

# ENERGY, ENVIRONMENT & GREEN AUDIT REPORT

**AUDIT CONDUCTED FOR**  
**THAMIRABHARANI ENGINEERING COLLEGE**  
Thatchanallur, Tirunelveli – 627 358, Tamil Nadu, India



**AUDIT CONDUCTED BY**  
**RAM-KALAM CENTRE FOR**  
**ENERGY CONSULTANCY AND TRAINING**

(Chennai ♦ Coimbatore ♦ Erode)

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**DATE OF AUDIT**

**24 JUNE 2021**



## **ACKNOWLEDGEMENT**

**RAM-KALAM CENTRE FOR ENERGY CONSULTANCY AND TRAINING**, Coimbatore - 641 062 is thankful to the Management, Principal, Faculty and Technical team members of **THAMIRABHARANI ENGINEERING COLLEGE**, Thatchanallur, Tirunelveli - 627 358, Tamil Nadu, India for providing an opportunity to conduct a detailed Energy, Environment and Green Audit process in the college premises.

It is our great pleasure which must be recorded here that the Management of **THAMIRABHARANI ENGINEERING COLLEGE** extended all possible support and assistance resulting in thorough completion of the audit process. The audit team appreciates the cooperation and guidance extended during the course of site visit and measurements. We are also thankful to all those who gave us the necessary inputs and information to carry out this very vital exercise of green audit.

Finally, we offer our sincere thanks to all the members in the engineering division/ technical / non-technical divisions and office members who were directly and indirectly involved with us during collection of data and while conducting field measurements.

<b><u>Management Team Members</u></b>	
<b>Mr. M. R. PAULRAJ</b>	Chairman
<b>Mr. SETHIL KUMAR PALRAJ</b>	Secretary

<b><u>Audit Team Members</u></b>	
<b>Dr. S.R. SIVARASU, Ph.D.,</b>	<b>BEE Certified Energy Auditor (EA-27299)</b> Lead Auditor-ISO-14001:2015 (EMS), IGBC AP, GRIHA CP, CII CP in SWM Carbon Footprint Auditor & Implementor <b>Mobile: +91- 80567 19372, 99420 29372</b>
<b>Er. B. SATHISH</b>	<b>Audit Associate</b>



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Thatchanallur, Tirunelveli - 627 358.

### 1.1: Preface about the Institution:

- ★ **Thamirabharani Engineering College** which is in the Tirunelveli Corporation limits is located at Thatchanallur, 5km away from Palayamkottal and 40 km from Tuticorin airport. Unfolding its grandeur over 25 acres of land, the college exhibits an attractive panorama conducive to studies. Considering a holistic approach to life and education, an ambient infrastructure is provided for the students. They enjoy a natural sanctuary of birds, magnificent scenery of evergreen trees and amazing mountains and a gorgeous garden of multicoloured flowers. **Thamirabharani Engineering College** was founded with the noble vision to raise professionals and leaders of high academic calibre and unblemished character, nurtured with a strong motivation and commitment to serve humanity. TEC aims at educating & training its students to become not only competent professionals but also excellent human beings to influence the quality of life of people around.
- ★ **Thamirabharani Engineering College** was established with the goal of producing outstanding students in Technical and Business fields and preparing them to tackle the challenges of a dynamic and rapidly changing world. The management implements an interdisciplinary approach to the programs of Anna University, making sure that practical applications are combined with the classroom material. All the programs offered by the institute are recognized by and affiliated to statutory bodies like the All India Council of Technical Education (AICTE), New Delhi and Anna University, Chennai. In a nutshell, Thamirabharani Engineering College is a co-educational, residential, technological college imparting holistic education to develop the technical and the character of the students.

### 1.2: Vision:

- To be a center of excellence in Engineering, exposing emerging technologies and instilling Entrepreneurial Attitude.

### 1.3: Mission Statement:

- ☞ Empower students through effective teaching and learning process for the development of critical thinking, effective communication and creativity.
- ☞ Develop Industry readiness by encouraging learning by doing, exposing current Innovation and providing adequate facilities for Research.
- ☞ Create the entrepreneurship desire by developing individual skills, professional ethics, moral values and societal concern.

### 1.4: Quality Policy:

We are committed to produce excellent technical personnel with ethical and moral values for overall growth of the country through;

- Resolute efforts at all levels.
- Continuous improvement in infrastructure.
- Improved teaching-learning process by committed and continually trained faculty.

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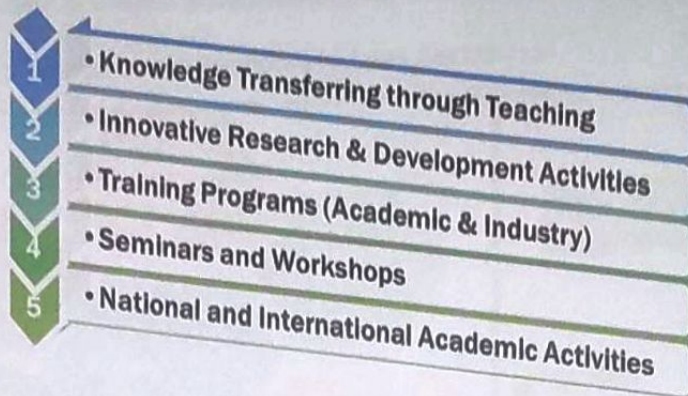
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### 1.5: Major Activities in the Institution:



### 1.6: Scope of the Audit Process:

- **Energy Audit:** To conduct a detailed energy audit in the college campus with a main focus to identify judicious usage of electrical and thermal energy (where, when, why and how energy is being utilized).
- **Environmental Audit:** Identification of history of activities, present environmental practices followed, monitoring records and known sources of environmental issues inside the college.
- **Green Audit:** Assessment on Campus greenery in terms of mature trees, flowering shrubs, bushes, medicinal plants, adoption of green energy generation and utilization, reduction of CO<sub>2</sub> due to green energy system and identification of possible implementation and enhancement of current greenery practices.

### 1.7: Outcomes of the Audit Process:

- Recommendations based on field measurement with achievable Energy Conservation (ENCON) proposals under **No cost/Low cost and Cost investment categories**
- **Minimization of present energy cost** by adjusting and optimizing energy usage and reduction of energy wastage without affecting the regular activities
- **Identification of possible cost and energy saving from energy conservation, waste reduction, reuse and recycling**
- Formation of methodology for long term road map for maintaining green environment within the campus and encourage the stakeholders for continuous improvements

### 1.8: Standards Used:

- Bureau of Energy Efficiency (BEE) Guidelines to conduct the detailed energy audit process
- **ISO 14064-Part-1** – Specification with guidance at the organization level for quantification and reporting of GHG emissions and removals (Second Edition)
- **ISO 14064-Part-2** – Specification with guidance at the project level for quantification, monitoring and reporting of GHG emissions reductions or removal enhancement (Second Edition-2019)
- **ISO 14064-Part-3** – Specification with guidance for the verification and validation of GHG statements (Second Edition-2019)
- The Greenhouse Gas Protocol - A Corporate Accounting and Reporting Standard (Revised Edition) released by World Resources Institute & World Business Council for Sustainable Development – 2014

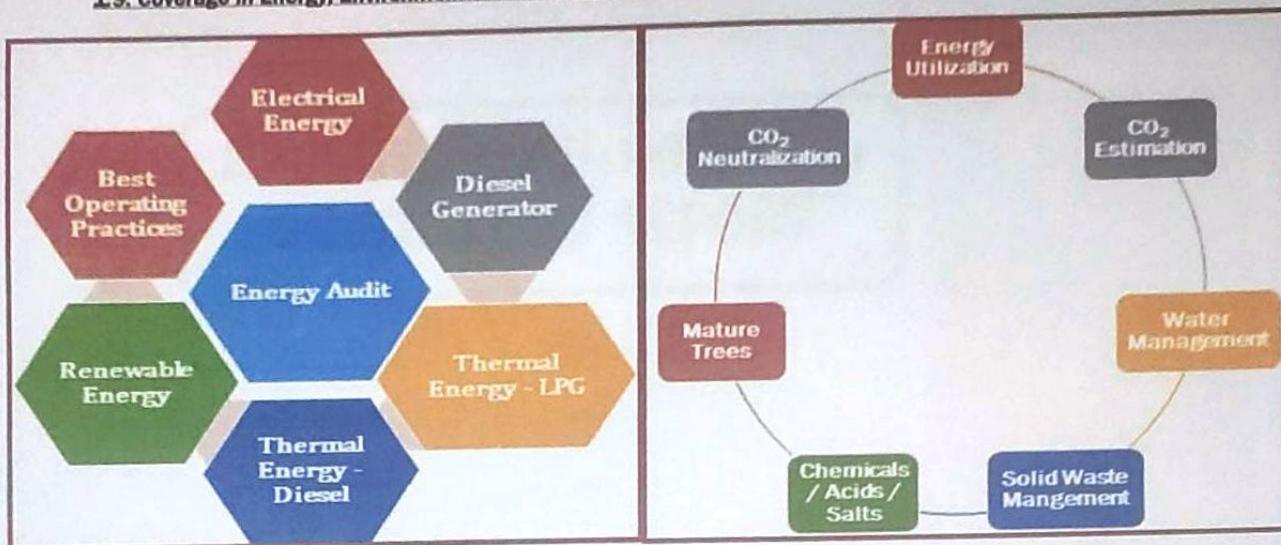
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- Ministry of Environment, Forest and Climate Change Notification on "Battery Waste Management Rules, 2020" & "E-Waste (Management) Rules, 2016", & "Solid Waste Management Rules, 2015"s

**1.9: Coverage In Energy, Environment & Green Audit Process:**



**1.10: List of Faculty Members Involved In Audit Process & Data Collection:**

S. No.	Faculty Details	Contribution
1.	<b>Mrs. S. PONSUNDARI</b> Assistant Professor, Department of CSE	Coordinator for the Audit Process
2.	<b>Mr. E. SUBRAMANIAN</b> Assistant Professor, Department of EEE	Collection of Electrical Energy Parameters, Water, RO plant details from College side
3.	<b>Mr. V. ARUNACHALAM</b> Assistant Professor, Department of ECE	Collection of Electrical Energy Parameters, Water, Fuel consumption from Hostel Side
	<b>Mr. S. RAJA MUNIYASAMY</b> Assistant Professor, Department of Civil Engg.,	
4.	<b>Mrs. S. SULOCHANA</b> Assistant Professor, Department of ECE	Collection of Chemical/Salts/Acids
5.	<b>Mr. J. RAVI KUMAR</b> Physical Director / Transport In charge	Collection of Fuel consumption from college side
6.	<b>Mr. S. JOHNSON</b> Office Admin	Collection of LPG consumption Data
7.	<b>Mr. M. MANIKANDARAJAN</b> Lab-Technician, Department of Mech. Engg.,	Collection of data regarding Trees and plants

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**ENERGY, ENVIRONMENT &  
GREEN AUDIT REPORT**

**2. EXECUTIVE SUMMARY**

**PART-A: ENERGY AUDIT REPORT**

## EXECUTIVE SUMMARY

### 2.1: Electrical and Thermal Energy Analysis:

A detailed audit was conducted in THAMIRABHARANI ENGINEERING COLLEGE, Thatchanallur, Tirunelveli - 627 358, Tamil Nadu, India. The audit team has come out with **5 Energy Conservation Proposals (ENCONs)** and the summary of all the ENCONs are given below:

S. No.	Description	Parameters		
		Present	After	Savings
1.	Annual Energy Consumption	28,096 kWh + 3,230 kg LPG	18,268 kWh + 3,068 kg LPG	9,828 kWh + 162 kg LPG
2.	Annual Energy Cost	Rs. 5.2 Lakhs	Rs. 4.0 Lakhs	Rs. 1.2 Lakhs
3.	Initial Investment Required	-	-	Rs. 2.7 Lakhs
4.	Simple Payback Period	-	-	Nearly 2.3 Years

Table-1: Energy Conservation Proposal (ENCON) along with Annual Energy and Financial Savings

S. No.	Proposed Energy Conservation Measures	% Saving & Source	Estimated Savings		Initial Investment (Rs.)	Payback Period
			Annual Energy Savings	Monetary Savings (Rs.)		
1.	Reduction of Cable Losses & Power Consumption using Load End Capacitor Compensation (At DB Level)	3.0 % (Electrical)	878 kWh	9,658	16,000	1.7 Years
2.	Replacement of Existing Water Pumps into BEE Star Labelled Energy Efficient Pumps.	20 % Pump & Motors	1,200 kWh	13,200	25,000	1.9 Years
3.	Replacement of Fluorescent Lamps with Energy Efficient Lamps (Swap FTL to LED Lamps)	50 % on Lighting	2,500 kWh	27,500	40,000	1.5 Years
4.	Replacement of Existing Convention Ceiling Fans into EC BLDC Fans	50 % on Fans Load	5,250 kWh	57,750	1,80,000	3.1 Years
5.	Reduction of LPG Consumption using Regular Burner Cleaning and Swapping of Active Burners.	5 % of LPG for Stove	162 kg	11,502	5,000	0.5 Years
Total			9,828 kWh + 162 kg LPG	1,19,610	2,66,000	-

Audit Conducted and Verified by



(Dr. S.R. SIVARASU)

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**ENERGY, ENVIRONMENT &  
GREEN AUDIT REPORT**

**PART-A: ENERGY AUDIT REPORT**


**3. STUDY ON ENERGY  
CONSUMPTION &  
GENERATION PATTERN**



**3.1: Assessment of Existing Electrical and Thermal Energy Systems:**

S. No.	Description	Parameters
<b>Electrical Energy (Consumption)</b>		
1.	Name of the customer (As per the utility bill)	<b>KALAIARASI EDUCATIONAL TRUST &amp; M.R. PAULRAJ THAMIRABHARANI ENGINEERING COLLEGE</b>
2.	Type of Utility Supply, Service No. & Tariff	LT SC. No: 07-007-013-230; Tariff-LT-II-B2 LT SC. No: 07-007-013-545; Tariff-LM-61 (Temporary Supply)
3.	Tariff Structure	Rs. 7.50/kWh + Rs. 120 as demand charges - College Rs. 12.0/kWh + Rs. 690 kVA as demand charges - Temporary
4.	Permitted Demand (PD)	LT SC. No: 07-007-013-230; <b>99.83 kW</b> LT SC. No: 07-007-013-545; <b>4 kW</b>
5.	Specification of the Diesel Generator (DG) Set	<b>63 kVA (200 L internal tank), Air-cooled - 1 No</b>
<b>Electricity from EB</b>		<b>Electricity from DG</b>
29,266 kWh (Both services)		83 kWh (0.3 % Contribution)
<b>Diesel Consumption for DG</b>		
26 Litres		
6.	Types of Thermal Energy Used	Liquified Petroleum Gas (LPG)
		Diesel (Ordinary)
<b>Annual Thermal Consumption</b>		LPG Consumption - 3,230 kg
		Diesel for Transport - 21,407 Litres
<b>General Loads (Both Electrical and Thermal)</b>		
7.	Lighting System	<ul style="list-style-type: none"> <li>Indoor lighting: Conversion of Florescent Tube Light (FTL) into LED in a phased manner</li> <li>Outdoor lighting: Combination of FTL, CFL &amp; LED</li> </ul>
8.	Fan Loads (Ceiling)	<ul style="list-style-type: none"> <li>All the indoor ceiling fans are conventional fans.</li> </ul>
9.	HVAC System	<ul style="list-style-type: none"> <li>Unitary air conditioning system installed in the required places</li> <li>Most of the AC units are <b>BEE star rated</b> and the outdoor units are mostly placed in shading.</li> </ul>
10.	Motors and Pump loads	<ul style="list-style-type: none"> <li>Mainly used for water distribution &amp; purification.</li> <li>Small motors are used in kitchen equipment's.</li> </ul>
11.	Uninterrupted Power System (UPS)	<ul style="list-style-type: none"> <li>All the computers, servers, surveillance systems, projectors, telephonic units are connected with UPS (<b>35 kVA Capacity</b>) with nominal back up time of <b>15-30 min.</b></li> </ul>

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**Table-2: Annual Consumption of Electrical & Thermal Energy Parameters (2020-21)**

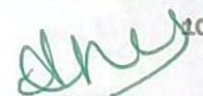
S. No.	Month	Electricity Consumption/ Generation (kWh)			LPG Consumption (kg)	Diesel Consumed (L)		
		SC. 230	SC. 545	From DG		DG	Transport	Total
1.	Jun-20	1,893	430	0	238	0	0	0
2.	Jul-20	1,349		0	204	0	0	0
3.	Aug-20	1,445	170	0	204	0	50	50
4.	Sep-20	1,664		0	306	0	1081	1,081
5.	Oct-20	1,884	400	83	238	26	1867	1,893
6.	Nov-20	1,824		0	221	0	2839	2,839
7.	Dec-20	3,104	170	0	306	0	3381	3,381
8.	Jan-21	2,035		0	221	0	2696	2,696
9.	Feb-21	2,937	0	0	340	0	4328	4,328
10.	Mar-21	4,409		0	442	0	4490	4,490
11.	Apr-21	4,420	0	0	442	0	492	492
12.	May-21	1,133		0	68	0	183	183
<b>Average</b>		<b>2,341</b>	<b>-</b>	<b>-</b>	<b>269</b>	<b>-</b>	<b>-</b>	<b>-</b>
<b>Total</b>		<b>28,096</b>	<b>1,170</b>	<b>83</b>	<b>3,230</b>	<b>26</b>	<b>21,407</b>	<b>21,433</b>

(The average cost of the I) electricity is Rs. 11.00/kWh & II) LPG is Rs.71 /kg)

**3.2: Recommendations and Best Operating Practices:**

- ⊕ The temporary connection for construction activities (nearly 4 kW at Tariff LM-61) has to be surrendered immediately if the construction activities are over.
- ⊕ All SSB must be fitted with digital energy meters and the readings must be taken daily. Or connect those meters with EMS and monitor the energy pattern of each building
- ⊕ Prepare block wise maintenance checklist of electrical and thermal system
- ⊕ Calculate the Unit Per Litre (UPL) for every run of DG and average it for monthly
- ⊕ Adopt a policy and fix a target to convert the existing conventional lightings and fans into energy efficient lights and fans
- ⊕ Install AIRCON energy saver gadget which works on dynamic un-saturation principle with the sensor algorithms so that the air conditioners run hours are cut by 20 to 25 %.
- ⊕ Similar to Fan, now BLDC based ACs are made available in the market; which consumes less amount of energy (Power) during its starting and running condition.
- ⊕ Install a dedicated unbalanced type servo stabilizer (with suitable power rating may be 15 kVA, 3-Phase input; 3-Phase output) through which all the lighting loads may be connected to ensure the optimum voltage of say 210 V.
- ⊕ It is essential and the right time to form an Energy Management Team

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**ENERGY, ENVIRONMENT &  
GREEN AUDIT REPORT**

**PART-B: ENVIRONMENT AUDIT**

**4. ESTIMATION OF CO<sub>2</sub>  
EMISSION  
& NEUTRALIZATION  
(ELECTRICITY, DIESEL, LPG & MATURE TREES)**

**4.1: Assessment of Annual Energy Usage:**

Table-3 shows the types of energy carriers used for their regular operation in the college campus along with application area and their source.

**Table-3: Energy Carriers, Application area and their sources used for College Operation**

S. No.	Type of Energy Carrier	Application Area	Source of Procurement
1.	Electricity LT Service for College + One temporary service (Construction Activities)	Powering to all electrical / electronic / HVAC equipments / Motors / Pumps	From TANGEDCO
			Captive power plant Installed at Main Buildings
2.	Diesel	Transport vehicles and Diesel Generator (Captve Generation)	From authorised distributor
3.	Liquified Petroleum Gas (LPG)	Used for cooking application	
4.	Mature Trees	Nearly <b>626 nos</b> of different varieties with more than 10 years old.	

**4.2: Environmental System: CO<sub>2</sub> Balance Sheet:**

The following tables provide the balance sheet indicating various energy carriers associated with the regular activities and their CO<sub>2</sub> mapping.

**Table-4: Environmental System: CO<sub>2</sub> Balance Sheet (2020-21)**

S. No.	Annual Energy Consumption & CO <sub>2</sub> Emission			Annual CO <sub>2</sub> Neutralization		
	Description	Annual Usage	CO <sub>2</sub> Emission (Tons)	Description	Annual Usage	CO <sub>2</sub> Neutralized (Tons)
1.	Diesel	21,433 Litres	56.6	Mature Trees	626 No's	13.6
2.	Electrical Energy	29,266 kWh	24.0			
3.	LPG	3,230 kg	9.7			
<b>Total Emission</b>			<b>90.3</b>	<b>Total-Neutralized</b>		<b>13.6</b>
<b>Balance CO<sub>2</sub> to be Neutralized = 76.7 Tons/Annum &amp; Per Capita CO<sub>2</sub> Consumption = 0.12 Tons/Annum <sup>1</sup></b>						

(<sup>1</sup> Total strength of students, teaching and technical staff = 650)

**4.3: Calculation Table:**

For Electricity = $\left[ \text{kWh} \times \frac{0.82 \text{ kg of CO}_2 \text{ emission}}{\text{kWh}} \right]$
For Diesel = $\left[ \text{Diesel Consumption (Litre)} \times \frac{2.64 \text{ kg of CO}_2 \text{ emission}}{\text{Litre of Fuel Consumption}} \right]$
For LPG = $\left[ \text{LPG Consumption (kg)} \times \frac{3.0 \text{ kg of CO}_2 \text{ emission}}{\text{kg of LPG Consumption}} \right]$
A mature tree is able to absorb nearly CO <sub>2</sub> at a rate of 21.8 kg/annum; hence total CO <sub>2</sub> to be neutralized is $\frac{(21.8 \times 626)}{1,000} = 13.6 \frac{\text{Tons}}{\text{Annum}}$

**ENERGY, ENVIRONMENT &  
GREEN AUDIT REPORT**

**PART-B: ENVIRONMENT AUDIT**

**5. TRANSPORT & REFRIGERANT  
GASES IN AC SYSTEM**

### 5.1: List of Transport Vehicles:


Pollution level of all vehicles are regularly monitored and are maintained within the prescribed limit since the college is committed to provide green environment for better atmosphere. The list of transporting vehicles along with their type of engine are represented in Table-5.

**Table-5: List of Transporting Vehicles available in the College**

S. No.	Type of Vehicle	Model & YoM	Fuel Used	Availability of Pollution Certificate
1.	BUS	SML 2011	DIESEL	YES
2.	BUS	SML 2011	DIESEL	YES
3.	BUS	SML 2012	DIESEL	YES
4.	BUS	SML 2012	DIESEL	YES
5.	BUS	SML 2012	DIESEL	YES
6.	BUS	SML 2012	DIESEL	YES
7.	BUS	EICHER 2013	DIESEL	YES
8.	BUS	EICHER 2013	DIESEL	YES
9.	BUS	EICHER 2013	DIESEL	YES
10.	BUS	SML 2014	DIESEL	YES
11.	BUS	SML 2014	DIESEL	YES
12.	WINGER	WINGER 2014	DIESEL	YES
13.	BUS	SML 2014	DIESEL	YES
14.	BUS	SML 2014	DIESEL	YES
15.	BUS	SML 2014	DIESEL	YES
16.	BUS	SML 2015	DIESEL	YES
17.	BUS	SML 2015	DIESEL	YES
18.	BUS	SML 2016	DIESEL	YES
19.	VAN	MARCOPOLO	DIESEL	YES

Certificate SL. No.	:	TN07200010014485
Registration No.	:	TN72BE1755
Date of Registration	:	22/Aug/2016
Month & Year of Manufacturing	:	July-2016
Valid Mobile Number	:	*****9655
Emission Norms	:	BHARAT STAGE III
Fuel	:	DIESEL
PUC Code	:	TN0720001
GSTIN	:	
Fees	:	(GST as applicable)
MIL observation	:	No

Vehicle Photo with Registration plate 60 mm x 30 mm	
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**Fig.1: Sample Pollution Certificate**

### 5.2: List of Air Conditioning System along with its Refrigerant:

Most of the AC system has R-22 as refrigerant which has Global Warning Potential (GWP) of 1,810 and Ozone Depletion Potential (ODP) is Medium. Some of the newly installed AC system are having R-410 A as refrigerant which has Global Warning Potential (GWP) of 2,068 and Ozone Depletion Potential (ODP) is Zero.

Table-6: List of Multi-variant AC System available in the TECC

S. No.	Location	Star Rating & Capacity	Quantity	Refrigerant	GWP	ODP
1.	CSE Main lab-I	2 Star&1.5 Ton	6	R 22	1,810	Medium
2.	CSE Main lab-II	3 Star& 1.5 Ton	4	R 410 A	2,068	Zero
3.	Chairman room	3 Star& 1.5 Ton	1	R 22	1,810	Medium
4.	Secretary room	5 Star& 1.5 Ton	1	R 22	1,810	Medium
5.	Principal room	3 Star & 1.5 Ton	1	R 22	1,810	Medium

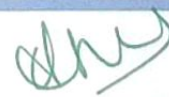
- **Note:** The most environment-friendly refrigerants that are available in Indian market currently are "R-290" and "R-600A". They are Hydrocarbons and their chemical names are "Propane" for R-290 and "Iso-Butane" for R-600A
- They are completely halogen free, have no ozone depletion potential and are lowest in terms of global warming potential. They also have high-energy efficiency but are highly flammable as they are hydrocarbons. (Kindly refer: <https://www.bijlibachao.com/air-conditioners/comparison-of-various-refrigerants-r-410a-r-22-r-290-r-134a-used-for-air-conditioners-and-refrigerators.html>).

Refrigerant	Global Warming Potential	Ozone Depletion Potential
R-22	1810	Medium
R-410A	2088	Zero
R-32	675	Zero
R-134A	1430	Zero
R-290	3	Zero
R-600A	3	Zero

**ENERGY, ENVIRONMENT &  
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**PART-B: ENVIRONMENT AUDIT**

**6. USAGE OF CHEMICALS,  
SALTS & ACIDS  
(STORAGE, HANDLING &  
BEST OPERATING PRACTICES)**





### **6.1: Handling of Chemicals/Salts/Acids used in the Laboratories:**

The science department use chemicals for experimental applications and are having strict safety rules as follows;

- Well trained faculty and lab assistants who have knowledge about the hazardous nature of each and every chemical are only allowed to handle the chemicals safely
- Strictly follow the manufacturer's instruction on the container in order to prevent accidents
- Volatile or highly odorous chemicals, fuming acids are stored in a ventilated area
- Chemicals are stored in eye level and never on the top shelf of storage unit
- All stored chemicals; especially flammable liquids are kept away from heat and direct sunlight. Reactive chemicals are not stored closely
- Hazardous and corrosive chemicals are kept on sand platform to avoid corrosion
- First aid box and fire extinguishers are readily available in the laboratory

### **6.2: Storage of Chemicals/Salts/Acids:**

Less concentrated chemicals, salts and acids are stored in proper racks, cupboards and high concentrated acids are stored in separate area filled with sand.

- Most of the chemicals, salts and acids used in the science departments are inorganic in nature and no harmful effects are created during the experiment process
- However after completion of each experiment, the wastes are washed in the water sink and are routed to common STP
- Only trained teaching and non-teaching staffs are handling the chemicals and also they are well trained to handle any abnormal situations
- Laboratories with chemicals are well ventilated with proper emergency exits. Adequate and correct sequence of fire extinguishers are placed near all the laboratories



**Fig.2: Storage of Chemicals/Salts/Acids & Laboratory Equipments (Rack & Sand Bed)**

**6.3: Use of Chemical for Vessels & Floor Cleaning:**

In order to maintain hygiene in the College campus; the administration regularly clean the floors and restrooms. In addition to this, the hostel management has to monitor 1) the cleaning of vessels, kitchen floor, dining hall, store room and gas station. Table-7 shows the cleaning agents used to clean the above mentioned area;

**Table-7: Cleaning Agents used for Floor and Vessel Cleaning**

S. No.	Cleaning Agent	Application
1.	Soap & Washing Power	Vessel Cleaning
2.	Soap Oil & Bleaching Powder	Floor Cleaning

**6.4: Recommendations: Eco Friendly – Green Cleaning Agents:**

- On an average; the cleaning agents used today have about 62 harmful chemicals like Paraben, Phosphates or Chlorides. A lot of them are multi-purpose cleaners
- It is recommended to use natural ingredients like orange peel extract & vinegar. It leaves a mild and pleasant fragrance after use. The formula is free from all harmful chemicals & toxins. It is pH-neutral, gentle on the skin as well as on the surface where it is used
- Also these products are IGBC GreenPro certified. GreenPro is a mark of guarantee that the product is environment friendly throughout its life cycle
- Fig. 3 shows the sample eco-friendly Green Pro certified cleaning agents



**Fig.3: Green Pro Certified Eco Friendly Cleaning Agents (ZERODER)**

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**PART-C: GREEN AUDIT REPORT**

**7. WATER UTILIZATION,  
CONSERVATION &  
WATER MANAGEMENT**

**7.1: Source of Water, Storage and Distribution:**

Table-8 shows the source of water, location of storage along with their application.

**Table-8: Source of Water, Location of Storage and Application**

Type of Water	Source	Application
Bore Water + Open Well	• Bore-1; Main Building - 300 ft	<ul style="list-style-type: none"> <li>• Input to the RO plant</li> <li>• Cooking Utensil Cleaning,</li> <li>• Bathing &amp; Cloth Washing</li> </ul>
	• Bore-2; ECE Block - 300 ft	
	• Bore-3; Mech Block - 300 ft	
	• Bore-4; Boys Hostel - 300 ft	
	• Bore-5; Girls Hostel - 300 ft	
Rain Water (6 Nos)	<ul style="list-style-type: none"> <li>• Collected from I) buildings run off and II) road run-offs</li> <li>• Each building has one RWH</li> </ul>	<ul style="list-style-type: none"> <li>• Used to increase the ground water level</li> <li>• Small pond is also available to collect the rain water</li> </ul>
	Treated Water using RO Plant (2 Nos of different capacity) from Bore and Well Water	<ul style="list-style-type: none"> <li>• RO Water: Drinking and Cooking</li> <li>• Grey Water: For Gardening &amp; Vessel Cleaning</li> </ul>
<ul style="list-style-type: none"> <li>• Raw water tank capacity and Location</li> </ul>	• Main Building - 5,000 L x 4 Nos	• 20,000 Litres
	• ECE & CSE - 3,000 L x 2 Nos	• 6,000 Litres
	• Mech & Civil - 5,000 L x 1 No	• 5,000 Litres
	• Thermal Lab - 1,000 L x 1 No	• 1,000 Litres
	• Boys Hostel - 3,000 L x 4 Nos	• 12,000 Litres
	• Girls Hostel - 3,000 L x 4 Nos	• 12,000 Litres
	• Mess - 3,000 L x 1 Nos	• 3,000 Litres
<ul style="list-style-type: none"> <li>• All are HPDE tanks and monthly once cleaned (Good practice).</li> <li>• Water filling is now in manual operation.</li> </ul>		

**7.2: Treated Water for Drinking Application:**

- The college management is keen on providing uninterrupted, safe and healthy drinking water to all; throughout the year.
- The overhead tanks storing the drinking water are cleaned at regular intervals and the water management team has been maintaining a cleaning schedule
- The specifications of RO Plant and distribution of potable water to the entire campus is given in Table-9.

**Table-9: Specifications of RO Plant and Potable Water Distribution System**

S. No.	Parameters	Description
1.	Total no. of RO Plant	• 05 No's (Total 450 LPH)
2.	Location of RO Plants	• Main Building - 50 LPH - 1 No
		• EE Building - 50 LPH - 1 No
		• CSE Building - 50 LPH - 1 No
		• Mechanical Building - 50 LPH - 1 No
		• Hostel - 250 LPH - 1 No
3.	Source of raw water	• Bore & Open well water
4.	% of RO & grey water output	• 70 % RO water : 30 % grey water
5.	Usage of grey water	• Used for gardening & vessel cleaning
6.	Cleaning schedule of filter	• Once in three months (Replaced every year)
7.	Cleaning schedule of membrane	• Yearly twice
8.	Functioning of RO Plant	• Manual operation
9.	Quality of RO water	• Internally tested
10.	RO water storage	• Stored in the HPDE tanks connected with taps for distribution
11.	RO water tank capacity & location	• 15 Litre in Mech building - 1 No
		• 15 Litre in Civil building - 1 No
		• 15 Litre in EEE building - 1 No
		• 15 Litre in ECE block - 1 No
		• 15 Litre in Main building - 3 No
		• 1,500 Litre in Hostel - 1 No (For both boys & girls hostel)

**7.3: Water Savings in Foreign Toilets:**

- The list of availability of Indian & Foreign style toilets are presented in the below Table-10.

**Table-10: List of Indian & Foreign Style Toilets**

S. No.	Location	No. of Toilet		Urine Outlets
		Indian	Foreign	
1.	Main Block-Ground Floor (Girls)	6	1	-
2.	Main Block-Ground Floor (Boys)	1	1	7
3.	Main Block-Ground Floor (Management-Ladies)	6	1	-
4.	Main Block-Ground Floor (Management-Gents)	1	1	7
5.	Main Block-First Floor (Boys)	2	2	14
6.	Main Block-First Floor (Girls)	12	2	12
7.	CSE Block -Boys	4	1	7
8.	CSE Block, Faculty Room & HOD Room -Girls	9	3	-
9.	EEE & ECE Block, Faculty Room & HOD Room - GF (Girls)	18	6	-

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10.	EEE & ECE Block - First Floor (Girls)	9	1	-
11.	EEE & ECE Block - Ground Floor (Boys)	8	2	14
12.	EEE & ECE Block - First Floor (Boys)	4	1	7
13.	MECH Block, Faculty Room & HOD Room - GF (Girls)	9	3	-
14.	MECH Block - Ground Floor (Boys)	4	1	7
15.	CIVIL Block, Faculty Room & HOD Room - Ground Floor (Girls)	9	3	-
16.	CIVIL Block - Ground Floor (Boys)	4	1	7
17.	Boys Hostel	28	4	-
18.	Girls Hostel	28	4	-
<b>Total</b>		<b>162</b>	<b>38</b>	<b>82</b>

- In general the flush tank capacity may be 8 to 10 Liters (depends on make and model). Water savings also leads to power saving it saves the operating duration of the water pumps directly.

#### **7.4: Rain Water Harvesting (RWH) - from Building Roof Area & Run-off Area:**

- The audit team appreciates the effects taken by the management of **THAMIRABHARANI ENGINEERING COLLEGE** for harvesting the rain water almost in all buildings.
- The roof area is so arranged to collect the rainwater and then passed through proper piping system, and then bring back to the RWH pits which are located close to each pits
- The building run off are collected through each pits mostly located in each buildings. Common area and road run-off are properly collected and routed to nearby water body.



**Fig.4: Rain Water Harvesting (RWH) system & Water Body Implemented In the College**

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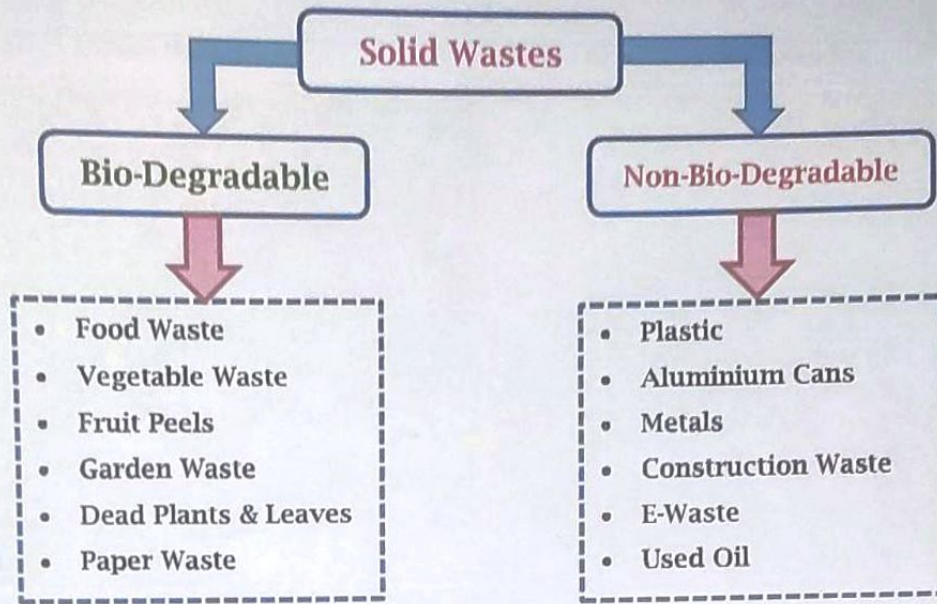
**PART-C: GREEN AUDIT REPORT**

**8. WASTE HANDLING &  
MANAGEMENT**



**8.1: Solid Waste Management System:**

Different types of wastes generated inside the college premises are represented in the block diagram given below.



**8.2: Process of Solid Waste Management:**

The college management practised some methods to treat the waste generated and Table-11 shows the process of treating the solid waste generated inside the college campus.

**Table-11: Process of Waste Management**

S. No.	Waste Type	Waste Treatment
<b>Bio-Degradable Waste Management</b>		
1.	Food and Vegetable Waste	Collected and dumped in a yard (used as manure)
2.	Garden Wastes and Plant Leaves	Daily collected and dumped in a yard
3.	Paper Waste	Collected and stored in a separate place
		Sold to third party for recycling
4.	Napkin Pads	Collected, dumped in a yard; set fire and destroyed
<b>Non-Bio-Degradable Waste Management</b>		
5.	Plastics	Banned in the college campus (Welcome step). The chemical/salt storage plastic containers are disposed to third party
6.	Metals	Construction metals or metals from any other sources are stored in a separate place
		Used for sale to third party for recycling
7.	Transport Oil + Tyres	Stored in a separate place and used for sale to third party



8.	Transport Vehicle and Computer Batteries	Procuring new batteries with buyback offer (old battery replacement)
9.	Used edible oil	Almost zero waste. Mostly used for internal cooking and frying.
10.	E-Waste Management	Used for sale to third party for recycling



**Fig.5: Solid Waste Management & Sample Bill Copy representing the Battery Buyback**

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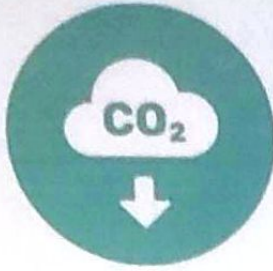
**9. ASSESSMENT ON MATURE  
TREES & BIO-DIVERSITY**



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### 9.1: Campus Greenery:

The college is completely covered with mature trees grown for more than 10 years. The total number of mature trees available in the college campus is **626 with 30 varieties of trees**. Apart from the mature trees; preserving the ecology; the entire college campus is planted with various flowering shrubs and bushes.



Total No. of Mature Trees available in the college campus is **626** which contributes for reduction of **13.6 Tons of CO<sub>2</sub> emission/Annum**

### 9.2: Implementation of Indoor Plants as Natural Air Purifier:

- Indoor plants not only do plants look good while bringing life to our living space, they also help purify the air, according to a NASA study that explains that even a small plant inside the workspace can help remove at least three household toxins (think benzene, formaldehyde, and trichloroethylene, which are carcinogenic chemicals commonly found in stagnant indoor environments).
- The college has planted many indoor plants which acts as a natural air purifier one can try with indoor area to remove toxins and improve air quality.



Fig.6: Indoor Plants Planted In the College Campus

AUDIT  
SUMMARY &  
CONCLUSION

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### **SUMMARY OF THE AUDIT PROCESS:**

In order to make the THAMIRABHARANI ENGINEERING COLLEGE campus 100 % energy efficient; Environmental sustainability and lush Greenery; the audit team recommends to implement the following measures:

#### **I. Energy Conservation & Management – Electrical Energy:**

- Plan to install a minimum of 10 kW (up to 25 kW) Roof top solar PV system
- In a phased manner, ceiling fans must be changed from conventional fans into BLDC fans. Also change FTL into LED with adequate illumination levels
- Implement Energy Management System (EMS) to accurately measure & monitor energy flow
- Prepare a policy plan to convert the distributed UPS layout into centralized UPS and save energy. This step also saves the maintenance time due to reduction in number of batteries
- Implement automatic street light controller to turn on and off based on different time in a day. Use astrological timer for better results and energy savings
- Diesel flow meter must be fitted with each DG and calculate the UPL accurately
- Prepare suitable formats for all energy consumption and regularly follow the records. At regular intervals conduct internal audits to assess the effectiveness of the practice. Make proper corrections; if it deviates from the standard operating procedure
- Regularly conduct i) Illumination study, ii) Thermal comfort study, iii) Flue gas study on DG, and Boiler, iv) Water quality assessment (for all types of water utilized) and v) Indoor and ambient air quality study

#### **II. Energy Conservation & Management – Thermal Energy:**

- Regularly clean the stove burners and ensure that the flame should be in light bluish colour

#### **III. Water Conservation & Management:**

- Construct a suitable capacity of Sewage Treatment Plant (STP) for proper liquid waste management
- To check the quantity of water utilized by each buildings by connecting digital water flow meter and optimize the water usage
- Prepare and maintain a Single Line Diagram (SLD) for water distribution network
- Try to reduce water tapped from the ground water source since it is not environmental friendly
- Paste water and energy saving slogans at appropriate places
- Generate your own power and water for regular activities and move towards Net Zero Energy and Net Zero Water Building
- Retrofit aerator based water taps for good water savings. For hand washing applications, all the pipes must be fitted with aerators
- Captures almost 100 % rain water harvesting through i) Recharging pits and ii) Open well type storage pits
- Properly follow scientific method of handling chemicals/Acids/Salts and safe disposal through 3<sup>rd</sup> party
- Water treatment log (for RO plant) must be maintained indicating the water inlet, treated and outlet water quantity
- Install sensor based water controller in each Over Head Tanks and reduce the water waste and power required to operate the pump

  
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- Energy required to process the water treatment must be calculated
- Overall cost of treated water by accounting i) consumables, ii) manpower iii) energy and iv) other conventional expenses
- Use the treated water at the maximum in whatever possible areas and try to minimize the fresh water intake (from any source)
- Set a policy and fix a target for usage of treated water; ensure that the plan is being executed without any deviation. Increase the % of usage of treated water year by year
- With the advent of smart technologies, it is possible to have centralized monitoring in real-time using Internet of Things (IoT), Geographic Information System (GIS) software, etc. as per **Jal Jeevan Mission, Department of Drinking Water & Sanitation Ministry of Jal Shakti**
- Awareness campus must be conducted to all the stakeholders at regular interval. Through this initiative; Painting, Photography, Slogan and Poster making contest are conducted to create consciousness among the students and faculties

#### **IV. Waste Management:**

- Cotton, Syringe, Needles are to be kept separately as these are treated as Bio-Medical wastes
- **Yellow dust bins** must be placed to collect these bio-medical wastes
- After COVID; mask, sanitizer bottles, gloves and other medical items must be trashed only through the yellow bins
- This must be informed to all the students and stakeholders. Suitable steps have to be taken to disseminate this information
- All the solid wastes are to be properly stored in a separate place and should be maintained as a record mentioning its quantity
- The food waste must be weighted and marked in a record before keeping into the digester unit. This must be checked with the amount of gas generated using suitable calculation and check with the designed output
- Any waste items given to trust office or to the 3<sup>rd</sup> party must have a record of the respective department
- **Reduction of Paper:** Workout a policy to move towards paperless office. Present system of paper usage may be reviewed and wherever possible; digitalize the activities and reduce the paper
- Use bar code scanning to identify the location, row and seat number of candidates during examination and avoid paper information pasted in the notice board
- Publish the internal marks, model examination marks through student ERP.
- Make attendance report, feedback, payments, salary slip in digital platform and if necessary take prints (only office copy)
- Adopt College Management System (CMS) and try to automate
- Automation saves energy, saves man power, saves paper, leads to better transparency, efficient man power utilization and thus saves cost

#### **V. Impart Training to Faculty and Technical Staffs:**

- ❖ Energy Conservation and Management
- ❖ Environmental Impact and assessment

- ❖ Fire and Safety (Operation and Handling)
- ❖ Electrical maintenance, AC, Battery Maintenance & Safety
- ❖ Emergency Preparedness
- ❖ E-Waste, Chemicals Handling & Solid Waste Management
- ❖ Training for Transport employees)
- ❖ Training for Faculty and Students on Vehicle Operation
- ❖ Training for Kitchen Employees
- ❖ General Medical Camps for Employees
- ❖ Training on Stress Management and Yoga

**VI. Way Forward towards Energy & Environmental Sustainability:**

- Prepare an exclusive **Energy and Environment Policy** based on the energy and environment practices followed in the campus. This must reflect the i) Present energy consumption & generation, ii) Projection of energy need, iii) Commitment by the college to conserve energy (in terms of percentage), iv) Road map to achieve the commitment, v) Facilities needed to achieve the same, vi) Roles and responsibilities of all stake holders, vii) Interim and final review mechanism, viii) Corrective measures, if the results deviates from the committed value and ix) Benchmarking, Case study preparation, Knowledge sharing and rewards
- Implement ENCONs and best operating practices proposed in the audit report and measure the results
- Adopt effective Waste Management Policy and reduce the food print of waste generation (Net zero waste campus)
- Practice appropriate ISO standards for System Management. The audit team highly recommend to follow i) ISO-9001 (Quality Management System), ISO-14001 (Environmental Management System) and ISO-50001 (Energy Management System)
- Working towards Net Zero Energy and Net Zero Water Campus and achieve **Platinum rated Global Leadership campus (as per IGBC rating)** and/or **5-star rated campus (as per GRIHA rating)** and/or **GEM-5 rated campus (as per ASSOCHAM GEM rating)**

## COMPLETION OF THE REPORT

This report is prepared as a part of the Energy, Environment and Green Audit process conducted at **THAMIRABHARANI ENGINEERING COLLEGE**, Thatchanallur, Tirunelveli – 627 358, Tamil Nadu, India by **RAM-KALAM CENTRE FOR ENERGY CONSULTANCY AND TRAINING**, Coimbatore – 641 062.

# ENERGY, ENVIRONMENT & GREEN AUDIT REPORT

**ANNEXURE:**  
**AUTHORISED CERTIFICATES OF THE AUDITOR**



Reg No.: EA-27299

Certificate No.: 9645/19



# National Productivity Council (National Certifying Agency) **PROVISIONAL CERTIFICATE**

This is to certify that **SIVARASU SULUR RATHINAVELU**  
son / daughter of Mr. **P RATHINAVELU** has passed the National certification Examination for Energy Auditors held in September 2010, conducted on behalf of the Bureau of Energy Efficiency, Ministry of Power, Government of India. He / She is qualified as **Certified Energy Manager** as well as **Certified Energy Auditor**.

He/She shall be entitled to practice as Energy Auditor under the Energy Conservation Act 2001, subject to the fulfillment of qualifications for Accredited Energy Auditor and issuance of certificate of Accreditation by the Bureau of Energy Efficiency under the said Act.

This certificate is valid till the Bureau of Energy Efficiency issues an official certificate.

Digitally Signed by: K V R RAJU  
Mon Apr 22 16:22:43 IST 2019  
Controller of Examination, NPC AIP Chennai

Controller of Examination

Place : Chennai, India

Date : 22nd April, 2019



## ISO 14001:2015 Lead Auditor (Environmental Management Systems) Training course

it is hereby certified that

**Dr. S. R. Sivasasu**

has successfully completed the above mentioned course and examination

08<sup>th</sup> - 12<sup>th</sup> December 2017

Coimbatore, India

Certificate No. 3521 2982 02  
Delegate No. 71968

Essen, 2018-01-11

Course 10125 is certified by CQI/IRCA and meets the training requirements for those seeking certification under the IRCA EMS auditor certification scheme.

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45141 Essen

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### The Indian Green Building Council

hereby certifies that

**Sivarasu S R**

has successfully demonstrated knowledge on the Green Building Design & Construction, Building Standards & Codes, IGBC Resources & Processes and Green Design Strategies & their impacts required to be awarded the title of

**IGBC Accredited Professional**

K S Venkatagiri  
Executive Director  
IGBC-Geelong GBC

V Suresh  
Chairman  
Indian Green Building Council

Gurmit Singh Arora  
Vice-Chairman  
Indian Green Building Council

200239

30 June 2020



### GREEN RATING FOR INTEGRATED HABITAT ASSESSMENT

### GRIHA CERTIFIED PROFESSIONAL CERTIFICATE

This is to certify that

Sivarasu SR

has qualified as a GRIHA Certified Professional For V. 2015

Date of issue: 18th September 2020

Note : This certification is valid only for GRIHA version 2015.

Chief Executive Officer  
GRIHA Council

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*(Signature)*  
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