கள் (BIO-GAS உருவாகுவதை தடுக்கும்)

- எலுமிச்சை பழம் மற்றும் தோல், ஊறுகாய்,
- நார்த்தங்காய், சாத்துக்குடி, ஆரஞ்சு
- பச்சைபுளி, எலுமிச்சை சாதம் , புளி சாதம்
- நெல்லிக்காய்,
- சோப்பு, பாத்திரம் கழுவும் பவுடர், ஷாம்பூ
- சோடா கூல்ட்ரிங்க்ஸ், ஆசிட் பொருட்கள்

தவிர்க்க வேண்டிய பொருட்கள் (BIO-GAS- ஐ உருவாக்காது)

- எலும்பு, மீன்முள், வாழைஇலை, வாழைத்தண்டு
- வெங்காயத்தோல், வெள்ளைபூண்டுத்தோல்,
- தேங்காய் ஓடு, முட்டை ஓடு, நண்டு ஓடு
- விதைகள், வேர்கடலை தோல், முருங்கைக்காய் சக்கை
- பேப்பர், பிளாஸ்டிக், கண்ணாடி, ரப்பர் பொருட்கள்
- செடிகொடிகளின் இலைதளைகள்

போடக்கூடிய பொருட்கள் (BIO-GAS உருவாக்கும்)

- மீதமான சாதம், குழம்பு, கூட்டு, பொரியல், அவியல்
- மிஞ்சிய மாவு வகைகள்
- புளித்தத் தயிர் , திரிந்த பால்
- நறுக்கிய காய்கறிகளின் கழிவுகள்
- அழுகிய காய்கறிகள், அழுகிய பழங்கள்
- கீரை வகைகள், கறிவேப்பிலை, மல்லிதழை
- மீன், இறால், மாமிச கழிவுகள்

Suitable organic wastes for biogas plant (Tamil) – Page 1

BRITT ENVIROTECH

- பேக்கரி பொருட்கள்
- அழுகிய தேங்காய் பத்தை, தேங்காய் நீர்
- வேகவைத்த தானிய வகைகள்
- உதிரி பூக்கள், நறுக்கிய ஆகாய தாமரை
- அரிசி மற்றும் தானியங்களின் வடிநீர்
- அரிசி, பருப்பு, மீன், மாமிசம் போன்றவைகளை கழுவின நீர்

வாரம் ஒருமுறை மட்டும் கொடுக்கக்கூடிய பொருட்கள்

- மீன், இறால் கழிவுகள்
- முட்டைகோஸ்
- பலாப்பல தோல் மற்றும் கழிவுகள்
- நறுக்கிய ஆகாயத்தாமரை

கவனிக்க வேண்டியவைகள்

- Gas Tube -ல் வாட்டர் தேங்கிநின்றால், அது நீக்க பட வேண்டும்
- குறிக்கப்பட்ட திடக்கழிவின் அளவினை விட அதிகமாக கொடுக்கக்கூடாது

Further Enquiries Please Contact:

Winston .M
9042 701 701

Muruganandhu.K
9043 701 701

BRITT ENVIROTECH CBE-35

Suitable organic wastes for biogas plant (Tamil) – Page 2

3. FACILITIES FOR ALTERNATE ENERGY SOURCES AND ENERGY CONSERVATION

The exploration of alternate energy sources and the promotion of energy conservation have emerged as pivotal strategies in shaping a sustainable future. This section covers alternate energy sources and energy conservation, with emphasis on their significance, principles and potential pathways towards a more resilient and eco-friendly energy landscape. As part of its commitment to alternate energy sources and energy conservation, Sri Krishna College of Engineering and Technology has initiated energy conservation measures throughout the campus. The following are the alternate energy source and energy conservation schemes:

1. Solar Energy
2. Biogas Plant (detailed in Section 1)
3. Sensor based Energy Conservation
4. LED Lamps

3.1 Solar Energy

Solar energy is utilized for the water heating system to produce hot water. It can raise the water temperature to a range of 60 to 80 degrees Celsius. Employing a solar water heater can significantly reduce electricity or fuel expenses, offering a cost-effective means of producing hot water for various purposes. Moreover, solar water heaters not only lead to substantial energy savings but also take advantage of the free energy source provided by the sun, as opposed to the costs associated with natural gas or fuel oil. Solar water heaters are installed in all the housing blocks for both men and women.

Installed Capacity of Solar Water Heater

S. No.	Location	Capacity in litres	Qty Available
1	HoR Men – A	2000	2
2	HoR Men – B	2000	2
3	HoR Men – C	2000	2
4	HoR Men – D	1000	6
5	HoR Men – E	2000	2
6	HoR Women – B1	2000	2
7	HoR Women – B2	2000	2

- An average of 25 litres of hot water is utilized by a single person per day.

Total strength of students in the hostel: 2150

Per day consumption of water (2150 × 25): 53750 litres

- One litre of solar water heater capacity per day saves 15 units/year.

Number of units saved per year: 53750 × 15 = 806250

Renewable energy generated and used = 806250 / 274152 × 100 = 38.8%

*Average units consumed per year: 274152



Solar water heater installed in Hall of Residence Men – 'A' Block: 3000 LPD with 5 bar (kg/cm^2)



Solar water heater installed in Hall of Residence Men – 'B' Block: 3000 LPD with 5 bar (kg/cm^2)



Solar water heater installed in Hall of Residence Men – 'C' Block: 3000 LPD with 5 bar (kg/cm^2)



Solar water heater installed in Hall of Residence Men – 'D' Block: 1000 LPD with 5 bar (kg/cm^2)



Solar water heater installed in Hall of Residence Men – 'E' Block: 3000 LPD with 5 bar (kg/cm^2)



Solar water heater installed in Hall of Residence Women – 'B1' Block: 3000 LPD with 5 bar (kg/cm^2)



Solar water heater installed in Hall of Residence Women – 'B2' Block: 3000 LPD with 5 bar (kg/cm^2)

Solar Panel in Two-Wheeler Parking

The objective of utilizing solar panels is to provide sustainable and efficient lighting while reducing reliance on the grid electricity source. The LED lamps in the two-wheeler parking area are powered by a 1 kW solar panel, which provides the illumination in the parking area.



1 kW Solar Panel – Two-Wheeler Parking



1 kW Solar Panel – Two-Wheeler Parking

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3.2 Sensor Based Energy Conservation

The institution has the provision of advanced water heater technology in both the Hall of Residence for Men and the Hall of Residence for Women. The aim is to provide hot water to the residents irrespective of climatic conditions. A temperature sensor detects a fall in the temperature of the water in the tank and sends a signal to the heating element inside the tank, which then heats the water. Once the water reaches 80° Celsius, the thermostat cuts off the power to the heating element, and the insulation keeps the inner tank warm.

Water level indicators are provided to turn off the motor automatically when the tank reaches 80% of its capacity.

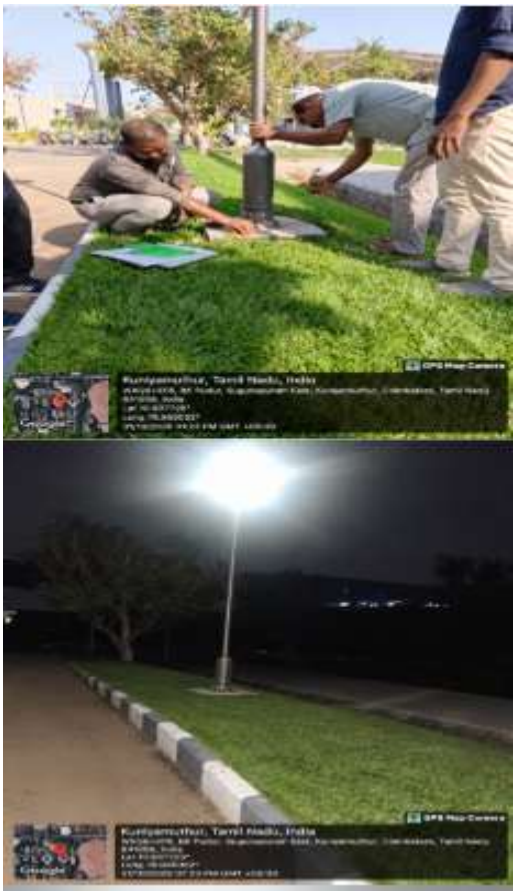
Water level control sensors are available in the Administrative Block. They sense the water level in the tank and, once the reference level is reached, automatically switch off the motor to avoid overflow.

Fire detection sensors are available in the conference halls. They sense abnormal fumes and, on detection of fumes due to fire, the water spray is activated. To maintain cleanliness on the campus, a **Smart Dustbin** has been designed to prevent overflow of waste and to keep the surroundings clean.

Automatic street lights using an LDR sensor are available on the campus. The Light Detecting Resistor (LDR) switches on the street lights automatically when the ambient luminance is low. During the daytime, the ambient luminance increases; the LDR senses the high luminance and switches off the street lights.

Automatic Street Lights using Light Detecting Resistor (LDR) Sensor

The Light Detecting Resistor (LDR) sensor senses the ambient luminance for switching the street lights on and off automatically. When the luminance is low, the LDR turns on the street lights. When the luminance is high, the LDR turns off the street lights.



Automatic Street Lights using Light Detecting Resistor (LDR) Sensor

Water Heater Sensor



Sensor based water heater at Men's Hostel – G Block with 3000 LPD tank, 6 mm thick



Sensor control unit of the water heater

Water Level Control Sensor



Automatic Water Pump Controller – Administrative Block

Fire Detecting Sensor



Fire Detecting Sensor – Administrative Block



Fire Detecting Sensor – Administrative Block

Sensor Based Water Sprinkler



Sensor Based Garden Water Sprinkler

Smart Dustbin

The Smart Dustbin is an automatic lid opening and closing system that operates when waste is to be deposited. The dustbin opens its lid on detecting a person who wants to throw out trash. It also detects the level of trash inside the dustbin, and once a particular level is reached, the lid will not open. The prototype comprises an Arduino UNO, ultrasonic sensors and a servomotor. The purpose of the project is to prevent overflow of waste and to keep the surroundings clean.



Smart Dustbin

3.3 LED Lamps

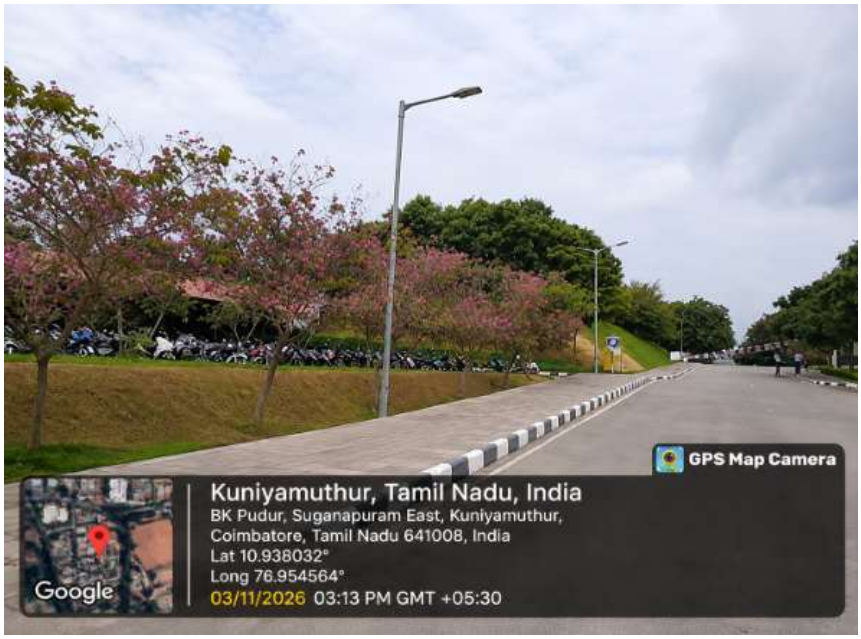
The institution campus has been equipped with LED lamps at various locations to achieve multiple benefits, including enhanced energy efficiency, extended lifespan, reliable operation in cold temperatures, instant illumination and increased durability. LED lamps emit light in specific directions, reducing unnecessary light and energy wastage.

Percentage of annual lighting power requirements met through LED bulbs

Total number of LED lamps	: 794 Nos
Total power consumed by LED lamps	: 24025 W
Total units/day (LED)	: (24025 × 10 hrs) / 1000 = 240.25 units/day
Total units/month (LED)	: 240.25 × 30 days = 7207.5 units/month
Total units/month, lighting loads*	: 37934.2
Percentage of lighting power requirements met through LED	: (7207.5 / 37934.2) × 100 = 19.16%

*Total units/month of lighting loads = 37934.2

LED Bulbs



Campus Street Lights



Campus Street Lights



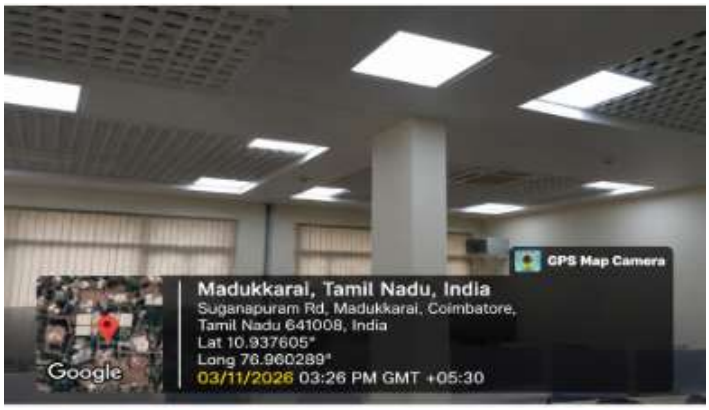
Computer Laboratory – NIKALAUS WIRTH LAB



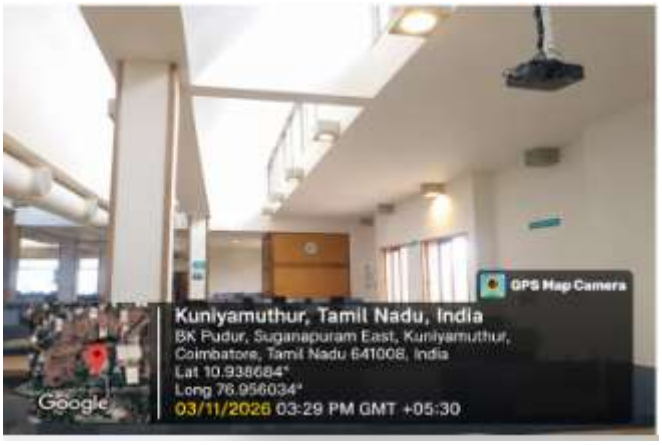
Computer Laboratory – ALAN KAY LAB



Computer Laboratory – DONALD LAB



Computer Laboratory – JIM GRAY LAB





Vankatram Learning Centre



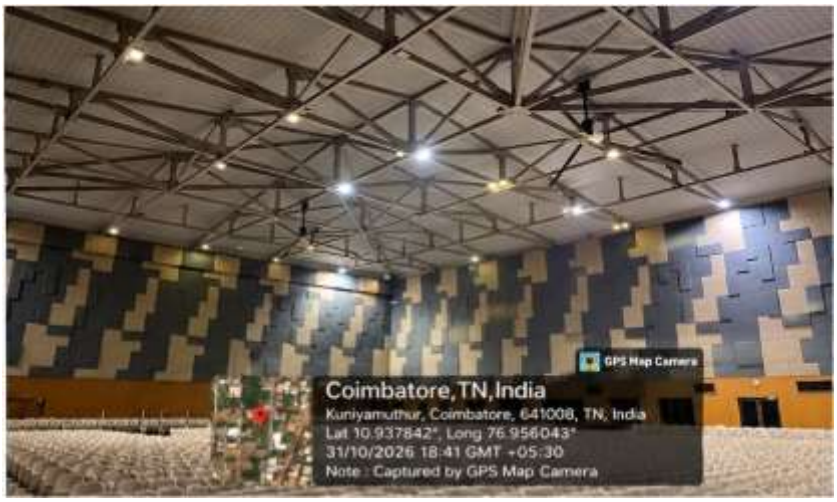
Sri Krishna Stadium

3.4 Power Efficient Equipments

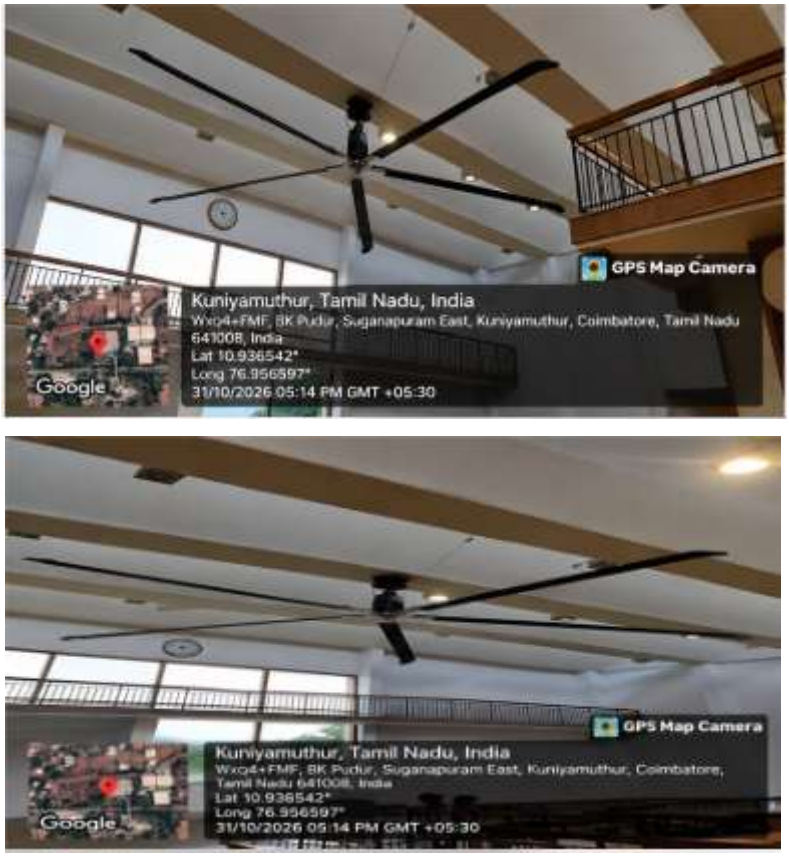
High Voltage Low Speed (HVLS) fans are fixed in Sri Krishna Hall and Vankatram Learning Centre to provide a high-throw air facility, which enhances the cooling effect. The HVLS fans are 24 feet in diameter and provide a high volume of air at low velocity. The air conditioners are 3-Star rated and centralized.



2.5 HP – 440 V, 50 Hz High Voltage Low Speed Fan at SRI KRISHNA HALL (STAGE)



3 HP – 440 V, 50 Hz High Voltage Low Speed Fan at SRI KRISHNA HALL



2.5 HP, 440 V, 50 Hz High Voltage Low Speed Fan at Vankatram Learning Centre

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