ENERGY AUDIT REPORT

TAMILNADU PHYSICAL EDUCATION AND SPORTS UNIVERSITY

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Report by

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1. ABOUT THE COLLEGE

The Tamil Nadu Physical Education and Sports University established by an Act of the Government of Tamil Nadu in 2004, is unique and the first of its kind in India as an affiliatory University, exclusively for Physical Education and Sports. After obtaining the accent from his Excellency the president of India on 5th August 2005, the said act came into force with effect from 15th September 2005. Accredited with ISO 9001 – 2015 Certification for Quality Management System It has been recognized as a premier institution of higher learning for job-oriented courses The College maintains high standards of excellence in the academic sphere and in the physical amenities and facilities intended to implement the educational programme. The College endeavours to enroll students who hold high standards of performance, discipline and achievement.

VISION

"To engage in relentless pursuit of Excellence in the promotion and development of Physical Education and Sports through innovative programmes in teaching, coaching, research and outreach activities and evolve a holistic approach to the betterment of human resources through a harmonious blend of body, mind and spiri**t"** "

MISSION

1. To create an ideal academic environment for Learning, Scholarship, Professionalism, and Collaboration that fosters Excellence in active student learning and professional growth.
2. To design and introduce innovative, integrated, inter-disciplinary curriculum in Physical Education and various Sports and games and allied areas and provide Leadership to the Profession.
3. To offer unique graduate, Post-graduate and research Programmes in Physical Education, Sports and allied fields.
4. To produce competent health conscious Physical Education teachers at various levels, who will be fully equipped to impart instruction in Physical Education and undertake physical activity programmes for children and youth.
5. To develop High-Tech research facilities and contribute to the body to knowledge through scholarly work and publications, and disseminate the findings to the professionals, faculty and students.

2. INTRODUCTION

The Energy Conservation Act, 2001 defines Energy Audit as "the verification, monitoring, and analysis of the use of energy including submission of technical report containing recommendations for improving energy efficiency with cost-benefit analysis and an action plan to reduce energy consumption".

It is an analysis of energy flows for energy conservation and to find energy losses. It is a process of collection of detailed data related to energy usage and comparison of collected results.It is a process by which we can reduce the amount of energy input to the system without a negative impact on the output.

It includes Inspection, Survey and Analysis of energy flows for energy conservation in a building, a process, or a system to reduce the amount of energy input into the system without negatively affecting the output(s) plugged. It is the quickest, cheapest, and cleanest way to reduce energy consumption.

An energy audit, sometimes referred to as an energy survey or an energy inventory, is an examination of the total energy used in a particular property. The analysis is designed to provide a relatively quick and simple method of determining not only how much energy is being consumed but where and when.

The energy audit will also identify deficiencies in operating procedures and in physical facilities. Once these deficiencies have been identified, it will be apparent where to concentrate efforts to save energy. The energy audit is the beginning of and the basis for an effective energy-management programme.

Increasingly in the last several decades, the demand to lower increasingly expensive energy costs and move towards a sustainable future has made energy audits greatly important.

3. OBJECTIVES OF ENERGY AUDIT

4. BENEFITS OF ENERGY AUDIT

- Energy audits will evaluate your facility “as a whole”, their goal is not to evaluate single measures but to consider a wide range of available alternatives (Electrical, Mechanical, Envelope and Water).
- It will analyse your historical energy use and find potential issues using statistical methods.
- The audit will not only inform you of opportunities but provide you with financial analysis. This will enable prioritization based on financial benefit and return on investment.
- Provide you with solid, easy-to-understand technical information regarding the proposed energy conservation measures
- Provide you with benchmark information to help you understand your energy use performance compared to others in your field and area.
- Provide you with an emissions analysis to help you understand the benefits of your decisions from an environmental standpoint.
- Understand where energy is used, and which areas are worth focusing on the most (energy hogs).
- The cost-benefit analysis of the audit report would help decision-makers prioritize opportunities and evaluate them as investments.
- These indicators would include, rate of return, net present value, cash flow analysis, and payback.

5. STAGES OF ENERGY AUDIT

A structured methodology to carry out an energy audit is necessary for efficient working. An initial study of the site should always be carried out, as the planning of the procedures necessary for an audit is most important.

The stages of an energy audit are:

- Phase – I Pre-audit phase
- Phase – II Audit phase
- Phase – III Post-audit phase

Phase – I Pre-audit phase

An initial site visit may take one day and gives the Energy Auditor/Engineer an opportunity to meet the personnel concerned, familiarize him with the site, and assess the procedures necessary to carry out the energy audit.

During the initial site visit, the Energy Auditor/Engineer should carry out the following actions:-

- Discuss with the site's senior management the aims of the energy audit.
- Discuss economic guidelines associated with the recommendations of the audit.
- Analyse the major energy consumption data with the relevant personnel.
- Obtain site drawings where available - building layout, steam distribution, compressed air distribution, electricity distribution etc. the site accompanied by engineering/production.

The main aims of this visit are: -

- To finalise the Energy Audit team
- To identify the main energy-consuming areas/plant items to be surveyed during the audit.
- To identify any existing instrumentation/ additional metering required.
- To decide whether any meters will have to be installed prior to the audit eg. kWh, steam, oil, or gas meters.
- To identify the instrumentation required for carrying out the audit.
- To plan with time frame
- To collect macro data on plant energy resources, major energy consuming centers
- To create awareness through meetings/ programme

Phase – II Audit phase

The information to be collected during this audit phase includes:

- Energy consumption by type of energy, by department, by major items of process equipment, by end-use
- Material balance data (raw materials, intermediate and final products, recycled materials, use of scrap or waste products, production of by-products for re-use in other industries, etc.)
- Energy cost and tariff data
- Process and material flow diagrams
- Generation and distribution of site services (eg.compressed air, steam).
- Sources of energy supply (e.g. electricity from the grid or self-generation)
- Potential for fuel substitution, process modifications, and the use of co-generation systems (combined heat and power generation).
- Energy Management procedures and energy awareness training programs within the establishment.

Phase – III Post-audit phase

- Plan and schedule an action plan for implementing the corrective measures.
- Follow-up and periodic review.

6. ENERGY MANAGEMENT

This indicator addresses energy consumption, energy sources, energy monitoring, lighting, appliance, natural gas, and vehicles. Energy use is clearly an important aspect of campus sustainability and thus requires no explanation for its inclusion in the assessment. The study carried out also analyzed the use of alternate energy resources that are eco-friendly.

7. OBSERVATIONS

The source of energy for all the buildings within the campus is electricity only. The institution consumes about **1800kW/Month**. However, **20KW** of the daily electricity requirement is supplied from **solar energy**.

The campus contains Lights and fans in use. The entire campus including common facility centers are equipped with LED lamps and LED tube lights, except at few locations. Besides this, photovoltaic cells are also installed in the campus as an alternate renewable source of energy.

Computers are set to automatic power saving mode when not in use. Solar water heaters are installed in hostel buildings and staff quarters as to promote renewable energy. Also, campus administration runs switch–off drill on regular basis. Equipment like Computers is used in power saving mode.

7.1 Solar panels

Solar panel systems are extremely durable and require little to no maintenance over their productive lifetime, which can span 25 years or more. Solar systems are also extremely easy to maintain. The main maintenance that these panels require is an occasional dusting to remove dirt, leaves, or any other fragments. Each kilowatt-hour (kWh) of solar that is generated will substantially reduce greenhouse gas emissions like CO_2, as well as other dangerous pollutants such as sulfur oxides, nitrogen oxides, and particulate matter.

Solar panels in the campus

Photo voltaic cells control unit

7.2 Diesel generator

The college campus is Equipped With Diesel Generators for power backup.The generators were tested for their efficiency, and physical and operating conditions and found to be fit.

Diesel Generator Inside the Campus

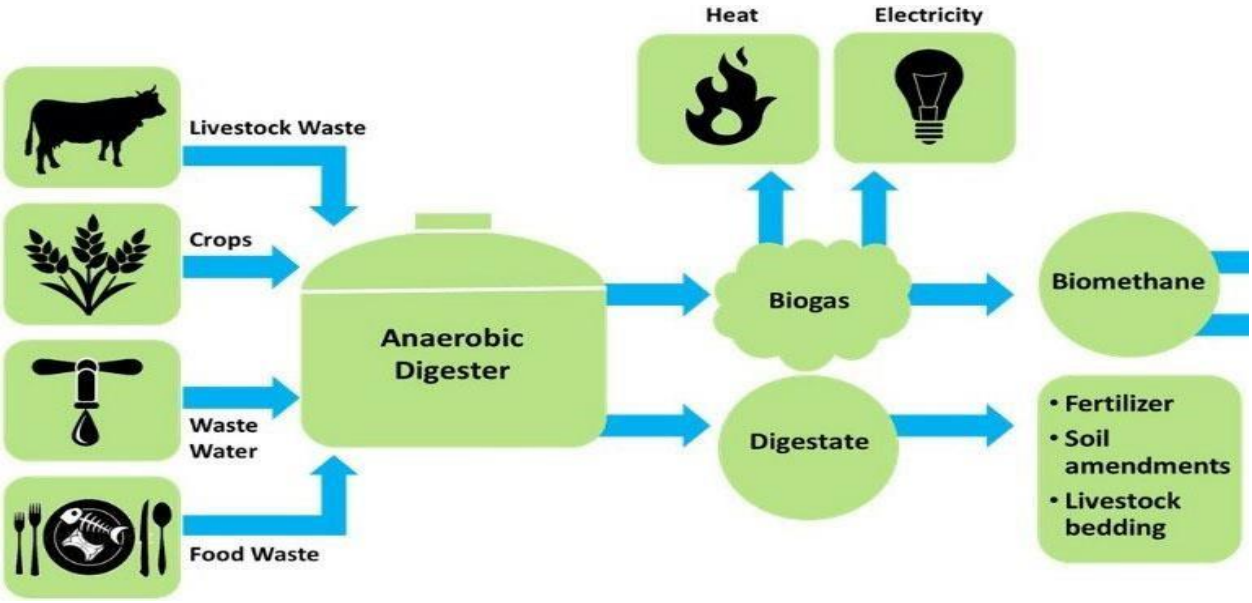
7.3 Biogas Plant

In TNPESU, kitchen waste is used to generate thermal energy for cooking and heating. The biogas produced from food waste, decomposable organic material,and kitchen waste, consisting of methane and a little amount of carbon dioxide is an alternative fuel for cooking gas (LPG).

Kitchen waste is processed and moistened to produce a suspension that subsequently undergoes a fermentation process. Fermentation produces biogas – a valuable energy source – that is desulphurised by biological means. Also, the waste materials can be disposed of efficiently without any odour or flies and the digested slurry from the bio-gas unit can be used as organic manure in the garden.

The major components of the bio-gas plant are a digester tank, an inlet for feeding the kitchen waste, a gas holder tank, an outlet for the digested slurry, and the gas delivery system for taking out and utilizing the produced gas.

The College campus is equipped With $1m^3$ Capacity Biogas Plant to promote the use of alternate energy.Eco-friendly technology allows to produce renewable natural gas in the form of biomethane.The facility processes about10kg of kitchen waste every day. The major waste is organic waste from College hostels, as well as leftover food from campus canteens and expired food.



Biogas production

Biogas Plant Installed inside the Campus

8.Carbon Foot Printing

Carbon Footprint refers to the potential climatic impact (Global Warming) of the Greenhouse Gases (GHG) emitted directly or indirectly due to an organization's activities. A Carbon Footprint Disclosure of any educational institution is very important to understand such that its key emission sources can be identified and necessary mitigation measures can be adopted for carbon reduction.In today's date, very few colleges disclose their carbon emissions. TNPESU has taken a initiative to compute its carbon footprint and set a benchmark for other Colleges/Universities. The college has adopted a carbon reduction strategy to undertake this project.

8.1 Objectives Of Carbon Foot Printing

- Identify key emission sources of GHG at the campus
- Compute Scopes of emissions for operations carried out at TNPESU Campus
- Analyze the results and provide cost effective & efficient measures for reducing the GHG emissions.

8.2 CARBON FOOT SURVEY & ESTIMATION INSIDE THE CAMPUS

Sl.No	Mode of Transport	No of Vehicles	Travellers	To & Fro Km/Per
1	Two Wheelers (Single/Shared)	15	20	20
2	Own Car (Single/Shared)	25	20	15
3	Mini Bus / Private Van	3	200	30
4	Public Transportation / College Bus	-	3000	30

Sl.No	Description	Emission Rate	Annual Consumption/Quantity	Eqt.Co_2 Tonnes/Year
I	Electrical Energy consumption	0.80 kg/kwh	12884kwh	103.91
	Diesel consumption	2.653 kg of Co_2/litre	6000litres	15.92
	LPG	2.983 kg of Co_2/kg	1786kg	5.33
	Fire Wood	1.65-1.80 kg of Co_2/kg	28 T	46.2
II	Food Waste	1.9 kg of Co_2/kg	3.75 T	7.125
	Paper Waste	1.725 kg of Co_2/kg	5.85 T	10.09
	Water Waste	0.298 kg of Co_2/kl	1760kl	0.524
	Plastic Waste	6 kg of Co_2/kg	200 kg	1.2
	Glass/Other	0.77 kg of Co_2/kg	10	0.065
	Sanitary Napkin	0.5 kg of Co_2/kg	2275 kg	1.1375
III	Two Wheelers	2.38 kg of Co_2/L	10000*250/50=50000	103
	Own Car	2.653 kg of Co_2/L	800*250/20=10000	26.52
	Mini Bus / Van	2.653 kg of Co_2/L	90*250/8=2812	7.46
IV	Events	Approx	500*8*1.5=6000kg	15.91
Total				**155.836**

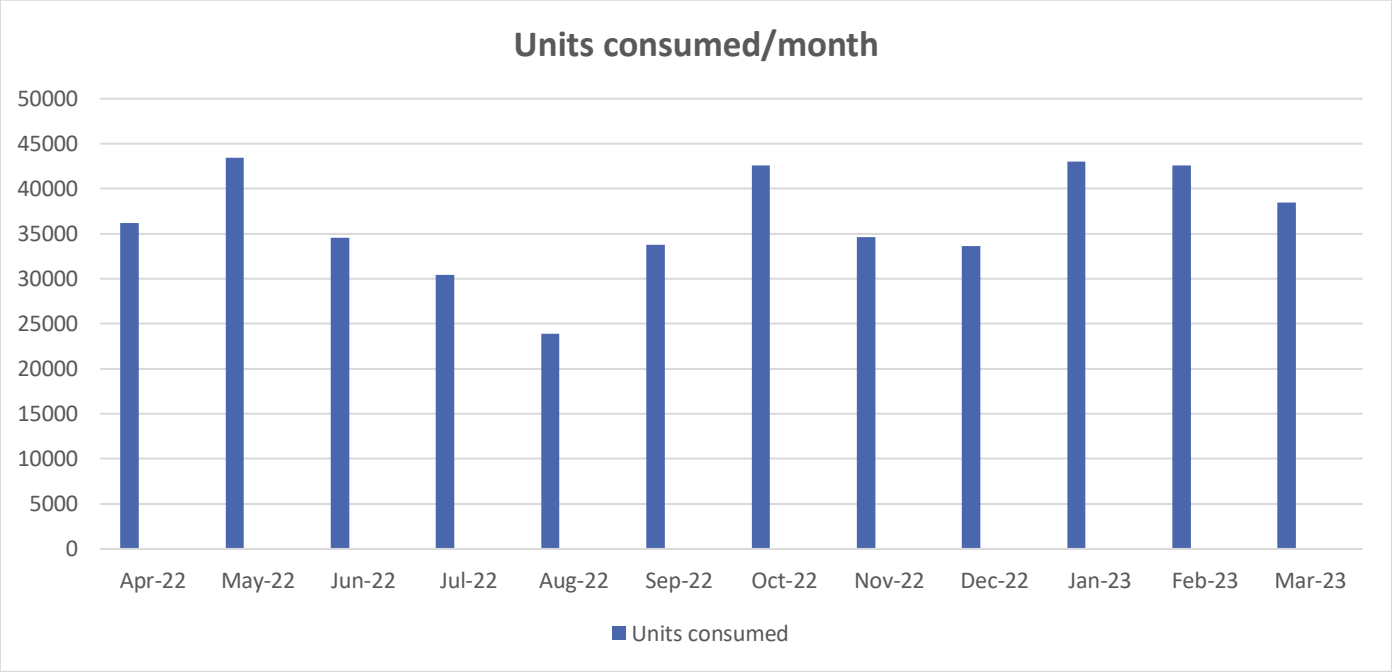
Recommendations

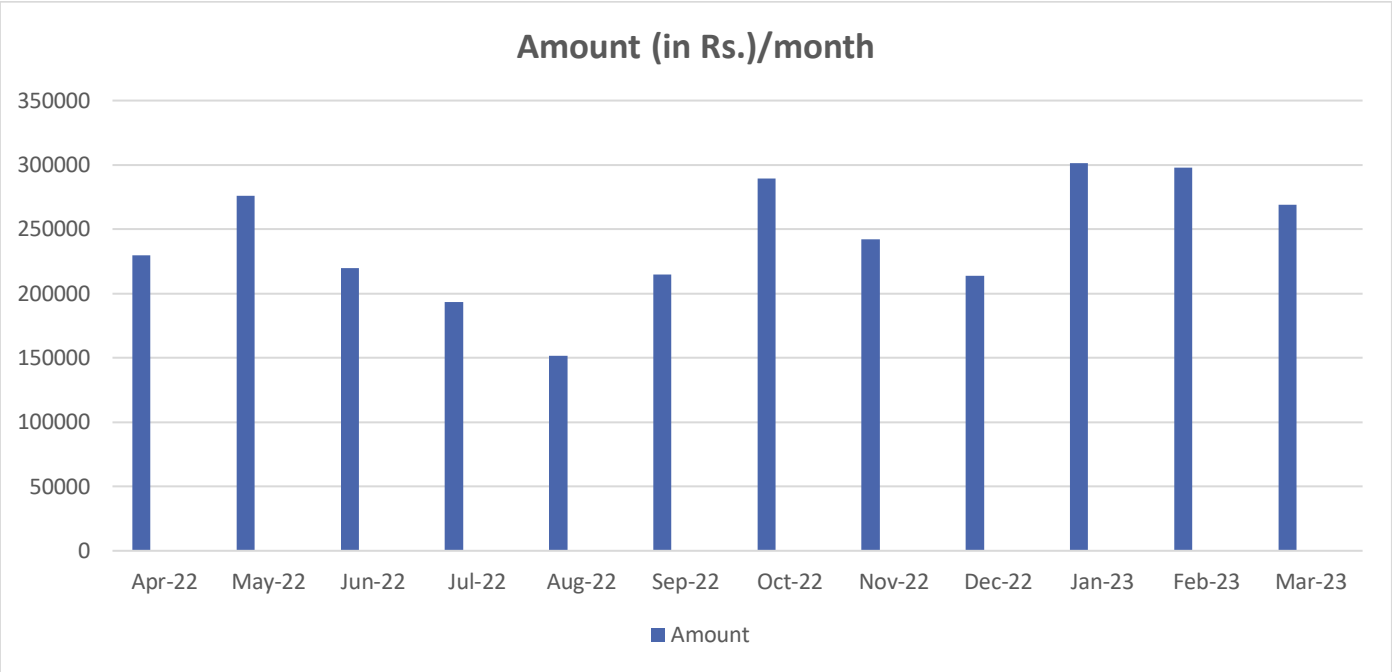
- Regular maintenance of the air conditioners and refrigerators should be done and records should be maintained
- Reheating of food can be done on induction / microwave minimizing the use of LPG.
- sub-metering system for electricity usage may help to identify high energy consumption areas.
- The systems (computers, laptops, air conditioners, refrigerators etc.) should be procured for the college considering the latest energy efficient technologies in the markets. (For ex All in One Units etc.)
- Occupancy sensors should be installed in the classrooms and offices.

9. POWER CONSUMPTION ANALYSIS

The power consumed by the college for a year on a monthly basis is depicted below:

S.No	Month/year	Units consumed (kw/h)	Bill amount
1	03/2023	38430	269010
2	02/2023	42569	297983
3	01/2023	43037	301259
4	12/2022	33615	213988
5	11/2022	34604	242228
6	10/2022	42557	289600
7	09/2022	33797	214610
8	08/2022	23879	151631
9	07/2022	30425	193198
10	06/2022	34580	219583
11	05/2022	43441	275850
12	04/2022	36157	229596





9.1 POWER QUALITY AUDIT

A power quality audit checks the reliability, efficiency, and safety of an organization's electrical system. The audit verifies the following aspects:

The continuity of the power supply: It checks if the power in the network is available on a regular basis and can ensure the efficient operation of the equipment.

The quality of the voltage: It checks if there are no low or high-frequency disturbances in the network capable of damaging the system components.

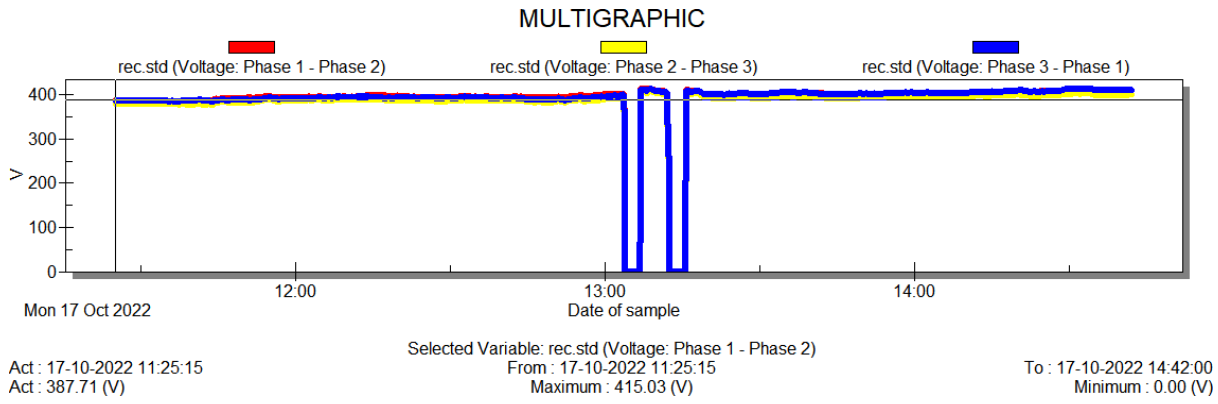
Benefits Of Power Quality Analysis

- Assist in preventative and predictive maintenance
- Identify source and frequency of events
- Establish precise location and timing of events
- Develop maintenance schedules
- Monitor and trend conditions
- Analyse harmonics, Flicker, Transients frequency variation,voltage variations (sag & swell).
- Ensure equipment performance
- Assess the sensitivity of process equipment to disturbances
- Evaluate performance against specifications

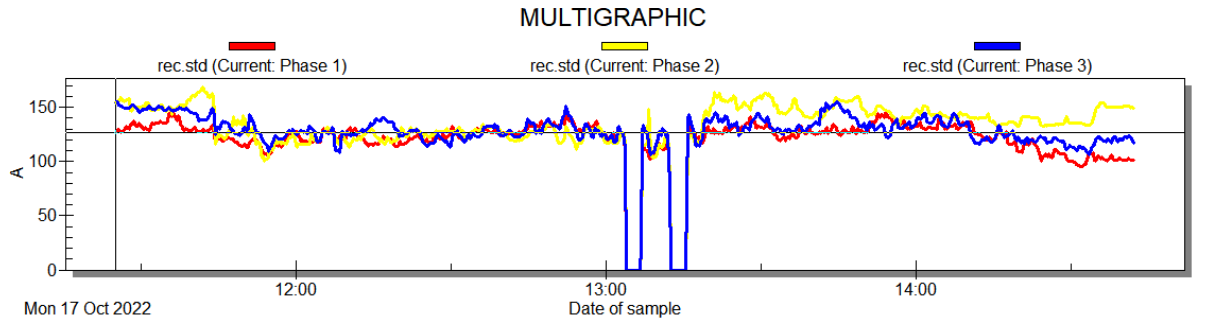
Observations

TRANSFORMER LT SIDE

Voltage profile



Current profile



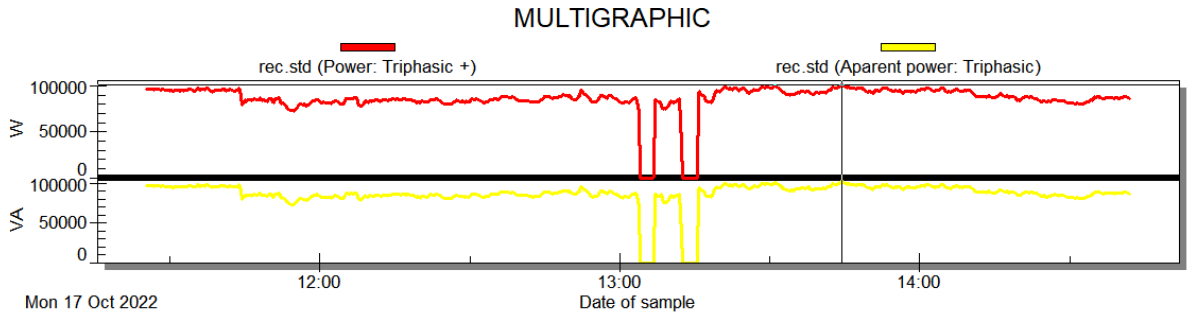
Selected Variable: rec.std (Current: Phase 1)

Act : 17-10-2022 11:25:15
Act : 127.1841 (A)

From : 17-10-2022 11:25:15
Maximum : 145.8516 (A)

To : 17-10-2022 14:42:00
Minimum : 0.0000 (A)

Load Profile



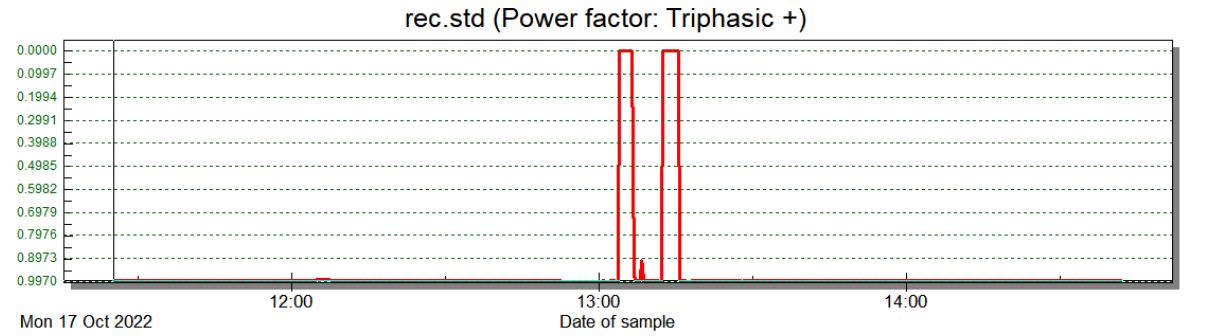
Selected Variable: rec.std (Power: Triphasic +)

Act : 17-10-2022 13:44:30
Act : 101257.0 (W)

From : 17-10-2022 11:25:15
Maximum : 101257.0 (W)

To : 17-10-2022 14:42:00
Minimum : 0.0 (W)

Power Factor Profile

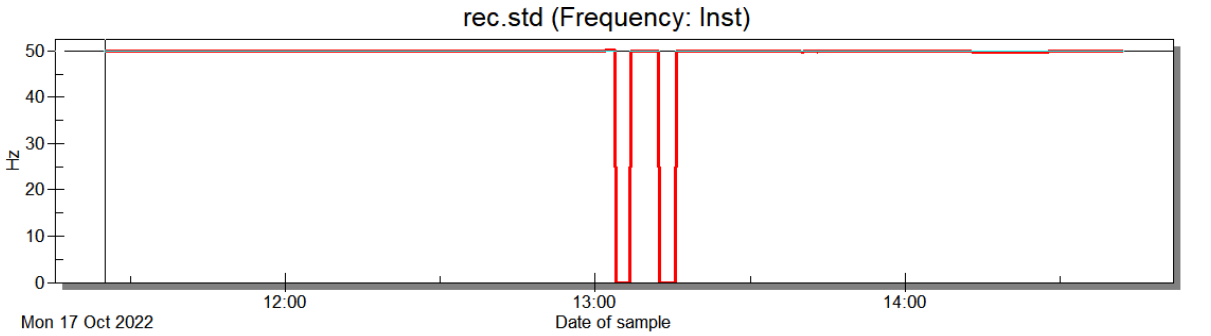


Act : 17-10-2022 11:25:15
Act : 0.992

From : 17-10-2022 11:25:15
Maximum : 0.000

To : 17-10-2022 14:42:00
Minimum : 0.997

Frequency

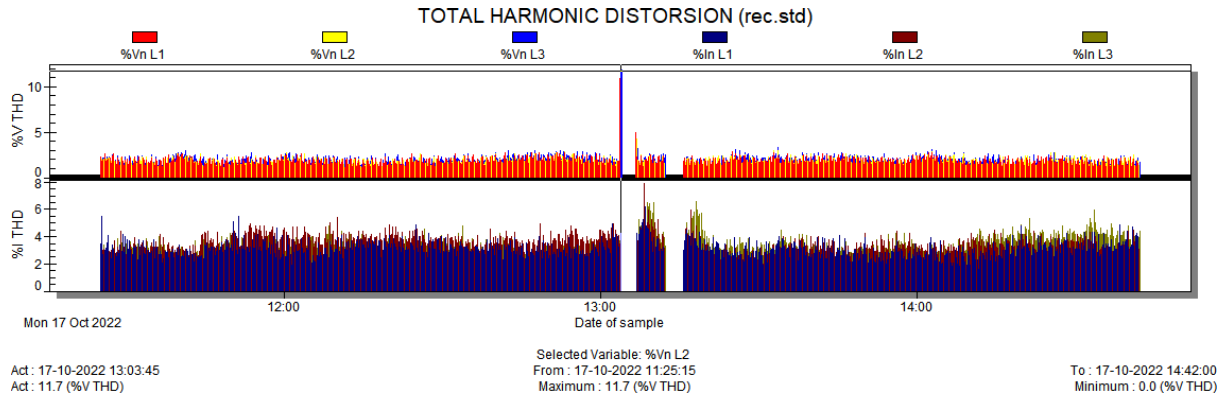


Act : 17-10-2022 11:25:15
Act : 49.96 (Hz)

From : 17-10-2022 11:25:15
Maximum : 50.13 (Hz)

To : 17-10-2022 14:42:00
Minimum : 0.00 (Hz)

Total Harmonic Distortion



Individual Harmonics

Individual Harmonics							
As per IEEE-519, 2014, permissible % of individual voltage harmonics is 5 % Current harmonics for <11 order is 10 %	Order of Harmonics	Voltage			Current		
		R	Y	B	R	Y	B
	3	0.21	0.36	0.41	2.18	3.16	2.04
	5	0.38	0.84	1.01	0.57	0.74	1.6
	7	1.45	1.2	1.23	0.47	1.17	1.44
	9	0.22	0.23	0.42	0.67	0.66	0.56
	11	0.34	0.27	0.55	0.47	0.59	0.29

Summary:

S. No	Description	Remarks	
1	Location	INCOMING MAIN POWER HOUSE	
2	Voltage	Incoming voltage is varying from 379.3 V to 387.7 V.	
3	Load Current, A	Varying from 101.3A A to 127.18 A.	
4	Power, Kw	Varying from 98.45 kW to 101.257 kW.	
5	Power, kVA	Varying from 98.23 kVA to 101.885 kVA.	
6	THD Voltage (%)	R	1.8
		Y	2.2
		B	2.6
7	THD current (%)	R	2.8
		Y	3.8
		B	2.8
8	Power Factor	Varying from -0.99 to 0.99	
9	Frequency, Hz	Varying from 49.8 Hz to 50.13 Hz.	
10	Any Interruption observed. if yes details	Yes. Power cut From 13:04:15 to 13:06:45 and 13:12:30 to 13:15:30	
11	Voltage Sags	No	
12	Over voltage	No	
13	Voltage unbalance, %	Varying from 0.5 % to 1.4 %.	
14	Current unbalance, %	Varying from 0.1 % to 12.8 %.	

Remarks:

- Current unbalance is slightly higher than acceptable level.

11. RECOMMENDATIONS

- The management should support more of renewable and carbon-neutral electricity options in any energy- purchasing consortium, with the aim of supplying all college properties with electricity that can be attributed to renewable and carbon-neutral sources.
- The campus administration should run switch–off drills on regular basis.
- 5–star rated Air Conditioners, Fans and CFLs should be used.

12. CONCLUSION

Energy Rating

After the complete survey and analysis of the campus as per ISO 50001:2018 energy management system standards, we rate the campus **Score 4/5.**

Energy Conservation is the wave of the future. The world is quickly moving towards Energy sustainability. An energy-efficient organization is a step toward the direction of renewable energy, environmental protection, and sustainable living. Thus, concluded that by energy auditing we identify cost-effective ways to improve the comfort and efficiency of buildings.

13. ACKNOWLEDGEMENT

We are grateful to the management and committee members of Tamilnadu Physical Education and Sports University to award this prestigious project on energy auditing. Further, we sincerely thank the college staff for providing us with the necessary facilities and cooperation during the audit. This ample co-operation helped us a lot in making this audit possible and successful.

FOR QRO CERTIFICATIONS

ER.P.VIVEK M.E

CHARTERED ENGINEER &COMPETENT PERSON