Certificate

Of

Energy Audit

This is to certify that **The Madura College, Madurai,** has conducted a detailed **Energy Audit** of their campus for the academic year 2021 – 2022 and has submitted the necessary data and credentials for scrutiny. The activities and measures carried out by the College have been verified based on the field visit and reports submitted and were found to be **Good**. The efforts taken by the Management, faculty and students towards Energy Conservation and use of Renewable Energy and Energy Efficient appliances are appreciated and commendable.

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CQI IRCA Certified Lead Auditor ISO 14001:2015 EMS (UID: 351851)

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THE MADURA COLLEGE

Autonomous Institution
Reaccredited *(3rd Cycle)* with "A" Grade *by* NAAC
(Affiliated to Madurai Kamaraj University)
Madurai – 625 011
TAMILNADU, INDIA

ENERGY AUDIT REPORT 2021-2022

AUDIT / REPORT BY

ALCHEME GREEN ENERGY COMPANY
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ACKNOWLEDGEMENT

We at ALCHEME GREEN ENERGY COMPANY, Madurai are thankful to the Principal for giving us the opportunity to carry out Energy audit at The Madura College, Madurai -625 011. Alcheme Green Energy Company team is also thankful to all other supporting Officers / Staffs of the above institute for their wholehearted support, hospitality and the courtesy extended to the Audit team during the course of the visit.

The following officers from Alcheme Green Energy Company under the guidance of Mr. C. Jebaraj, B.Tech., have carried out the Energy Audit.

Name	Qualifications	Certification Number
Mr. C. Jebaraj	B.Tech., PDGEM., DIS., BEE Certificated Energy Auditor, IRCA Certified Lead Auditor - OHSMS Internal Auditor-QMS CII Certified Carbon footprint Professional	EA-9847
Mr. S. Lakhsmana Kumaran	B.Tech., MSc.,(Env. Science), MBA., IRCA Certified Lead Auditor ISO 14001 EMS	UID - 351851

The following staff from the Institution participated in the audit process

Name	Designation
Dr. J. Suresh	Principal
Mr. S. Sivaramakrishnan	Dean (Academics)
Dr. I. Sahul Hamid	Dean (Planning and Development)
Dr. S. Karuppusamy	Assistant Professor of Botany
Mr. P. Kumar	Electrical Supervisor

Energy Audit - Methodology

Energy audit consists of survey, analysis and inspection of the energy flow in the system. Its aim is to find the scope of energy conservation by implementing energy saving procedures without affecting the outputs of the system. Energy audit plays a significant role in finding opportunities to save energy and reduce electricity bills / carbon emissions. Energy audit recommends ways to implement renewable energy systems & energy efficiency enhancement technologies thereby reducing the overall carbon footprint and to achieve carbon “net zero” emissions.

Step 1: Pre-audit data collection

The main purpose of this step is to evaluate the characteristics of the energy systems and the energy use. Some of the tasks that can be performed in this step are presented below, with the key goals expected from each task:

- Identify the energy consumption
- Determine the consumption patterns of energy
- Understand utility rate structure (energy and demand)

Step 2: Walk-Through Survey

In this step we should identify potential for energy savings measures. The results of this step are important since they determine if it requires any further energy auditing work. Some of the tasks involved in this step are

- Identify the customer’s concerns and needs
- Check the current operating and maintenance procedures
- Determine the existing operating conditions of major energy use equipment
- Estimate the occupancy, equipment, and lighting (energy use density and hours of operation)

Step 3: Baseline for Building Energy Use

The main purpose of this step is to develop a base model that represents the existing energy use and operating conditions. This will be used as a reference to estimate the energy savings due to appropriately selected energy conservation measures. The major tasks to be performed during this step are

- Inspect, test, and evaluate equipment for efficiency, performance, and reliability
- Obtain all energy consuming equipment (including lighting, fans, HVAC systems, motors, pumps etc.,)

Step 4: Evaluation of Energy-Saving Measures

In this step, a list of cost-effective energy conservation measures is determined using both energy savings and economic analysis. To achieve this goal, the following tasks are recommended:

Prepare a comprehensive list of energy conservation measures (using the information collected in the walk-through survey)

Evaluate the cost-effectiveness of each energy conservation measure using an economic analysis method (simple payback or life-cycle cost analysis) The outcome of this audit can recommend for a detail audit with clear evidence and easily implementable suggestions/solutions can be given to reduce energy consumption.

Energy audit consists of:

- Scout energy consumption in the organization
- Find the scope for saving
- Identify the most likely areas for attention
- Identify areas of improvements/ savings
- Set a 'reference point

Summary of Audit

Energy audit of The Madura College was carried on 21.11.2022 by Alcheme Green Energy Company. The Audit team has gone through the data related to TNEB GRID Electrical Energy, Renewable Energy, Diesel and LPG consumption. A study was also carried out on Renewable energy utilisation and Energy Conservation measures to reduce energy consumption.

During the visit it was observed that The Madura College strictly follows reduce, reuse and recycle policy to limit energy usage. The concept of energy conservation is disseminated among the students and staffs through various seminars/workshops and training programs.

We hope that the results presented in the energy auditing report will serve as a guide for the institution on the existing energy related practices and resource usage.

Noteworthy

Installation of 25KW Solar Power Plant and utilisation of Green Energy to reduce the usage of energy from TNEB Grid from 02.02.2022

The audit outputs and recommendations are summarised as follows

- Electrical Energy consumption from TNEB during the year 2021-2022 –1,61,251 units.
- Electrical Energy consumption from Diesel Generator – 3,300 units.
- Solar Power Electrical energy consumption from 25 KW Power Plants – 12,198 units (from 02.02.2022
- Total Electrical Energy consumption from EB,DG and Solar –1,76,749 units.
- Solar Electrical Energy contribution on Total Electrical energy is 6.9 % Only
- LPG consumption -3,952 Kgs
- Solar Energy usage on Total energy usage is 5.27 % Only
- Lot of Energy conservation initiatives are taken.
- More Renewable energy utilisation shall be planned in the coming years
- Periodical cleaning of Solar Power plant to be carried out.

ENERGY SAVING POTENTIALS

1.**Conventional tube lights shall be replaced with LED tube lights**

Replacement cost for 100 LED tube lights-Rs 180x100= RS 18,000
Payback period-16 months
Cost savings for 100 LED tube lights-Rs 13,300 / year
Energy savings for 100 LED tube lights-2,200 units/ year

2**.Conventional fans shall be replaced with energy efficient fans**

Replacement cost for 100 Nos. ENERGY EFFICIENT FAN-Rs 2,800x100= RS 2,80,000
Cost savings for 100 Nos. ENERGY EFFICIENT FAN -Rs 30,800 / year
Energy savings for 100 Nos. ENERGY EFFICIENT FAN -5,100 units/ year
Payback period 107 months

- Remaining Conventional Tube lights shall be replaced with LED tube lights in a phased manner
- 5 Star rated Energy efficient electrical equipments shall be procured in future

We are happy to submit this detailed energy audit report to The Madura College

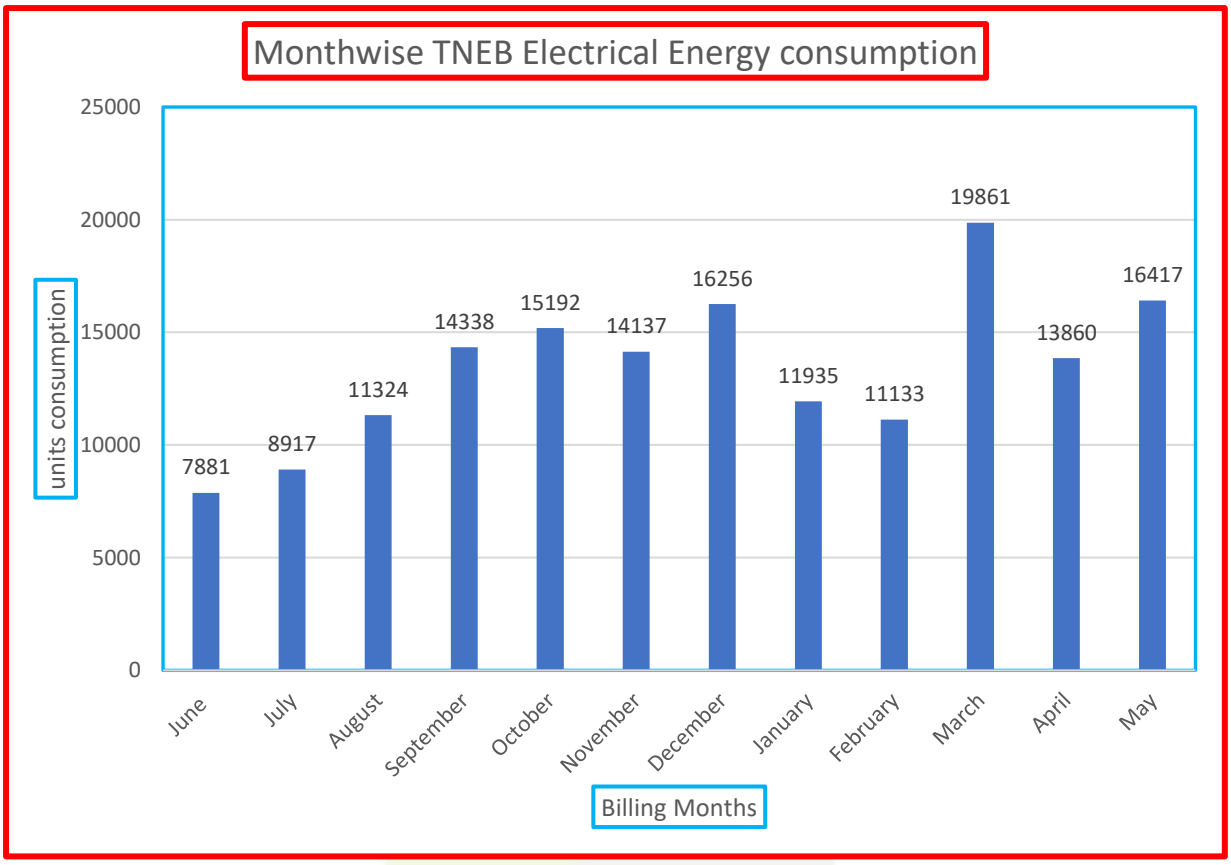
Alcheme Green Energy Company
Madurai

1. TNEB LT Service connection Tariff, Connected Load and Energy Cost and consumption details

TNEB LT SERVICE CONNECTION DETAILS	
Service Number	05 021 001 618
Maximum Demand Permitted	112 KW
Tariff	LM 2B1
Energy Cost	Rs 5.75/ unit
Fixed Cost	Rs 120/KW for every two months

1.Service No 05 021 001 618 112 KW 3 Phase Tariff LM2B1

Sl. No.	Assessment Date	Months	Units Consumed	Bill Amount -Rs	Unit cost-Rs
1	30.06.2021	June	7881	54420	6.91
2	27.07.2021	July	8917	60690	6.81
3	27.08.2021	August	11324	75263	6.65
4	27.09.2021	September	14338	93556	6.53
5	27.10.2021	October	15192	98741	6.50
6	27.11.2021	November	14137	92341	6.53
7	28.12.2021	December	16256	105260	6.48
8	27.01.2022	January	11935	79043	6.62
9	25.02.2022	February	11133	74237	6.67
10	29.03.2022	March	19861	368865	18.57
11	25.04.2022	April	13860	246330	17.77
12	25.05.2022	May	16417	106154	6.47
	Total		161251	1454900	9.02



2.DG set Electrical Energy consumption

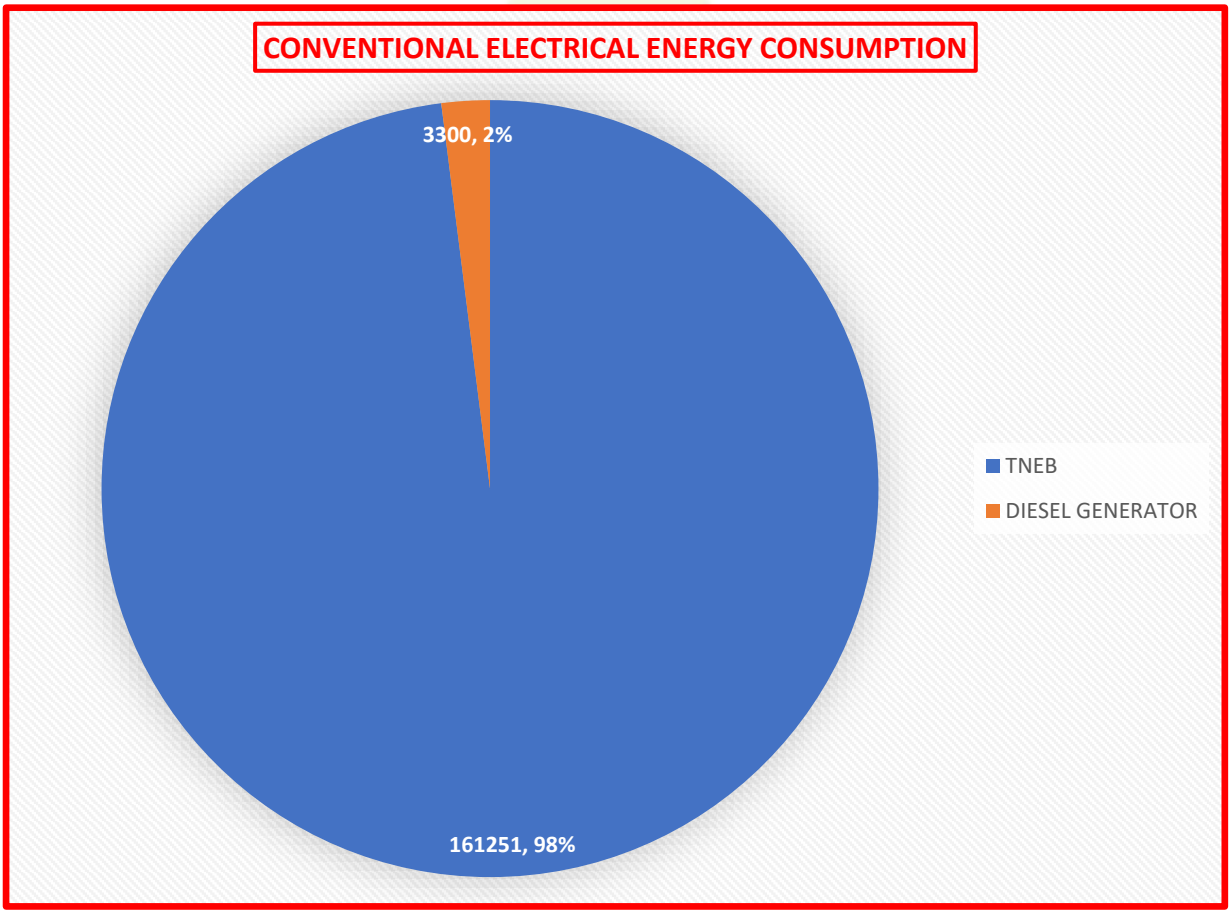
No of DG set- One

Capcity-125 KVA

Electrical Energy Consumption from DG sets- 3,300units

3.Total Conventional Electrical Energy Consumption details

Sl. NO	Source	Consumption in Units	Percentage
1	TNEB	1,61,251	98
2	DG	3,300	2
	Total	1,64,551	100



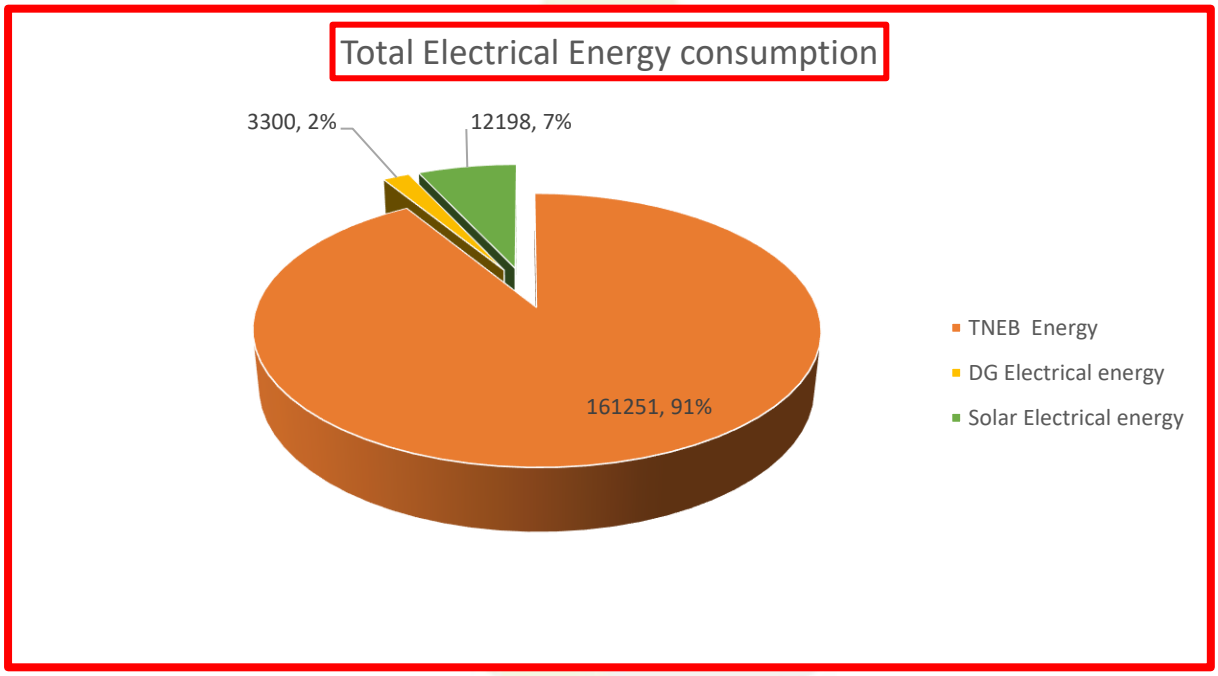
4. Renewable Electrical Energy-Solar Electrical energy Consumption from Solar Power Plant

Solar Power Plant total installed capacity-25 KW

Total Solar energy generation from solar power plant-12,198 units

5.Total Electrical Energy Consumption -Conventional and Renewable

S.L. No	Source	Consumption in units	Percentage
1	TNEB Energy	161251	91.23
2	DG Electrical energy	3300	1.87
3	Solar Electrical energy	12198	6.90
	Total	176749	100.00



6.Conventional Thermal Energy consumption - LPG

- LPG cylinders used- commercial

  LPG cylinders consumed in the college during the year 2021-2022-8

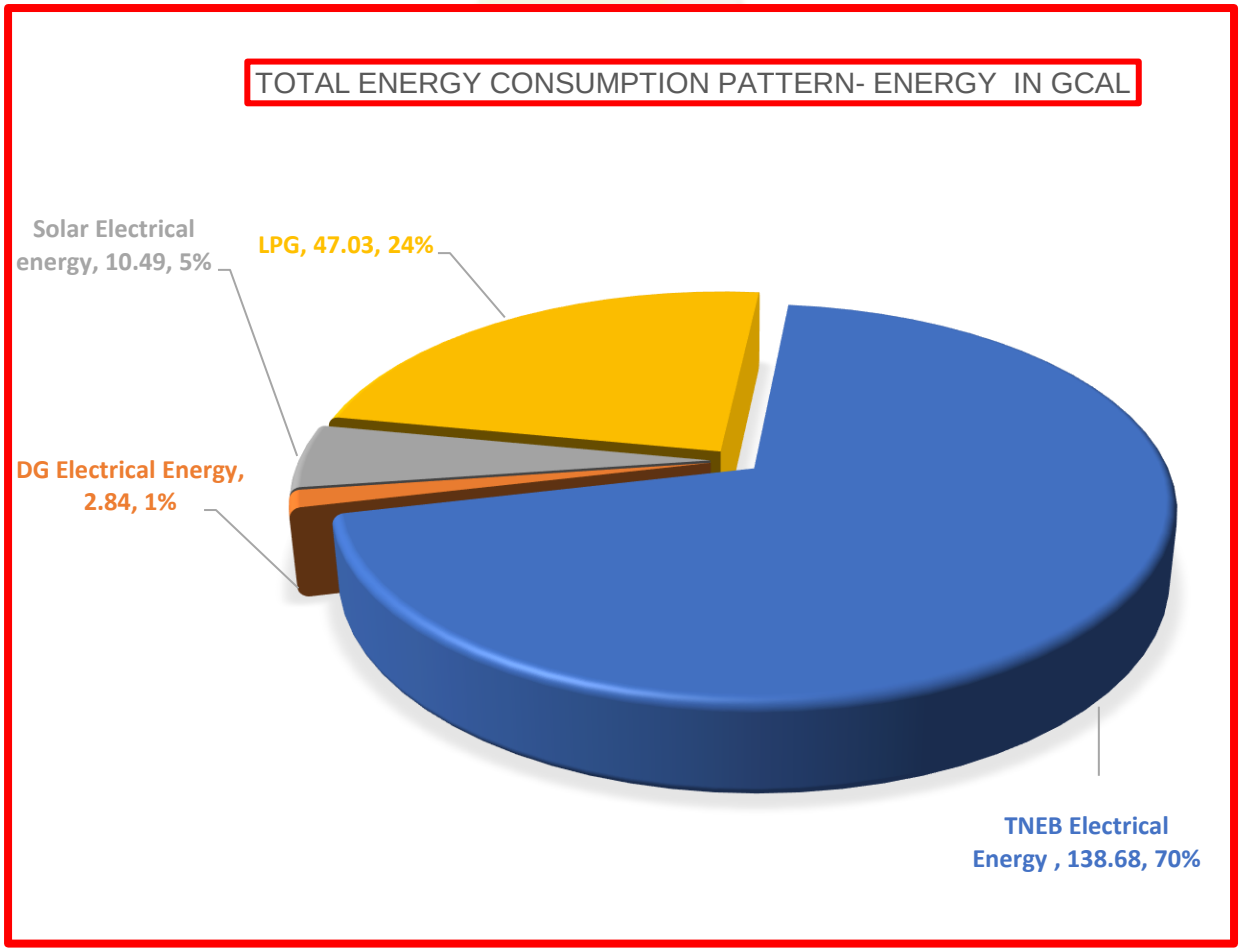
  LPG cylinders consumed in the canteen during the year-2021-2022-200

- Total LPG consumption during the year 2021-2022- 3952 Kgs

7.Total Energy consumption

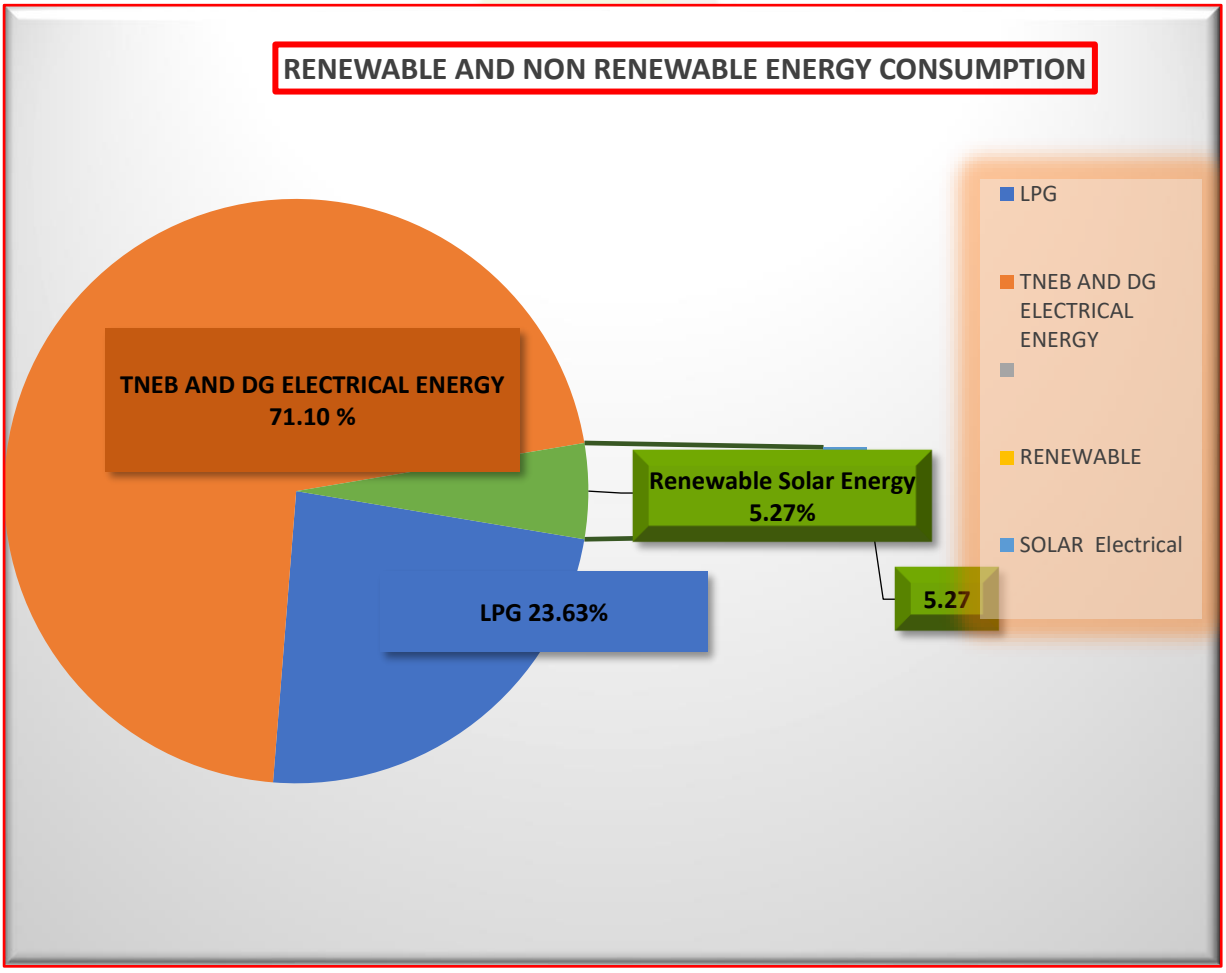
Electrical (Conventional & Renewable) and Thermal(Conventional & Renewable)

SL.NO	TYPE OF ENERGY	ENERGY -GCAL	Percentage
1	TNEB Electrical Energy	138.68	69.67
2	DG Electrical Energy	2.84	1.43
3	Solar Electrical energy	10.49	5.27
4	LPG-Thermal	47.03	23.63
	Total	199.0	100



8.Renewable and Non Renewable(Conventional) energy distribution

ENERGY	PERCENTAGE
NON RENEWABLE	
LPG	23.63
TNEB & DG Electrical	71.10
RENEWABLE	
Solar Electrical	5.27
Total	100.00



9.The energy conservation measures followed

- Regular monitoring of air conditioners is done in order to maintain a temperature of 24ºC in all the places that they are installed in
- Replacing conventional electrical light fittings with energy efficient Light-Emitting Diode (LED) bulbs is going on as continuous process.
- Switching off the fans and tube lights in the classroom and faculty rooms are done after the working hours
- Staff and Students are made aware of using public transport and individual vehicle usage is reduced to the maximum.
- Periodical maintenance and overhauling of generators is being carried out.
- Periodical maintenance of UPS and Battery systems are carried out.
- The air-conditioners and other electronic and electrical equipments are switched off when not in use.
- Computers are switched to sleep mode or hibernate mode automatically when not in use.
- At the end of every practical session, Computer monitors and UPS are switched off.
- Soft copies are maintained instead of hard copies, to reduce power consumption and paper.
- Work supervisor and electrician regularly check the usage of lights, fans and all other energy sources during and out of the college hours.

10.Major Electrical loads

S.I.No	Equipments	Numbers	Load in KW
1	Fans	904	54.240
2	Tube Lights	2047	73.692
3	Computers	311	77.750
4	ACs	50	
5	Refrigerators		8.800
6	Street Lights		5.050
7	Pumps		32.625
8	Online Ups KVA	71	
9	Generator KVA	125	
10	Batteries 150AH	30	
11	Batteries 65AH	104	

LED Lighting loads

S.I.No	LED Bulbs/Tube -watts	Numbers	Total watts
1	15	69	1035
2	22	169	3718
3	25	5	125
4	30	10	300
5	50	42	2100
6	80	13	1040
7	100	3	300
8	200	1	200
9	300	33	9900
Total		345	18718

Lighting Load

- LED lighting load- 18.718 KW
- Conventional Tube light Load- 73.692 KW
- Total Lighting Load- 92.41 KW
- LED lighting load on total Lighting load -20.25%

11.COMMON OBSERVATION AND FEEDBACK

1. Three numbers lightning arrestor was provided at the highest point of the college campus.
2. Solar Power Plant solar PV panels to be cleaned periodically
3. Vegetation around Earth pits to be removed periodically.
4. Earth pits maintenance to be carried out periodically
5. Service of Fire Extinguishers are carried out as per schedule
6. Fire Extinguishers kept on college walls are easily accessible and operable
7. Fire Extinguishers kept at canteen is to be fixed on wall for easy access
8. Fire stand buckets to be maintained as per safety standards
9. Hands on training to operate Fire Extinguishers shall be given to all teaching and non- teaching staffs on periodical manner
10. UPS and Battery rooms are well maintained
11. Battery Purchase details, Warranty periods to be maintained
12. Unwanted/non-related materials from Computer department UPS rooms shall be removed
13. Salt formation on battery terminals to be avoided by applying anti corrosion gels
14. Sign board for Energy conservation to be increased

12.AUDIT FINDINGS & ENERGY SAVING POTENIAL

12.1 Findings

- Electrical Energy consumption from TNEB during the year 2021-2022 – 1,61,251 units.
- Electrical Energy consumption from Diesel Generator –3,300 units.
- Solar Power Electrical energy consumption from 25 KW Power Plants – 12,198 units (From 02.02.2022)
- Total Electrical Energy consumption from EB,DG and Solar –1,64,551 units.
- LPG consumption -3.952 Kgs
- Lot of Energy conservation initiatives are taken.
- More Renewable energy utilisation shall be planned in the coming years
- In Auto Power Factor Control Panel, condition of capacitor banks and relays are to be checked periodically.
- Conduct more awareness programs on importance of energy saving for students and staff
- Remaining Conventional Tube lights shall be replaced with LED tube lights in a phased manner
- 5 Star rated Energy efficient electrical equipments shall be procured in future
- In total Lighting loads, 20.25 % lighting loads are converted into LED lighting system. Remaining Conventional Tube lights shall be replaced with LED tube lights in a phased manner

12.2 Renewable Energy

- Solar Electrical Energy contribution on Total Electrical energy is 6.9 %
- Solar Electrical Energy contribution to be increased and Electrical energy consumption from TNEB grid to be reduced
- On Grid Solar power plant shall be planned in a phased manner in future to achieve 50 % renewable energy target
- Periodical Cleaning of Solar Power plants to be carried out to get the desired output
- In Roof Top Solar Grid Interactive On Grid sytem,1KW solar plant generates 1500 units per year
- By saving one unit of electricity 0.79 KG of CO_2 emission is avoided

Energy saving potentials

1.Conventional tube lights shall be replaced with LED tube lights

Conventional tube light (with electronic choke) energy consumption-40 watts/hr

LED Tube lights energy consumption-20 watts/ hr

Savings per tube light -20 watts/hr

No of hours usage per day – 6 hrs

No of college working days -180 days

Energy savings per tube light per year -180 x6x20= 21,600wh=22 units

Average energy cost- Rs 6.04 /unit

Cost saving per year per tube light-21.6 x 6.04 = Rs 133

Cost savings per month-Rs 11

Approximate Cost of LED tube light -Rs 180

Payback period-16 months

Replacement cost for 100 LED tube lights-Rs 180x100= RS 18,000

Cost savings for 100 LED tube lights-Rs 13,300 / year

Energy savings for 100 LED tube lights-2,200 units/ year

Payback period-16 months

2. Conventional fans shall be replaced with energy efficient fans

Conventional FAN energy consumption-75 watts/hr

ENERGY efficient BLDC fan energy consumption-28 watts/ hr

Savings per fan -47 watts/hr

No of hours usage per day– 6 hrs

No of college working days -180 days

Energy savings per fan per year -180x6x47= 50,760 Wh=51 units

Average energy cost- Rs 6.04 /unit

Cost saving per year per FAN=51 units x 6.04 = Rs 308

Cost saving per month-Rs 26

Cost of ENERGY EFFICIENT BLDC FAN -Rs 2800

Payback period 107 months

Replacement cost for 100 Nos. ENERGY EFFICIENT FAN-Rs 2,800x100= RS 2,80,000

Cost savings for 100 Nos. ENERGY EFFICIENT FAN -Rs 30,800/ year

Energy savings for 100 Nos. ENERGY EFFICIENT FAN -5,100 units/ year

Payback period 107 months