2023-2024

GREEN & ENERGY AUDIT REPORT of Kalinga Institute of Industrial Technology (KIIT, Deemed to be University U/S 3 of UGC Act 1956)

Prepared by

ENER VISION
(ISO 9001 CERTIFIED & BEE empaneled ESCO)
Kandivali EAST, MUMBAI

ENERVISION
We serve to save
An Empanelled ESCO of B.E.E

Acknowledgement

M/S. ENER VISION places on record its sincere thanks to the KIIT DEEMED TO BE University Management giving us the opportunity for carrying out Green Audit (Environment, Electrical, Energy and Fire Safety Audit) of the KIIT University campuses. We also sincerely thank to Mr. Suvendu Panda (KIIT & KISS Nodal Officer) & Mr. S.N.Nayak (Chief Engineer Electrical KIIT Campus) & his maintenance team for their excellent co-ordination & help during the Third-Party Inspection of Green Audit on 8th August 2023.

Our engineers under the lead auditors Mr. Chinmoy Dutta – Chartered Electrical, Engineer & BEE Certified Energy Auditor, have carried out the power & facility audit.

Chinmoy Dutta

Place: Mumbai

Date: 14th January 2024

Chinmoy Dutta
(Chartered Elect Engineer & BEE Certified Energy Auditor EA-0985)
ENER VISION
(ISO 9001 Certified & BEE empanel ESCO)

Certification of the company

ऊर्जा दक्षता ब्यूरो
(भारत सरकार, विद्युत मंत्रालय)
BUREAU OF ENERGY EFFICIENCY
(Government of India, Ministry of Power)

15 YEARS OF CELEBRATING THE MAHATMA

17/05/ESCO/22-23/ 4341 – 420 15th September,2022

Shri Chinmoy Dutta
Proprietor
ENER VISION
3, Bldg No 6, Thakur Village,
Kandivali East, Mumbai -400101

Sub: Empanelment of Energy Service Company (ESCO)

Dear Sir,

This has reference to your application for empanelment/ re-empanelment as an Energy Service Company with BEE in response to our advertisement for re-empanelment and fresh empanelment of ESCOs in the month of May, 2022.

Consequent to scrutiny and evaluation of your documents by SEBI accredited Grading Agencies CRISIL /CARE Advisory/ICRA Analytics/SMERA/ IRR Advisory in terms of the approved parameters for evaluation, BEE is pleased to inform that your company **ENER VISION** has qualified for empanelment with BEE as a **Grade 3** Energy Service Company (ESCO). This empanelment would be effective from 16th August, 2022 and will be valid till 15th August, 2024.

Further, the list of all the empanelled ESCOs along with grade assigned is uploaded on its website (www.beeindia.gov.in) for use by State/Central government/Public Sector agencies as well as by any other agency interested in implementing energy efficiency projects on ESCO mode. Please acknowledge your acceptance to this letter.

Yours faithfully,

(Arijit Sengupta)
Director

स्वहित एवं राष्ट्रहित में ऊर्जा बचाएँ Save Energy for Benefit of Self and Nation

चौथा तल, सेवा भवन, आर० के० पुरम, नई दिल्ली–110 066, वेबसाईट / Website : www.beeindia.gov.in
4th Floor, Sewa Bhawan, R.K. Puram, New Delhi-110 066 टेली / Tel.: 91 (11) 26766700, फैक्स / Fax: 91 (11) 26178352

Certification of the company

QRO
QUALITY RESEARCH ORGANIZATION

Certificate of Registration

This is to certify that

ENER VISION

BUILDING NO. 1C, FLAT NO. 03, NG SUNCITY PHASE-1, THAKUR VILLAGE, KANDIVALI (E), MUMBAI-400101 (MAHARASHTRA) INDIA

has been independently assessed by QRO
and is compliant with the requirement of:

ISO 9001:2015

Quality Management System

For the following scope of activities:

ENERGY AUDIT & ENERGY MANAGEMENT, ELECTRICAL & FIRE SAFETY AUDIT, EM CONSULTANCY.

Date of Certification: 28th January 2021
1st Surveillance Audit Due: 27th January 2022
2nd Surveillance Audit Due: 27th January 2023
Certificate Expiry: 27th January 2024

Certificate Number: 3050210128170

QRO EGAC IAF

Head of Certification

Validity of this certificate is subject to annual surveillance audits to be done successfully on or before 365 days from date of the audit.
(In case if surveillance audit is not allowed to be conducted, this certificate shall be suspended / withdrawn)
The Validity of this certificate can be verified at www.qrocert.org
This certificate of registration remains the property of QRO Certification LLP, and shall be returned immediately upon request.

India Office : QRO Certification LLP
142, IInd Floor, Avtar Enclave, Near Paschim Vihar West Metro Station, Delhi-110063, (INDIA)
Website : www.qrocert.org, E-mail : info@qrocert.org

Audit Team:

Mr. Chinmoy Dutta: B.E. Electrical & Certified Energy auditor from Bureau of Energy Efficiency, Ministry of Energy, Govt. of India and Chartered Engineer More than 28 years of experience in designing and Project Management of all types of Electrical, Automation & HVAC system. Handled various projects during his tenure. Also has hands on experience in Facility Management and has handled some of the prestigious facilities. Worked with TISCO, Siemens, Saudi Aramco, IPMSL & Pantaloon retail India. Audited Mall, Hotel and Corporate Buildings, Data Centers etc.

Mr. Pravin Shankar: Certified Energy auditor from Bureau of Energy Efficiency (EA 9892), Ministry of Energy, Govt. of India. Experience in designing and Project Management of all types of Electrical & HVAC system. Hands on experience in Facility Management.

Mr. D T Naik - Diploma in Electrical & Mechanical, PWD certified Electrical Supervisor, ISO 50,000 Certified energy auditor and HVAC auditor with 40 years of experience in design and execution of HVAC system.

Capt. Balasubramanian G S - An ex-Army officer with a certificate on firemanship from Nagpur Fire brigade College. He has also done his diploma in Industrial safety from Labour Institute of Madras. Apart from his career in Army, captain has been working in the field of training on fire safety and auditing of status of firefighting system in various organization for good around 25 years

Rahul Kalamata – Manger in Operations. B Tech Mechanical MSME certified Industrial safety NEBOSH Trained in Health and Safety Management at Work experience-7 years & National safety council trained fire safety auditor experience of Elect & Fire safety audit 400 sites (Warehouses – 50000 sq ft to 4 lakh sq ft), Mall, residence, Industry, Corporate offices, retail branches).
Abhishek Anand- Sr Engineer. B Tech Electrical experience in electrical audit of 300 plus sites. NEBOSH Trained in Health and Safety Management at Work
Experience – 7 years (Warehouses, Mall, residence, Industry, Corporate offices, retail branches)
Dipesh Mayekar – Sr. Supervisor. Diploma in Electrical Engineering. NEBOSH Trained in Health and Safety Management at Work Experience – 8 years. Audit experience of more than 400 plus site. (Warehouses, Mall, residence, Industry, Corporate offices, retail branches).

Executive Summary:

Eco campus is a concept implemented in many educational institutions, all over the world to make them sustainable because of their mass resource utilization and waste discharge in to the environment. Waste minimization plans for the educational institute are now mandatory to maintain the cleanliness of the campus. To find out the environmental performance of the educational institutions and to analyze the possible solutions for converting the educational campus as eco-campus the conduction of Green Auditing of institution is essential.

The Energy & Green auditing of KIIT Campuses enables to assess the life style, action and its impact on the environment. This is the first attempt to conduct green auditing of this college campus. This audit was mainly focused on greening indicators like consumption of energy in terms of electricity and fossil fuel, quality of soil and water, vegetation, waste management practices and carbon foot print of the campus etc.

Initially a questionnaire survey was conducted to know about the existing resources of the campus and resource consumption pattern of the students and staffs in the college. In order to assess the quality of water and soil, water and soil samples were collected from different locations of the college campus and analyzed for its parameters. Collected data was grouped, tabulated and analyzed.

Finally a report pertaining environmental management plan with strength, weakness and suggestion on the environmental issue of campus are documented.

On physical verification of the electrical system, it is noticed the maintenance team has done a good work. Physically the condition of wires, cables, breakers, panels, DB's, transformers, DG sets, etc are good. Entire university electrical system is thermal scanned and found normal as the temperature is less than 45 Deg C except in few places. These hotspots are also rectified during the time of audit and now it is normal. Earth pits are found good. AC machines were checked and are working with normal efficient range. Except at some places the maintenance has not been done which indeed are serviced properly during the period of audit.

- With respect of fire safety, all the campus are installed with proper fire-fighting systems and fire detecting systems. Signages are also in-tact. Fire extinguishers are installed in the campus. Smoke detectors and fire alarm system is absent for the campus which has to be installed.
- Water management is good but need to install meters to monitor the flow and usage of water. Records has to be maintained and reviewed by the superior. Main water pipe lines need to be installed with globe valves in each floor to regulate the water flow and minimize the water waste.
- Waste management system is good. All the garbage has to be properly maintained and measured. Need to maintain the records for different kinds of waste generation.
- Greenery and plantation inside the campus has been improved compared to last year. Plants & trees of different kinds with flowers are planted in much quantity to control the pollution and CO emissions.

- Rain water harvesting is implemented in the campuses. As lot of other buildings are under construction it is recommended to implement rain water harvesting which will help to reduce the water consumption from the underground.
- Energy is not monitored. Meters are installed only in the LT panel and these meters are also not working. Need to install IOT based energy meters in each and every panel which will give help to monitor and regulate the energy consumption. All the panels and DB's has to be serviced. All the unwanted openings need to be closed in all the panels and DB's.
- Install light sensor in the academic and admin buildings to synchronize the LED lights with day light. This will help to reduce the further energy consumption.
- Globe valves at floor level main water pipes are not installed due to which the water flow at lower floors is very high and this results in the water wastage. Install globe valves at the floor's main water pipe lines and set the valves accordingly to the maintain the water pressure.
- The policy on Green energy and sustainability requires improvement in all sectors.

ENERGY AUDIT REPORT:

POWER QUALITY:

Power Quality of all campuses has been carried out by the power quality analyser and recorded for 24 hours to analyse the different electrical parameters. The summary of all the campuses are as follows and a sample power quality report is mentioned for campus-20

Summary of Power Quality:

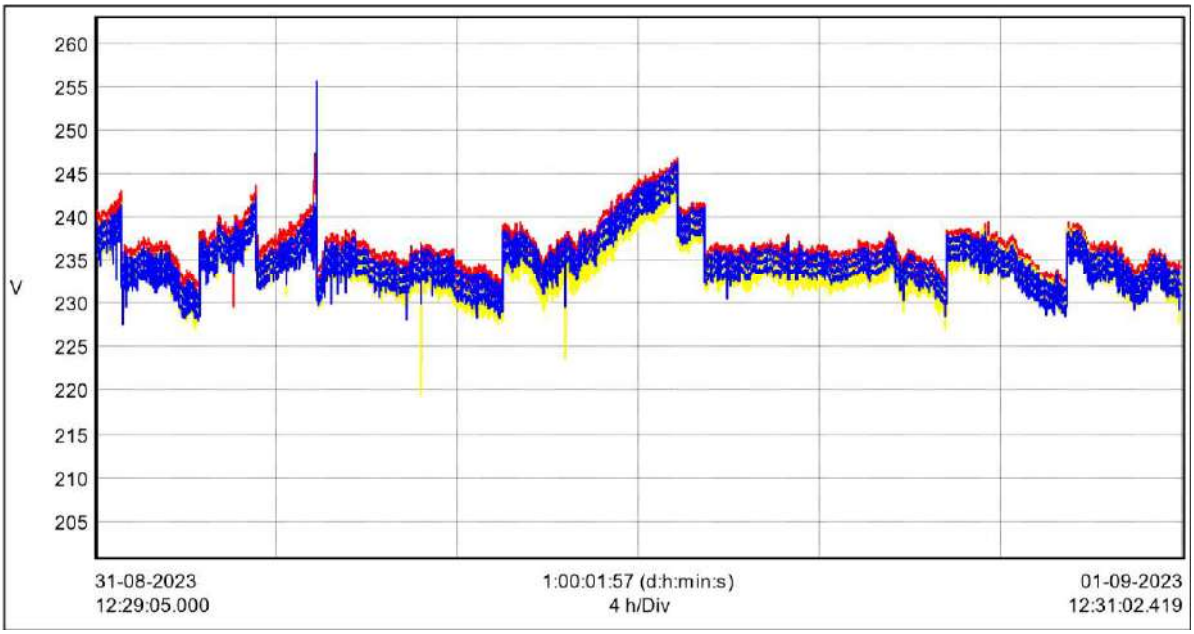
Campus	Voltage	Distribution of Load	Harmonics	Power factor
Campus-1	Little Fluctuations recorded	Uniformly distributed	Little on higher side	Avg is 0.98 which is normal.
Campus-2	Normal	Uniformly distributed	Within the limit	Avg is unity which is normal.
Campus-3	Normal	Uniformly distributed	Within the limit	Avg is unity which is normal.
Campus-4	Normal	Uniformly distributed	Within the limit	Avg is unity which is normal.
Campus-5	Normal	Uniformly distributed	Within the limit	Avg is unity which is normal.
Campus-6	Normal	Uniformly distributed	Within the limit	Avg is unity which is normal.
Campus-7	Normal	Uniformly distributed	Within the limit	Avg is unity which is normal.
Campus-8	Normal	Uniformly distributed	Within the limit	Avg is unity which is normal.
Campus-9	Normal	Uniformly distributed	Within the limit	Avg is 0.99 which is normal.
Campus-10	Normal	Uniformly distributed	Within the limit	Avg is unity which is normal.
Campus-11	Normal	Uniformly distributed	Within the limit	Avg is unity which is normal.
Campus-12	Normal	Uniformly distributed	Within the limit	Avg is unity which is normal.
Campus-13	Normal	Uniformly distributed	Within the limit	Avg is unity which is normal.
Campus-14	Normal	Uniformly distributed	Within the limit	Avg is 0.99 which is normal.
Campus-15	Normal	Uniformly distributed	Within the limit	Avg is unity which is normal.
Campus-16	Normal	Uniformly distributed	Within the limit	Avg is unity which is normal.
Campus-17	Normal	Uniformly distributed	Within the limit	Avg is unity which is normal.
Campus-18	Normal	Uniformly distributed	Within the limit	Avg is unity which is normal.

Campus-19	Normal	Uniformly distributed	Within the limit	Avg is 0.99 which is normal.
Campus-20	Normal	Uniformly distributed	Within the limit	Avg is unity which is normal.

Main Panel:

V_{rms} –

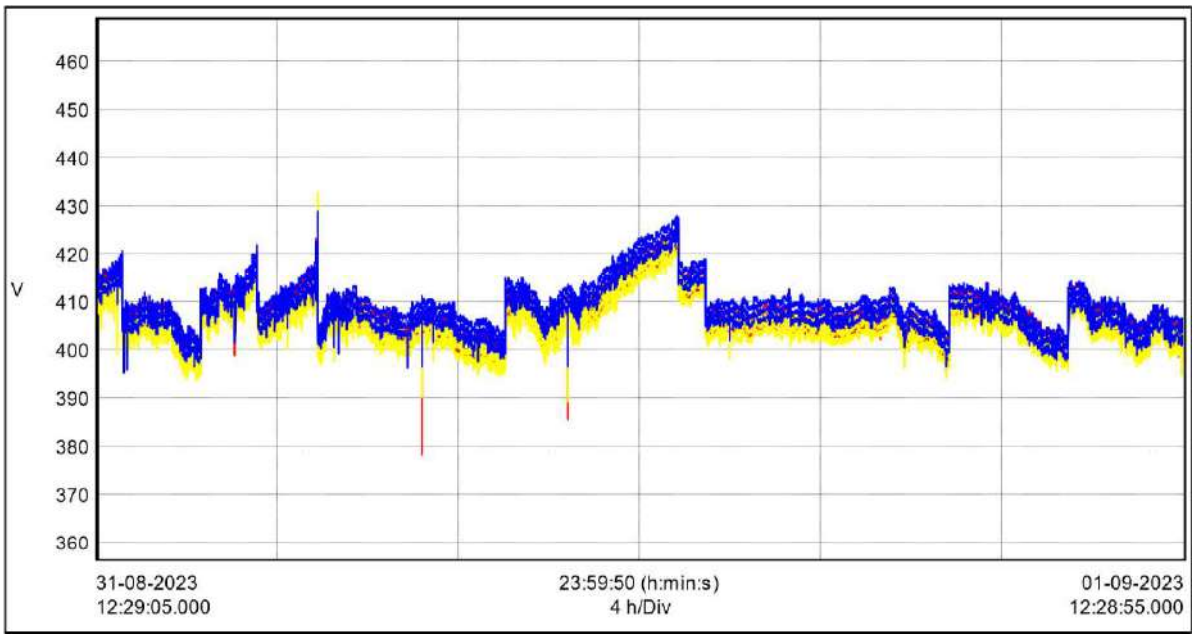
Name	Date	Time	Avg	Min	Max	Units	Duration	Units
V1 rms	31-08-2023	12:29 PM	236.09	223.30	247.40	V	23:59:55	(h:min:s)
V2 rms	31-08-2023	12:29 PM	234.46	219.60	245.70	V	23:59:55	(h:min:s)
V3 rms	31-08-2023	12:29 PM	235.13	227.70	255.70	V	23:59:55	(h:min:s)
VNE rms	31-08-2023	12:29 PM	0.08	0.00	5.50	V	23:59:55	(h:min:s)



Remarks: Average voltage is good and within the limit.

U_{rms} –

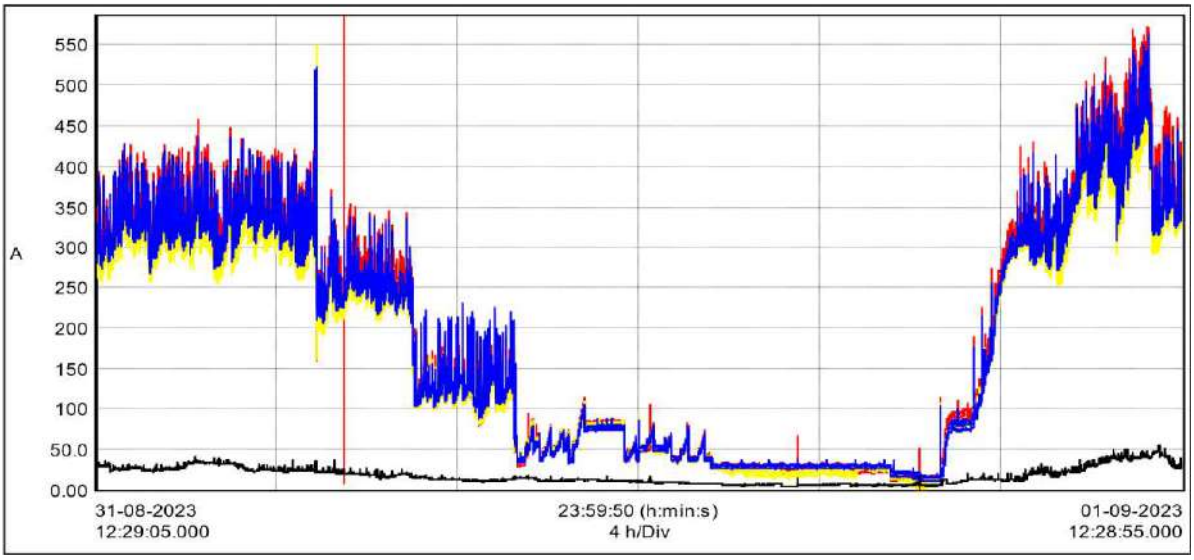
Name	Date	Time	Avg	Min	Max	Units	Duration	Units
U12 rms	31-08-2023	12:29 PM	407.53	378.50	426.40	V	23:59:55	(h:min:s)
U23 rms	31-08-2023	12:29 PM	405.78	389.40	433.00	V	23:59:55	(h:min:s)
U31 rms	31-08-2023	12:29 PM	408.97	395.20	428.90	V	23:59:55	(h:min:s)



Remarks – Average voltage is good and within the limit.

A_{rms} –

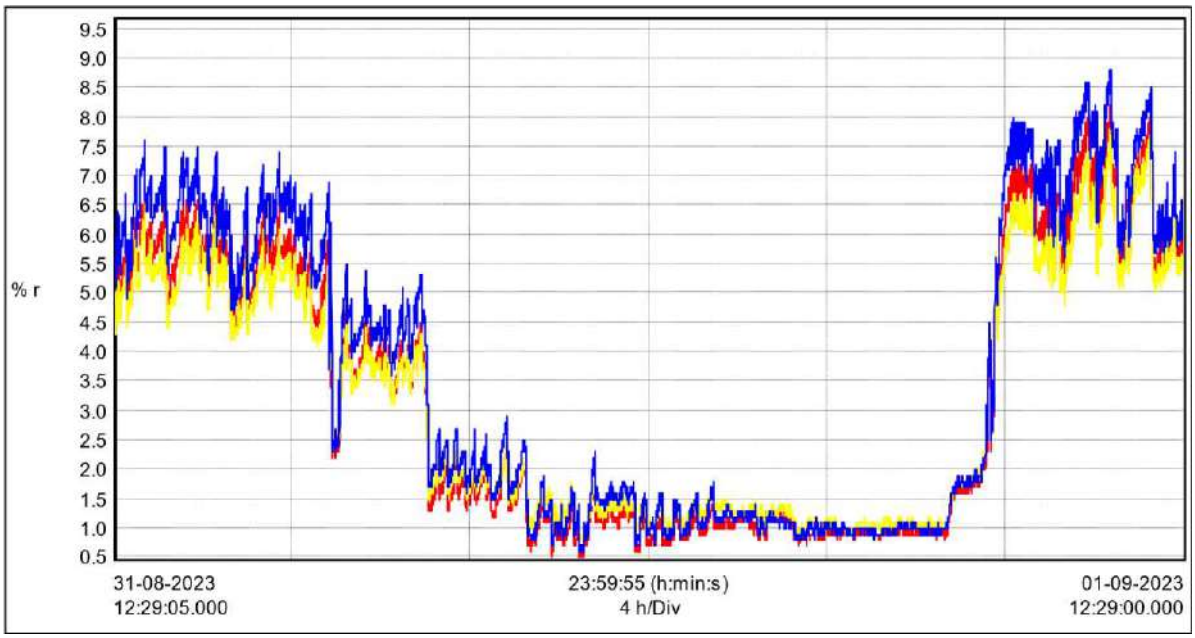
Name	Date	Time	Avg	Min	Max	Units	Duration	Units
A1 rms	31-08-2023	12:29 PM	238.30	0.00	701.50	A	23:59:55	(h:min:s)
A2 rms	31-08-2023	12:29 PM	216.97	0.00	551.00	A	23:59:55	(h:min:s)
A3 rms	31-08-2023	12:29 PM	227.61	12.00	564.50	A	23:59:55	(h:min:s)
AN rms	31-08-2023	12:29 PM	20.97	4.77	56.09	A	23:59:55	(h:min:s)



Remarks: Load is distributed uniformly in all the phases.

VThdr:

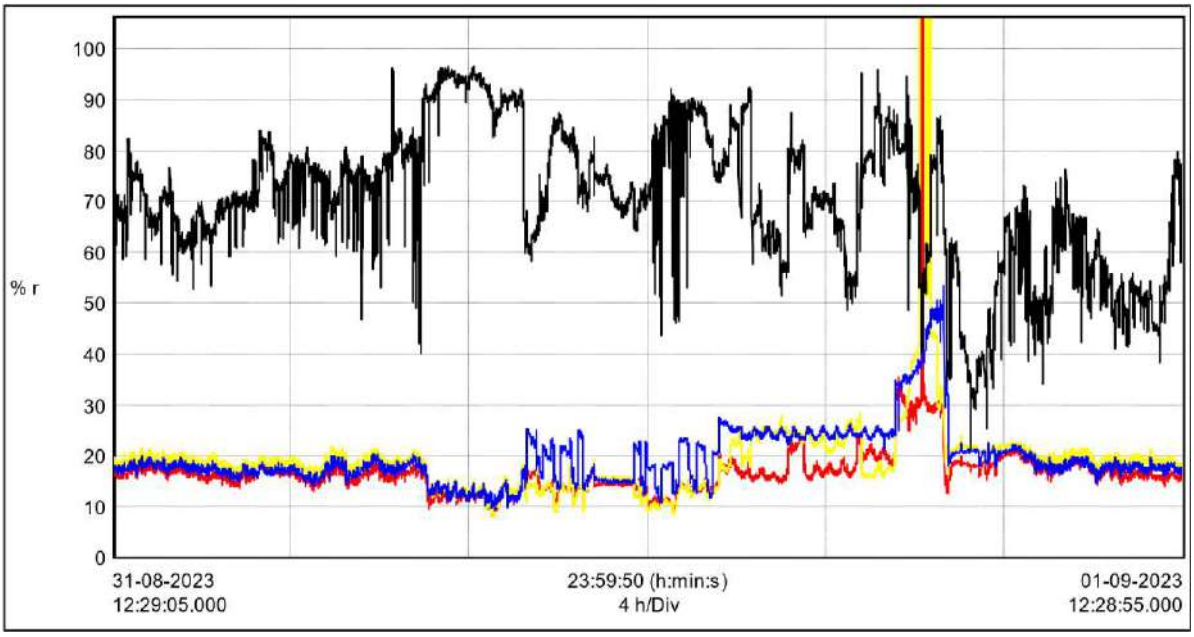
Name	Date	Time	Avg	Min	Max	Units	Duration	Units
V1 THDr	31-08-2023	12:29 PM	3.242	0.5	8.2	% r	23:59:55	(h:min:s)
V2 THDr	31-08-2023	12:29 PM	3.183	0.8	7.8	% r	23:59:55	(h:min:s)
V3 THDr	31-08-2023	12:29 PM	3.633	0.6	8.8	% r	23:59:55	(h:min:s)



Remarks: Voltage harmonic values are normal and are within the limit.

AThdr:

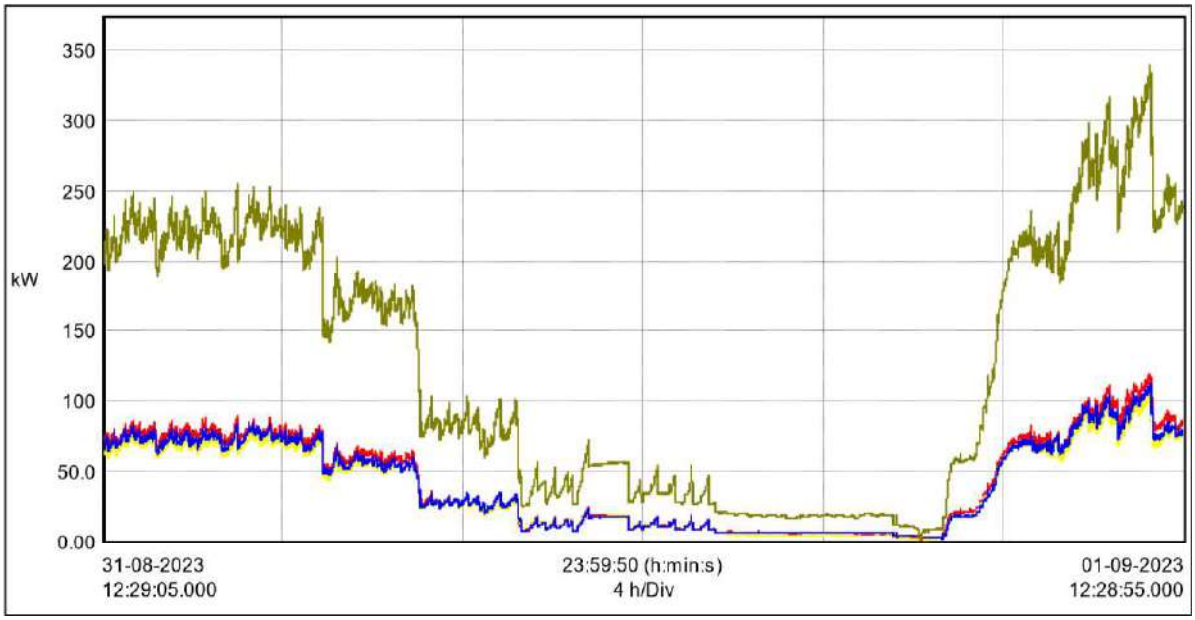
Name	Date	Time	Avg	Min	Max	Units	Duration	Units
A1 THDr	31-08-2023	12:29 PM	16.829	8.2	49.5	% r	23:59:55	(h:min:s)
A2 THDr	31-08-2023	12:29 PM	18.851	8.3	52.6	% r	23:59:55	(h:min:s)
A3 THDr	31-08-2023	12:29 PM	19.761	9.4	53.6	% r	23:59:55	(h:min:s)
AN THDr	31-08-2023	12:29 PM	70.938	21.5	96.6	% r	23:59:55	(h:min:s)



Remarks: Current harmonic values are low and within the limit.

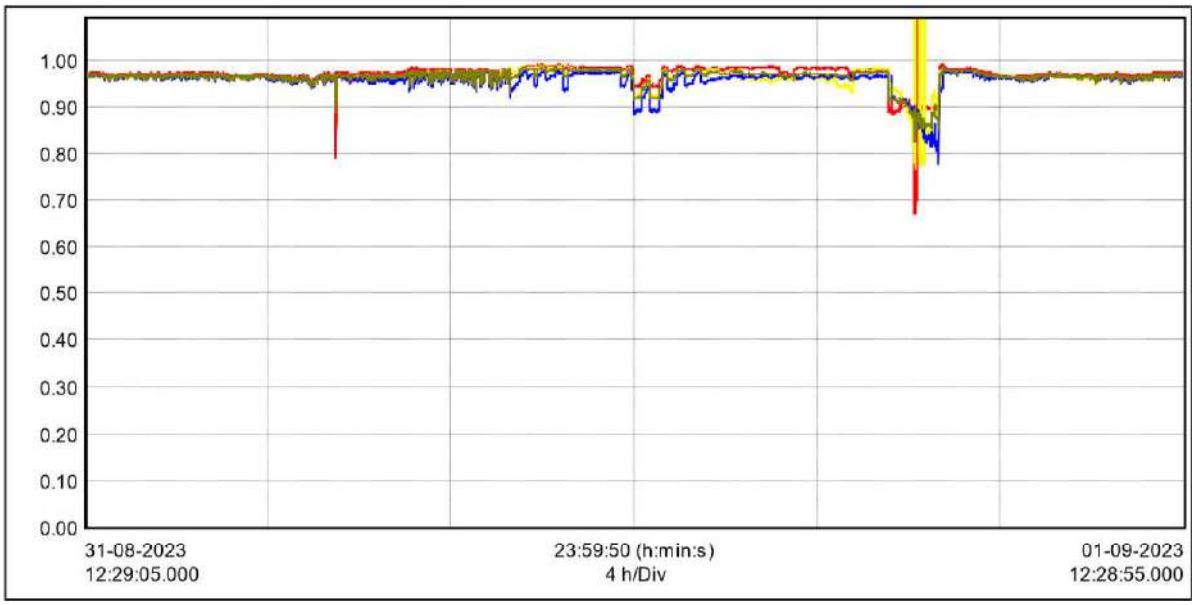
Power (KW):

Name	Date	Time	Avg	Min	Max	Units	Duration	Units
P1 (W)	31-08-2023	12:29 PM	43.2	0	119.97	W	23:59:55	(h:min:s)
P2 (W)	31-08-2023	12:29 PM	39.078	0	106.853	W	23:59:55	(h:min:s)
P3 (W)	31-08-2023	12:29 PM	41.002	2.67	113.211	W	23:59:55	(h:min:s)
PT (W)	31-08-2023	12:29 PM	123.28	3.803	340.034	W	23:59:55	(h:min:s)



Power Factor:

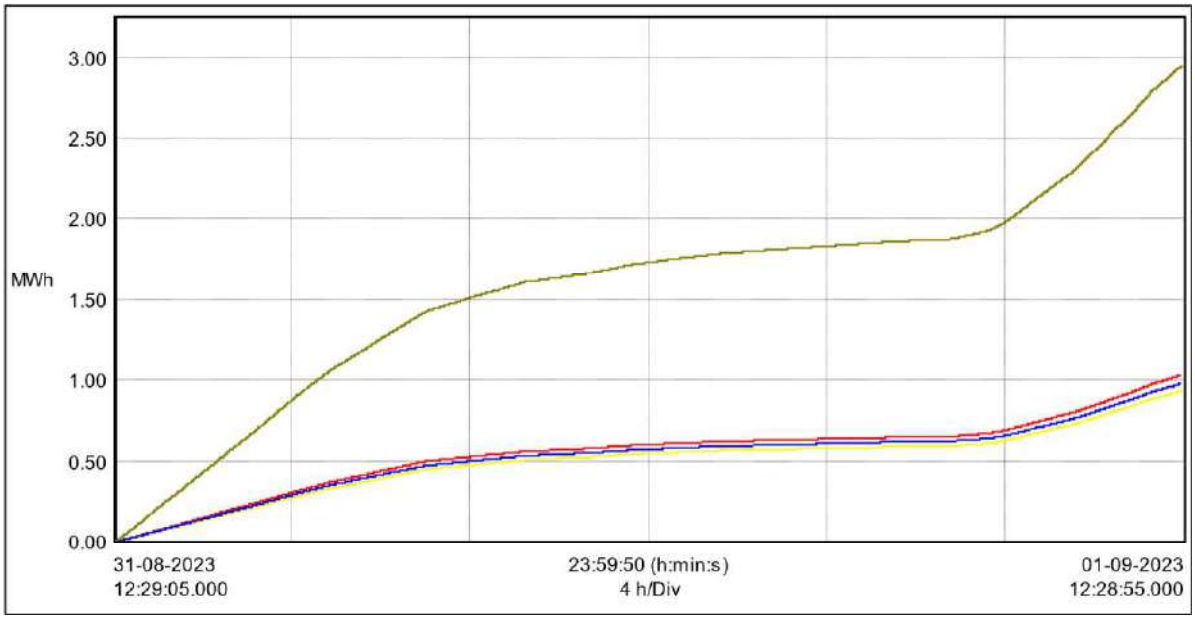
Name	Date	Time	Avg	Min	Max	Duration	Units
PF1	31-08-2023	12:29 PM	0.97	0.67	0.99	23:59:55	(h:min:s)
PF2	31-08-2023	12:29 PM	0.96	0.77	0.99	23:59:55	(h:min:s)
PF3	31-08-2023	12:29 PM	0.96	0.78	0.98	23:59:55	(h:min:s)
PFT	31-08-2023	12:29 PM	0.96	0.83	0.99	23:59:55	(h:min:s)



Remarks: Avg Power factor values are good.

Energy:

Name	Date	Time	Max	Units	Duration	Units
Ep1 (Wh)	31-08-2023	12:29 PM	1.04	Wh	23:59:55	(h:min:s)
Ep2 (Wh)	31-08-2023	12:29 PM	937.82	Wh	23:59:55	(h:min:s)
Ep3 (Wh)	31-08-2023	12:29 PM	983.98	Wh	23:59:55	(h:min:s)
EpT (Wh)	31-08-2023	12:29 PM	2.96	Wh	23:59:55	(h:min:s)



Remarks: Total unit consumption during this recording session that is for 24 hours is 2959 units.

Detection of Hotspot and repair and maintenance of feeders

Hotspot leads to various problems like I^2R loss, unbalanced condition and harmonic injection. Using thermography, different cables and feeders are checked for higher temperature. Temperature above 40 degree centigrade is identified as hotspot zone. Thus faulty feeders and cables are replaced and all maintenance are done like checking of lugs fitting or any wear and tear etc.

List of some of the repair and maintenance work carried out (energy audit)

Problems	Solution
Hot spot are noticed in most of the places in the AC panels and outdoor MCB boxes.	Service the cable terminations by proper alignment of cables, lugs and tightening of nut bolts. Also replace the outdoor units MCB's boxes with new one.
Insulation of all the AC condenser units are damaged and are exposed to the sunlight, water, dust, etc. There is a reduction in the performance of the machine	All the refrigerant pipes from the outdoor to indoor units has to be insulated with new thick coated sheet.
Due to bad AMC services, there is a chocking of filters of the indoor units which than results in the formation of	A proper cleaning of the filters has been done to check the pressure of the refrigerant gas in the pipes lines. Need

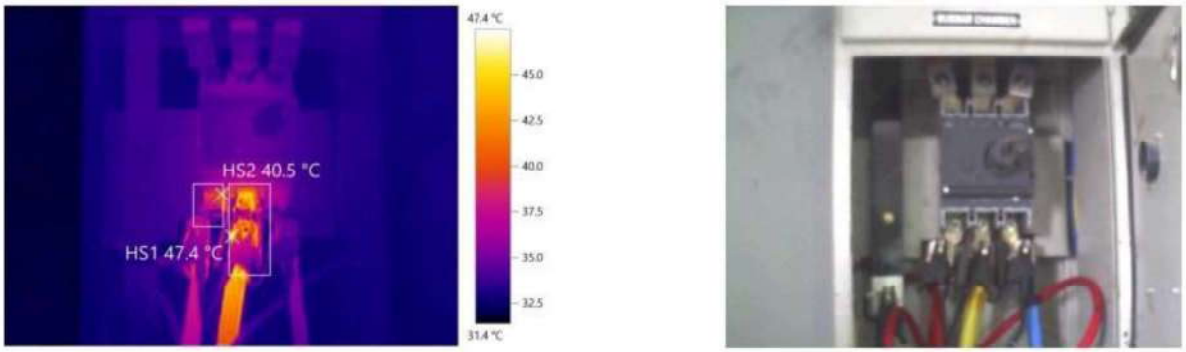
ice on the surface of indoor unit coils. This will end up with cooling of the machine itself but not the room. Also the terminals are heating and deposited with carbon content which results in the drop of voltage. Because of poor maintenance and servicing there will be a reduction in the efficiency by 10-15 %	to check working of thermostat of every machine during its AMC servicing. All the terminations serviced and cleaned.
Some of the capacitor banks are found faulty.	faulty capacitor banks are replaced

From the data calculated it was found that the efficiency are improved from 85% of the existing to 89%.Thus a change 4% leads to 380000 units of energy saving.

Hence amount saved =380000 KwH ×5.85= **Rs** 22,23,000.00 / at the rate Rs 5.85/ per unit.

Some of the hotspots are as follows:

AC panel-1 main incomer:



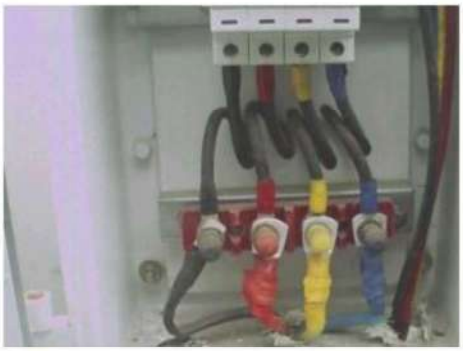
Picture data:	**Date:**	04-09-2023	**Emissivity:**	0.88
	Time:	15:17:03	**Refl. temp. [°C]:**	19.0
	File:	IV_23511.BMT		

Picture markings:

Measurement Objects	Temp. [°C]	Emiss.	Refl. temp. [°C]	Remarks
Hot spot 1	47.4	0.88	19.0	Temperature found in Y phase.
Hot spot 2	40.5	0.88	19.0	Temperature found in R phase.

Remarks: temperature now is normal but may increase in future. Need to do the relogging andcrimping properly.

C 5th AC outdoor terrace MCB:



Picture data:	**Date:**	04-09-2023	**Emissivity:**	0.88
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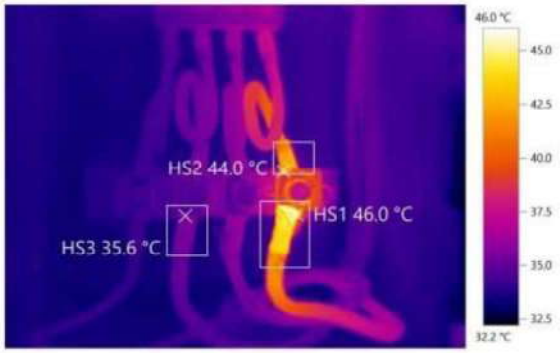
	File:	IV_23488.BMT		

Picture markings:

Measurement Objects	Temp. [°C]	Emiss.	Refl. temp. [°C]	Remarks
Hot spot 1	35.8	0.88	19.0	Temperature found in B phase.

Remarks: temperature now is normal but may increase in future. Need to do the relogging andcrimping properly

B 3rd AC Outdoor terrace MCB:



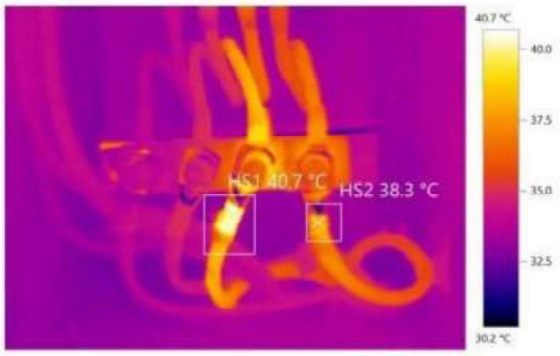
Picture data:	**Date:**	04-09-2023	**Emissivity:**	0.88
	Time:	14:54:08	**Refl. temp. [°C]:**	19.0
	File:	IV_23503.BMT		

Picture markings:

Measurement Objects	Temp. [°C]	Emiss.	Refl. temp. [°C]	Remarks
Hot spot 1	46.0	0.88	19.0	Temperature found in B phase.
Hot spot 2	44.0	0.88	19.0	Temperature found in B phase.
Hot spot 3	35.6	0.88	19.0	Temperature found in R phase.

Remarks: temperature now is normal but may increase in future. Need to do the relogging andcrimping properly

A 3rd AC outdoor MCB terrace:



Picture data:	**Date:**	04-09-2023	**Emissivity:**	0.88
	Time:	14:55:44	**Refl. temp. [°C]:**	19.0
	File:	IV_23506.BMT		

Picture markings:

Measurement Objects	Temp. [°C]	Emiss.	Refl. temp. [°C]	Remarks
Hot spot 1	40.7	0.88	19.0	Temperature found in Y phase.
Hot spot 2	38.3	0.88	19.0	Temperature found in B phase.

Remarks: temperature now is normal but may increase in future. Need to do the relogging and crimping properly

AC panel-2 main incomer:

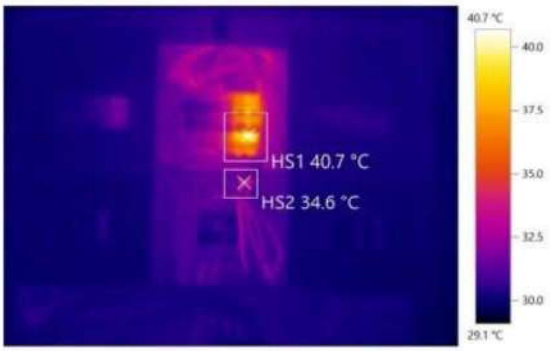
Picture data:	**Date:**	04-09-2023	**Emissivity:**	0.88
	Time:	15:25:22	**Refl. temp. [°C]:**	19.0
	File:	IV_23520.BMT		

Picture markings:

Measurement Objects	Temp. [°C]	Emiss.	Refl. temp. [°C]	Remarks
Hot spot 1	51.2	0.88	19.0	Temperature found in Y phase.
Hot spot 2	42.3	0.88	19.0	Temperature found in B phase.

Remarks: temperature now is normal but may increase in future. Need to do the relogging and crimping properly

3rd floor LDB:



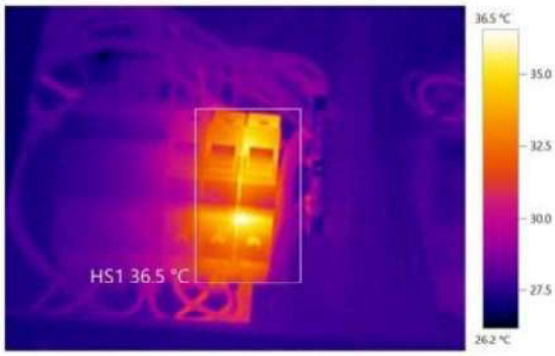
Picture data:	**Date:**	04-09-2023	**Emissivity:**	0.88
	Time:	16:02:05	**Refl. temp. [°C]:**	19.0
	File:	IV_23562.BMT		

Picture markings:

Measurement Objects	Temp. [°C]	Emiss.	Refl. temp. [°C]	Remarks
Hot spot 1	40.7	0.88	19.0	Temperature found at MCB Body.
Hot spot 2	34.6	0.88	19.0	Temperature found in Y phase.

Remarks: temperature now is normal but may increase in future. Increase the MCB rating.

Basement LDB:



Picture data:	**Date:**	04-09-2023	**Emissivity:**	0.88
	Time:	17:06:29	**Refl. temp. [°C]:**	19.0
	File:	IV_23610.BMT		

Picture markings:

Measurement Objects	Temp. [°C]	Emiss.	Refl. temp. [°C]	Remarks
Hot spot 1	36.5	0.88	19.0	Temperature found at MCB Body.

Remarks: temperature now is normal but may increase in future. Increase the MCB rating.

Old transformer replaced with new ones

The efficiency of the transformer can be defined as the intensity or the amount of power loss within a transformer. Therefore, the ratio of the secondary winding's power output to the primary winding's power input.
Efficiency = ((Power O/P) / (Power O/P + Copper Losses + Core Losses)) × 100%

Generally, the efficiency of a normal transformer is extremely high that ranges from 96% to 99%. So the efficiency of the transformer cannot be decided through high accuracy by measuring input and output directly. The main dissimilarity among the readings of input and output and input of instruments is very small that an instrument error will cause an error of the 15 % orders within the transformer losses.

Additionally, it is not convenient and expensive to include the essential loading devices of the exact ratings of voltage & power factor (PF) to load the transformer. There is also a large amount of power wastage & no information is obtainable from a test regarding the number of transformer losses like iron & copper.

The transformer losses can be determined through the accurate method would be to calculate losses from short circuit & open-circuit tests, so that efficiency can be determined

From an open circuit test, the iron loss like P1 = P0 or Wo can be determined

From the short circuit test, the copper loss on full loads like Pc = Ps or Wc can be determined

Copper loss on a load x times full load = I22 R02 => x2 Pc

Transformer efficiency (η) = V2I2 CosΦ / V2I2 CosΦ + Pi + x2 Pc

In the above equation, the result of instrument readings can be restricted to losses simply so that overall efficiency can be achieved from it is very accurate as compared with the efficiency attained through direct loading.

All-Day Efficiency

As we discussed above that the transformer ordinary efficiency can be given as

Ordinary Efficiency of Transformer = Output (Watts)/Input (Watts)

However, in some kinds of transformers, their performance cannot depend on their efficiency. For instance, in distribution transformers, their primaries always energized. However, their secondary windings will supply a slight load most of the time in a day

Once transformer secondary's will not supply any load, after that only transformer's core losses are significant & copper losses are not present.

Copper losses are significant only once transformers are loaded. Therefore, for these transformers, losses like copper are mostly less important. So the performance of the transformer can be compared based on the energy used in a single day.

The transformer's all-day efficiency is less always as compared with normal efficiency of it.

Factors that affect the efficiency of a transformer include the following

- The current heating effect in a coil
- Induced eddy current's Heating Effect
- Iron Core's Magnetization.
- Leakage of Flux

How to Improve the Efficiency of Transformer?

There are different methods to improve the efficiency of transformers like loop area, insulation, coils resistance, and flux coupling.

Loop area

Insulation

The insulation among core sheets must be ideal to prevent eddy currents.

Primary and Secondary Coil's Resistance

The material of primary and secondary coils must be stable so that their electrical resistance is extremely little.

Flux Coupling

Both the coils of the transformer must be wound in such a manner that flux coupling among the coils is utmost as power transfer from one coil to another will takes place during flux linkages.

Thus, this is all about an overview of the efficiency of the transformer. Transformers are electrical devices with high efficiency. So, most of the transformer's efficiency will range from 95% to 98.5%.

As per the electricity bill and energy consumption pattern total savings by replacing a less efficient transformer with a new one is found to be 500kwh for a month.

Hence amount saved 1131000 units* 5.85/ =Rs 66,16,350.00 / at the rate Rs 5.85/ per unit

Use of LED light at various Campuses in KIIT for lighting purpose.

LED bulbs are designed to be a more energy-efficient light source, by using a semiconductor to convert electricity into light. LEDs emit very little heat. In comparison, incandescent bulbs release 90% of their energy as heat and CFLs release about 80% of their energy as heat. Lifetime: LED lighting products typically last much longer than other lighting types.LED lighting produces **less waste light and more useful lumens** than other lighting technologies. If you replaced all the lighting in your office, school or other facility with LEDs, you could see as much as a 60% to 70% improvement in your overall energy efficiency

Advantages of LED lighting system

- Better lumens and longer lamp life. High efficacy and lower power consumption
- Provide high brightness and excellent illumination even in high ceiling areas
- Extraordinary long life of LED's and high end electronic driver (over 30000 burning hours) ensure zero maintenance
- No UV or IR radiations, environment friendly as it does not contain mercury
- Application: Residence, showrooms, cove light, hospital premises, educational institutions, corridors

40 Watt CFL Tube light changed to 10 Watt LED light.

Total number of tube-light :6320

Total load using CFL: 6320×40 watt=252800 W
Total load using LED: 6320×18 watt= 113760 W

Electrical consumption using CFL

252800 Watt×12 hours per day×300 days= 9,10,080 units

Electrical consumption using LED

113760 Watt×12 hours per day×300 days= 4,09,536 units

Energy saved= 9,10,080 units - 4,09,536 units
= 5,00,544 units

Hence amount saved Rs 29,28,182.4 /- at the rate Rs 5.85/ per unit as per new tariff

Replacement of single phase induction type conventional ceiling fan with BLDC motor ceiling fan

For years, ceiling fans used to come with the same hardware of induction motor which typically consumed **70-80 watts** for a standard ceiling fan. But in the last few years, a new technology called **BLDC** is being used to make fans consume a lesser amount of energy, without compromising much on the air delivery. **BLDC** stands for **brush-less direct-current motor**, a special type of motor which has permanent magnet instead of electromagnets found in a conventional induction motor. BLDC motor has important advantages over induction motor like low electricity consumption, lesser noise generation and better lifespan.

The super-efficient 5-star rated BLDC fans that are available in the market generally use a different type of motor (BLDC motor) which further facilitates efficient blade designs, making ceiling fans far more efficient. Most of the BLDC ceiling fans are 5-star rated consuming 25-40 watts of energy, which is about 40-70% less than the regular old fans. Also, BLDC fans do not require installation of an additional regulator which saves 200-500 rupees upfront. Instead, they are controlled wirelessly with the help of remote just like air conditioners.

Advantages of BLDC Motor Used in BLDC Fan

Prominent advantages of BLDC motor over induction motor is summarized as:

- Lower Electricity Consumption (65% savings)
- Longer backup on Inverters (even on Solar)
- Improved reliability
- Noise reduction
- Longer lifetime

Total number of fans : 6536
single phase induction type conventional ceiling fan: 75 Watt
BLDC fan:30 Watt

(6536*75)-(6536*30)=4,90,200-1,96,080=2,94,120 Watt
Yearly calculation considering the fan running on a daily basis of 15 hours each day for a period of 300 days.
2,94,120*15*300= 13,23,540KwH

Hence amount saved Rs.77,42,709/ at the rate Rs 5.85/ per unit

Replacement of 3 star Air conditioners with 5 star AC

Air conditioners with 5 star ratings are often preferred over ACs with low ratings. The reason can be power consumption, maintenance cost and more. Besides, 5 star or higher rating ACs are chosen because of their efficiency to cool the inside of the room or hall, way faster than other ACs with low ratings. A star rating appliance or AC showcases its energy efficiency. The more the number of stars, the more will be the appliance's energy efficiency. Generally, the star rating starts from 1 and ends at 5. More stars labelled on an AC depict its energy efficiency and hence, are more likely chosen by people.

The following points elaborate the differences between a 5 star AC and a 3 star AC-

- Cooling and power efficiency in a 5 star AC is higher than the AC with 3 stars
- 5 stars AC consumes less energy as compared to 3 stars ACs; hence, lets a user save money on electricity bills.
- ACs with 5 stars have a better build than those with 3 stars.
- Usually, 5-star ACs have a bigger condenser when comparing it with 3 star AC, which eventually results in better heat exchange
- 5 star ACs produce less heat than 3 stars ACs
- ACs with 5-star ratings can be used round the year
- ACs with higher ratings are considered powerful as they cool the room faster

There are numerous factors that affect the AC power consumption, a few among them are written below-

- Number of people in a room affects the AC power consumption. For example- a room of 20-25 people requires multiple ACs, whereas a room with 3-5 people requires a single AC to cool the room.

- Total number of electrical appliances inside the room generate more heat, which eventually increases the AC power consumption to cool the room.

- 5 star rated AC helps in saving energy, whereas, 1 star or 2 star AC demonstrates higher AC power consumption.

- The temperature outside and inside the room affects the AC electricity consumption. If the temperature outside is more than 35 degrees, the AC requires more electricity to cool the room.

- The choice of AC like window AC, Inverter AC, split AC, central AC affects the AC power consumption.

- The size of the room plays a major role when it comes to AC power consumption. The larger or bigger the room is, the more will be the AC power consumption. Similarly, smaller rooms do not consume higher AC electricity consumption

Energy Calculation

7650 AC @1.5ton each

There are two varieties of ac used 1.5 ton single phase and 3.5 ton 3 phase.

No of 1.5 ton AC =4038

No of 3.5 ton AC =650

For 1.5 ton three star AC

Energy consumed on yearly basis at 10hrs running per day=
1104watt*4038*10*8365=16271524.8units

Hence Energy consumed 16271524.8 KwH.

For 3.5 ton three star AC

Energy consumed on yearly basis at 10hrs running per day=
2614.5watt×650×10*365=6202901.25units

Hence Energy consumed 6202901.25 KwH.

Total energy consumed for three star AC

=16271524.8 KwH +6202901.25 KwH=22474426.05 KwH

For 1.5 ton five star AC

Energy consumed on yearly basis at 10hrs running per day=
840watt*4038*10*365=12380508 units

Hence Energy consumed 12380508 KwH.

For 3.5 ton three star AC

Energy consumed on yearly basis at 10hrs running per day= 1939watt×650×10×365=
4600277.5units

Hence Energy consumed 4600277.5 KwH.

Total energy consumed for three star AC

=12380508 KwH+4600277.5 KwH= 16980785.5KwH

Hence total saving from 3 star AC to 5 star AC

= 22474426.05 KwH -4600277.5 KwH= **5493640.55 KwH**

Hence amount saved = 5493640.55KwH ×5.85= Rs3,21,37,797.217/ at the rate Rs 5.85/ per unit

It was observed few machines are under performing. This is due to age of the machines and construction work, It is recommended to clean the coil frequently to improve the performance.

It was noticed that there is maintenance activity process for the AC system but Weekly/Monthly maintenance checklists are good. The maintenance checklist is as follows:

Check and clean condenser coils.

Check and clean drain pan (If installed).

Check and clean condensate drains to prevent water overflow.

Leak test all coils and connections for Freon leaks.

Check capacitors for hazardous leaks.

Clean and sanitize evaporator coil [in place] for mold and mildew prevention. [Removal for cleaning additional charge]

Check and clean filters.*

Check thermostat calibration & battery life.

Check all supply vents for proper air circulation.

Test heating elements for trouble-free operation.

Check safety controls.

Check Lubricate motor and blower bearings.

Note all corrosion spots and apply protective film, on equipment as needed.

Inspect, clean and spray controls and switches.

Check all electrical components for proper operation.

Check all wire connections and replace, as needed.

Check all relays for trouble-free operation.

Inspect and clean contactor points.

Test compressor's running current.

Document motor amperages to compare to future visits.

Check refrigerant flow control device.

Test and monitor refrigerant pressures.

Check operating temperatures and temperature drop across coils.

Provide a detailed report upon completion of a maintenance visit

Looking at the age of the AC machines, the fouling of the oil inside the refrigerant pipe is noticed. Oil fouling of heat transfer surfaces of air conditioning and refrigeration systems, will cause a loss of about 7% efficiency the first year, 5% the second year and 2% per year the following years.

As the machines were ran at min set temp at all the time and due to the its age factor, the wear and tear of the machine increased, which decreases the machine life.

It is recommended to use Thermo conductive Refrigerant Oil with Special ANTI FRICTION Additive for all types of Refrigeration and Air-conditioning equipment this will help to improve the energy consumption by 10% and improve cooling.

Also the length of the refrigerant pipes between the indoor and outdoor units of ground floor and 1st floor is more. This causing the decrease in the pressure of the refrigerant in the pipe.

Analysis of Chiller Plants:

1. Since the condensers are exposed to lot of dust from the roads, radiated heat, hot air from the condensers of split units and exposure East to West sun shine, the efficiency and performance of the condensers is de-rated. Frequency of condenser fin cleaning is frequent which reduces the life of condensers. It is required to provide shade, guard from dust and radiant heat, provide cold air at the inlet of the condensers to improve performance and efficiency of the condensers to save energy.

2. The operating procedure has to be corrected. since two chillers are operated, they need 350gpm at the design flow rate of 2.4gpm/TR, however two pumps operating provides 940gpm with all the valves of non-working chillers kept open, these mixes return water with chilled water and also unnecessarily

causes erosion of tubes, from the load study it appears that one pump is sufficient to provide circulation. The chiller staging along with one pump has to be established.

3. The AHU's need total up gradation and cleaning. Cleaning of walls and insulation to be provided for walls and floor, filters to be thoroughly cleaned, HEPA treated fresh air to be supplied as per ASHRAE standard to maintain required humidity in the operation theatres, all infiltration to be sealed. Duct should be cleaned by robotic duct cleaner and ducts should be disinfected as per health care standards.

Replacement of conventional water cooler with star rated water purifier.

Total number of water purifiers=236@40 litres

Energy consumed in conventional model=236(number of purifier)*800Watt*10hr*300days= 5,66,400units

Energy consumed in star rated purifier =236(number of purifier)*450Watt*10hr*300days= 3,18,600units

Hence energy saved using star rated purifier =5,66,400units - 3,18,600units

=247800 unit

Hence amount saved =247800KwH ×5.85= Rs 14,49,630/ at the rate Rs 5.85/ per unit

Diesel saving : 38,395 litres

Conclusion:

Sl No	Description	Observation / Recommendations
1	Power Distribution System	Overall Electrical distribution is in good condition.
2	Protection System	All Panel feeders are checked annually and maintained. MCCB are tested annually. All DB's have RCCB and same are tested once in six month. It is recommended to install IoT base advance fault detection system on all DB's.
3.	IR testing of cables	Major Power Cables IR values are above 200 M Ohms. This is good
4.	HOT Spot test of Power Distribution system	Entire distributions systems are thermal scanned by TESTO German make, calibrated Thermal Imager. Few cable termination the temperature was noticed 50 to 60 Deg C. These are serviced and thermal scanned once again. Temp after service is below 40 Deg C.

5	Power Quality of Normal Power / DG Power / UPS Power	Power quality of Normal / UPS / DG Powers were monitored and Voltage, Current Waveforms are found normal. Voltage is quite Stable, Both Voltage and Current Harmonics are within limit. There is no Noise noticed between Earth and Neutral.
6	Energy Monitoring	Energy is monitored on Main and sub meter installed on each Panels Main Incomer on daily basis. This is recommended to install IoT base remote energy monitoring system. This will help to track all load properly, optimize energy consumption.
7	Water Pumping	Water Pump are operating based on the level sensor. All the valves are checked on monthly basis to stop any leakages.
8	Air Conditioning System	Most of the AC machines ET type and some window. The filters of the AC machines are found cleaned. CFM is measured and found ok, KW/ Tr is also good.
9	Electrical Rooms	Overall the elect room and panels are found neat and cleaned.

1. Energy Audits and Benchmarking
   - Conduct an Energy Audit: Assess current energy use to identify areas of inefficiency. This audit helps prioritize improvements and often reveals hidden issues, like air leaks or outdated insulation.
   - Benchmarking: Use tools like Energy Star's Portfolio Manager to track energy usage and compare it to similar buildings. This helps set realistic goals for energy reduction.
2. Upgrading Insulation and Air Sealing
   - Improve Insulation: Adding or upgrading insulation (in walls, roofs, and floors) can significantly reduce heating and cooling costs by minimizing heat loss in winter and heat gain in summer.
   - Seal Air Leaks: Check for leaks around doors, windows, ducts, and other openings, then seal them. Proper air sealing reduces drafts, improves comfort, and lowers heating/cooling demands.
3. Modernizing HVAC Systems
   - High-Efficiency Equipment: KIIT has replaced outdated HVAC systems with energy-efficient models that meet or exceed Energy Star ratings such as VRV/VRF and PAC units.
   - Variable Frequency Drives (VFDs): KIIT has installed VFDs on fans and pumps to adjust motor speed according to demand, which reduces energy consumption in the central library building.
   - Advanced Controls: Use smart thermostats and occupancy sensors to adjust heating, ventilation, and cooling based on occupancy and time of day.
4. Lighting Upgrades
   - Switch to LEDs: All the conventional lighting systems were replaced with LED lighting which is more energy-efficient and longer-lasting than traditional lighting. LED retrofits can significantly cut lighting costs.

- Daylighting and Occupancy Sensors: It is recommended to use daylighting controls and occupancy sensors to automatically adjust artificial lighting, reducing energy consumption when spaces are unoccupied or naturally lit.

5. Water Heating Efficiency
   - High-Efficiency Water Heaters: KIIT is replacing old water heaters with high-efficiency models, such as heat pump water heaters or tankless systems in hostels.
   - Low-Flow Fixtures: KIIT installed low-flow faucets and showerheads to reduce water usage, which in turn decreases the energy required for water heating which is limited to some hostels and academic buildings. It is recommended to install the fixtures for entire university

6. Windows and Doors Improvements
   - Upgrade Windows: KIIT is using Energy-efficient windows with low-emissivity (low-E) coatings and double or triple glazing reduce heat transfer and improve indoor comfort for all their upcoming and ongoing building projects.,

7. Building Automation Systems (BAS)
   - Automated Controls: It is recommended to Integrate a BAS for centralized control of lighting, HVAC, and security systems. This allows for monitoring, scheduling, and adjusting settings based on occupancy, time, and weather.
   - Real-Time Monitoring: A BAS can provide real-time energy monitoring to identify unusual energy use patterns and make immediate adjustments.

8. Renewable Energy Integration
   - Solar Panels: KIIT Installed rooftop -mounted solar panels to generate electricity on-site, reducing reliance on the grid and lowering energy costs.
   - Solar Thermal Systems: KIIT Uses solar thermal systems to preheat water, which can cut down on conventional water heating costs.

9. Building Envelope Improvements
   - Green Roofs or Cool Roofs: It is recommended to use Green roofs which provide insulation and reduce stormwater runoff, while cool roofs reflect more sunlight and absorb less heat, reducing cooling demands.
   - Exterior Insulation Finishing Systems (EIFS): It is recommended to add EIFS to exterior walls improves insulation and reduces thermal bridging, further enhancing energy efficiency. This will decrease the energy by 6% in the HVAC systems.

10. Regular Maintenance and Optimization
    - Routine HVAC and Lighting Maintenance is been carried out by the KIIT maintenance and engineering department. Regularly maintenance helps to optimize HVAC and lighting systems to keep them running efficiently.
    - Retro-Commissioning: KIIT is periodically re-evaluating and adjusting building systems to ensure they operate as intended, especially after upgrades such as LED lights, Window ACs, water pumps.