Energy Audit Report of

M/s **Institute of Aeronautical Engineering,**

Dundigal, Hyderabad, Telangana - 500043

2025-26

By

SRI GAYATRI ENERGY SERVICES

we support you conserve

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ACKNOWLEDGEMENT

M/s **Sri Gayatri Energy Services,** Hyderabad places on record its sincere thanks to progressive management of M/s **Institute of Aeronautical Engineering,** Dundigal, Hyderabad, Telangana for entrusting the Energy Audit work of their College.

The study team is appreciative of the keen interest and encouragement shown by

Sri **M Rajasekhar Reddy**	Chairman
Sri **Ch. Sathi Reddy**	Secretary and Correspondent
Sri **B Rajeshwar Rao**	Executive Director & Treasurer
Dr.**L.V. Narasimha Prasad**	Principal

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We trust the data provided by the M/s **Institute of Aeronautical Engineering,** Dundigal, Hyderabad, Telangana personnel is true to their best of knowledge and we didn't verify the correctness of it.

Audit Study team

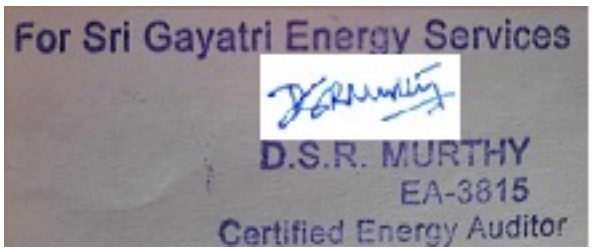
Shri D.S.R.Murthy	Senior Energy Auditor
Shri Durga Rao	Engineer
Shri Avinash	Engineer

LIST OF INSTRUMENTS USED

- True RMS Power Meter
- Digital Earth Resistance meter (Clamp Type)
- Digital Earth Resistance Meter (Conventional Type , Kyoritsu, Japan)
- Digital Infrared Thermometer (Fluke)

CERTIFICATE

We here by certify that we carried out Energy Audit in the M/s **Institute of Aeronautical Engineering,** Dundigal, Hyderabad, Telangana during 9 September 2026 and following Observations were presented below. The Energy Bills were analyzed for energy consumption ,Power factor , Electrical Load distribution , Distribution Losses if any and Recommendation to reduce the same .We appreciate the efforts of the M/s **Institute of Aeronautical Engineering**, Dundigal, ,Telangana for their Pro Energy Conservation measures in this regard.



Executive Summary of Observations & Recommendations

1. A Detailed Walk Through Energy Audit is carried out at the Campus with following observations.
2. The Power Factor at the Main Incoming panel (after Transformer) is satisfactory.
3. The Power Factor at some of the individual Blocks is not good , it is recommended to install small PF improvement capacitor banks at the individual Blocks to improve the PF and reduce the losses.
4. The Electrical machine load is though its high the diversity is low hence no recommendation for this load.
5. The Loading of the UPS is observed to be low, where evert they are found to be low , shift the load to the other UPS and switch off the lowly loaded UPS to reduce the losses.
6. It is observed that the Billed Demand is high and exceeding the CMD for the last one year due to pending of the enhancement of CMD . This resulted in an excess payment of Rs 9,97,120/-. As informed by maintenance team that the CMD enhanced recently to 300 kVA.

Detailed Walk Through Energy Audit scope of work

1. Physical inspection of the premises with reference to Energy Efficient equipment/ Energy Conservation measures/ Renewable Energy .
2. Identifying the Energy saving Opportunities with in the premises by installing efficient equipment /devices / system of the electrical installation.
3. Identifying the Energy Saving opportunities by adopting continuous suitable monitoring methods

Project Schedule :

1. Walk Through Audit : 1 day
2. Report generation : 2-3 Days

Introduction of the Institution

Institute of Aeronautical Engineering (IARE), Hyderabad was established in the year 2000 and is run by Maruthi Educational Society founded by a devoted group of eminent professional and industrialists having a long and outstanding experience in educational system with a mission 'Education for Liberation'. It is the first institute to start B.Tech program in Aeronautical Engineering in the state of Telangana and has gradually transformed itself into an integrated multi-disciplinary technological institute. It is the most preferred institute with 100% admissions in the state of Telangana.

IARE is a prestigious Autonomous engineering college offering eleven B.Tech programs Computer Science and Engineering, Computer Science and Engineering (Artificial Intelligence and Machine Learning), Computer Science and Engineering (Data Science), Computer Science and Engineering (Cyber Security), Computer Science and Information Technology, Information Technology, Electronics and Communication Engineering, Electrical and Electronics Engineering, Aeronautical Engineering, Mechanical Engineering, Civil Engineering and six M.Tech programs in engineering and MBA (Master of Business Administration) with 21 years of rich standing in the educational sphere. The institute is approved by AICTE, New Delhi; recognized by Govt. of Telangana; permanently affiliated to Jawaharlal Nehru Technological University Hyderabad (JNTUH); and accredited by National Assessment and Accreditation Council (NAAC) with 'A' Grade. All the seven B.Tech programs are accredited thrice by National Board of Accreditation (NBA), New Delhi since 2008. The institute also received UGC recognition under Sections 2(f) and 12(B) of the UGC Act.

The institute is ranked 170 in Engineering category as per National Institutional Ranking Framework (NIRF) – 2020, Ministry of Human Resource Development (MHRD), Govt. of India. This illustrates positive performance and quality standards we maintain in Teaching, Research, Employability, and Innovation. Categorized as 'Band B' institution (rank between 26-50) in category of 'Private or Self-Financed College/Institutes' in Atal Ranking of Institutions on Innovation Achievement (ARIIA) – 2020, as per MHRD's Innovation Cell, Ministry of Education, Govt. of India.

Besides the institute has been ranked by different independent national agencies which include Careers 360 (AAAA), India Today (57), The Week (87), Times of India (79), Competition Success Review (17), Outlook (Rank Band:126-170), DataQuest (59), Business World (60).

The total number of students is 4952 and that of faculty is 292, out of which, 82 are Ph.D's (33%) ensuring healthy faculty student ratio. The research activity on campus is woven in pursuance of its vision & mission statements around the philosophy of Inspire, Innovate, and Implement to benefit the contemporary society. It unwinds itself into different fields such as environment, aerospace, PLC, CAD/CAM, CNC machining, tool design, welding, embedded systems, and low power VLSI digital system design. Emphasis is also being laid on manufacturing, automation, business analytics, big data, cloud computing, wireless technology, image processing, and next generation networks.

IARE has fourteen sponsored research projects, and has received grants of worth Rs. 570.59 lakhs for research and other activities by different agencies including DST, AICTE, UGC etc. The institute has a record of intellectual property with 850+ research paper publications by faculty as well as students and 1705+ citations, 35 patents in last 5 years. Internal Revenue Generation through consultancy facilitates

and promotes activities pertaining to energy audit, mobile apps, drones in agriculture, agricultural tools, and material testing.

Big placements greet our students with ample opportunities with around 62 core and software companies visiting the institute every year with 700+ Placements. Placement and training centre is instrumental in signing the Memorandum of Understanding (MOU) with many reputed organizations including Capgemini, L&T Infotech, TCS, Cognizant, Accenture, Accolite Digital, Wipro, Mindtree, MPhasis, NTT Data, Infosys, Hexaware, Optum, TEK Systems, Atos Syntel, Tata Advanced Systems Limited, Cyient, Virtusa, Temenos and so on...

To promote incubation centres, start-ups and entrepreneurship, IARE signed an MOU with National Research Development Corporation (NRDC) to cooperate for the development of technologies and their successful transfer to industry for commercial and socio economic benefits. The students are provided with avenues to showcase their talents and innovative skills. They also participate in various national level engineering competitions like Baja SAEINDIA, Supra SAEINDIA, Go-kart, ADC championships to name a few and have made their mark by winning prizes and ranks. They participate in national and state level project competitions as well as conferences to share their research findings. Students have represented the institute at international level as well.

The central library houses a rich collection of books for all subjects with recent publications. There are about 76,473 books, 20,665 individual titles, nearly 714 National / International Journals, 2715 back volumes, and e-journals from Elsevier (Science Direct), Springer, ASME, ASCE and IEEE (ASPP). Apart from this, the students have an exclusive access to DELNET for resource sharing. The library is open for 10 hours on weekdays and even on Sundays. Book distribution process has been automated for quick and easy access. For circulation of library books 'Automated Self Service Kiosk' has been installed, which enables users to issue, return and renew books by themselves.

Institute has state of art infrastructural facilities to support teaching-learning, research and administrative services. The institute is spread over 17 acres with built up area of 3,37,500 sft. housing 65+ smart class rooms, 2 ICT studio rooms,4 flipped classrooms, 4 conference halls, auditorium, 8 research laboratories, 103 academic laboratories, science and technology startup park, technology innovation and incubation center, open air amphitheater, makerspace, community facilitation center, skill development center and library. Campus-wide networking with 600 Mbps internet connectivity, Wi-Fi and CCTV facility is available. To reduce the consumption of electricity efficient lightings are used with solar electric energy of 160 KW on the grid. A captive power of 480 KVA is provided to ensure smooth working of the institute in times of power outage. The institute operates 32 buses for the benefit of students and staff.

IARE has a home away from home with the best amenities for the students to provide them a comfortable lifestyle within a vicinity of 1 km of the campus. The institute provides separate hostels for boys and girls, made to grow as places to support learning not only academics but also life skills in a multi-cultural and multi-lingual environment.

Students are encouraged to participate as actively in sports and other extracurricular activities as in academics. The institute maintains a separate unoccupied open area of 4 acres for the play fields in any time fit condition. Apart from this, the institute also has several sports rooms where students can play and revive their energies and be mentally and physically fit.

The IARE also enjoys geographical advantage, as it is well connected by air, rail and road. The college campus is adjacent to Nehru Outer Ring Road close to Dundigal junction exit-5, making it accessible to several important centers in and around the city. The Campus is situated 20 Km away from Secunderabad railway station and 11 Km from JNTUH University, Kukatpally, in a lush green and pollution free environment.

With its belief in holistic approach to excellence, the institute offers distinct Teaching-Learning Process to push the boundaries of human knowledge. The Institute excels in supporting "Research initiatives among students and faculty members" and "Entrepreneurship drive among students" which makes IARE as one of the best institutions to enhance the performance of the students.

Facility Description

The Facility Receives Power supply from TSSPDCL at 11 KV , the installed transformer is 11 KV/433 V transformer of 630 KVA and the Contracted Maximum Demand with TSSPDCL is 300 KVA, The total connected Load is around 1452 KW.

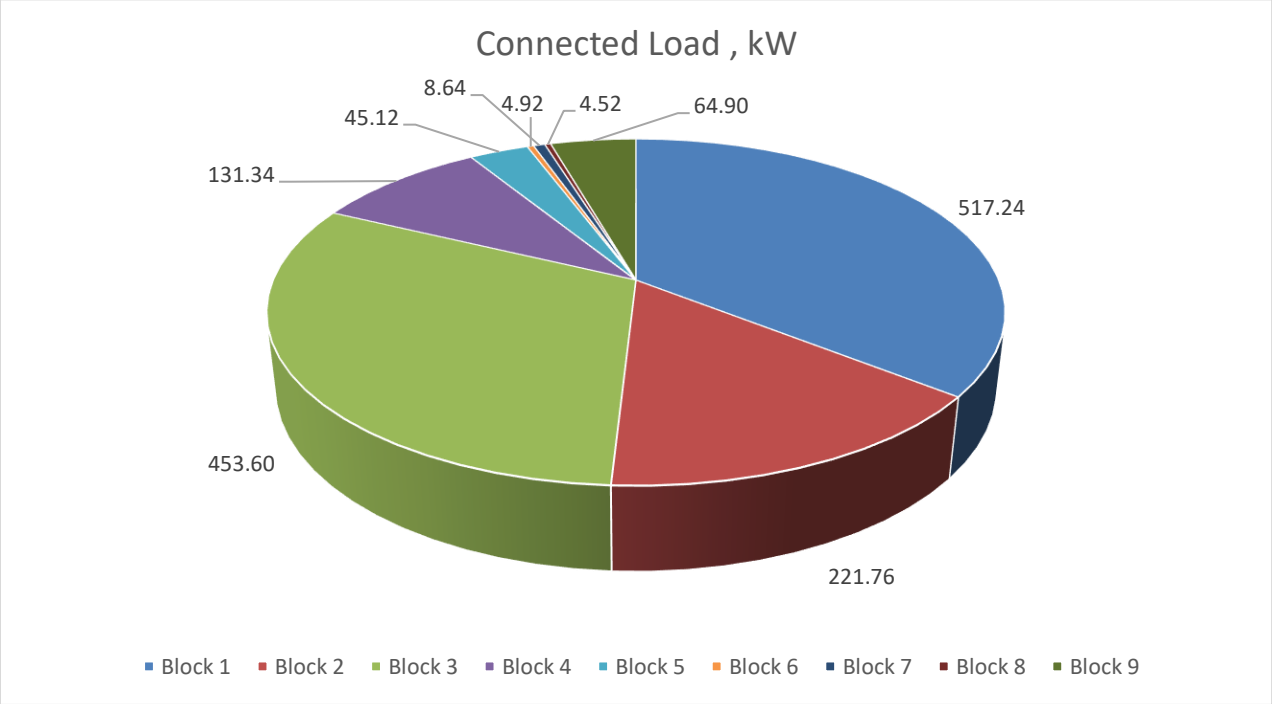
There are total nine blocks , Block 1 to Block 9 . The connected load details and actual operating load details are shared in the following pages

Electrical Load Distribution

The Incoming power supply is from a 11 KV TSSPDCL ,with one Transformers of rating 11kV/433 V 630 KVA , The total connected load is around 1452 KW . The emergency supply taken care by DG Sets . All the three Blocks are equipped with UPS supply for Power back up for the computer systems. The details of the connected Load across the campus ins given below

Lighting	120.628
Fans	105.36
AC's	524
Computers	702.05
Bore Well	11.175
STP	7.45
machines lab	37.25
work shop	14.9
Motors - RO	11.175
Motors - Lifts	18.625

Block Wise Connected Load, kW



The UPS Installed across the campus is Total 44 No's and capacity total to 500 KVA.

Power Measurements: This measurements shows the areas wherever the power factor is less , it is recommended to improve the same by adding small capacitor banks at the respective locations

Power Measurements													
		Voltage(V)			Current(A)			Power Factor			Power(Kw)		
S.NO	Location	R	Y	B	R	Y	B	R	Y	B	R	Y	B
1	Main I/C TP 630A MCCB	227.9	227.9	228.4	241.3	396.4	389.1	0.943	0.956	0.968	51.89	86.3	86.18
2	Bharadwaja Block-01, TP 400A MCCB RAW Power Panel	220.1	223	223.8	140.8	111.9	95.3	0.983	0.961	0.971	30.53	23.97	20.7
3	Bharadwaja Block-01, TP 400A MCCB A /C Panel	228.1	225.9	227.9	21.7	21.9	5.7	0.967	0.989	0.97	4.84	4.84	1.28
4	APJ Abdul kalam Block-02, TP 400A MCCB RAW Power Panel	226.8	227.7	228.9	51.3	42.9	34.7	0.873	0.881	0.932	10.13	8.62	7.35
5	APJ Abdul kalam Block-02, TP 400A MCCB A/C Panel	226.9	227.6	229.1	0	0	0	-	-	-	-	-	-
6	Aryabhata Block-03,TP 400A MCCB RAW Power Panel	231.1	226.8	227.6	42.2	69.1	60.1	0.991	0.993	0.971	9.67	15.54	13.29
7	Aryabhata Block-03,TP 400A MCCB AC Power Panel	232.3	231.7	232.1	6.4	19.1	25.2	0.885	0.994	0.995	1.47	4.41	5.82
8	IT Park Block-04, TP 125A MCCB AC Panel	229.4	227.7	230.9	44.1	45.9	45.2	0.991	0.984	0.993	10.08	10.29	10.42
9	IT Park Block-04, TP 125A MCCB RAW Power Panel	229.6	232.2	230.8	25.6	22.8	20.4	0.801	0.765	0.696	4.68	4.02	3.24
10	Lecture Hall Complex Block-05,TP 400A MCCBRAW Power Panel	226.9	229.1	230.4	28.4	35.6	21.4	0.876	0.917	0.67	5.65	7.52	3.32
11	Lecture Hall Complex Block-05,TP 400A MCCB AC Panel	226.8	228	228.3	0	0	0	-	-	-	-	-	-
12	Work Shop Block-06, TP 100A MCCB RAW Power Panel	232.2	225.7	22.3	1.2	0	0	0.784	0	0	0.22	0	0
13	Food Court Block-07 Raw Power DB C63A MCB	223.7	221.7	228.5	4.1	25.2	4.9	0.987	0.989	0.864	0.88	5.51	0.98
14	Club House Block-08 , TP 125A MCCB RP Panel	223.7	223.9	225.7	9.1	15.3	8.3	0.981	0.991	0.987	2.01	3.41	1.81
15	Research Park Block-09, TP 125A MCCB AC DB	225.6	226.6	227.9	0	0	0	-	-	-	-	-	-
16	Research Park Block-09, TP 125A MCCB RPDB	226.3	227.1	227.3	2.9	2.9	9.3	0.99	0.969	0.98	0.66	0.66	2.08

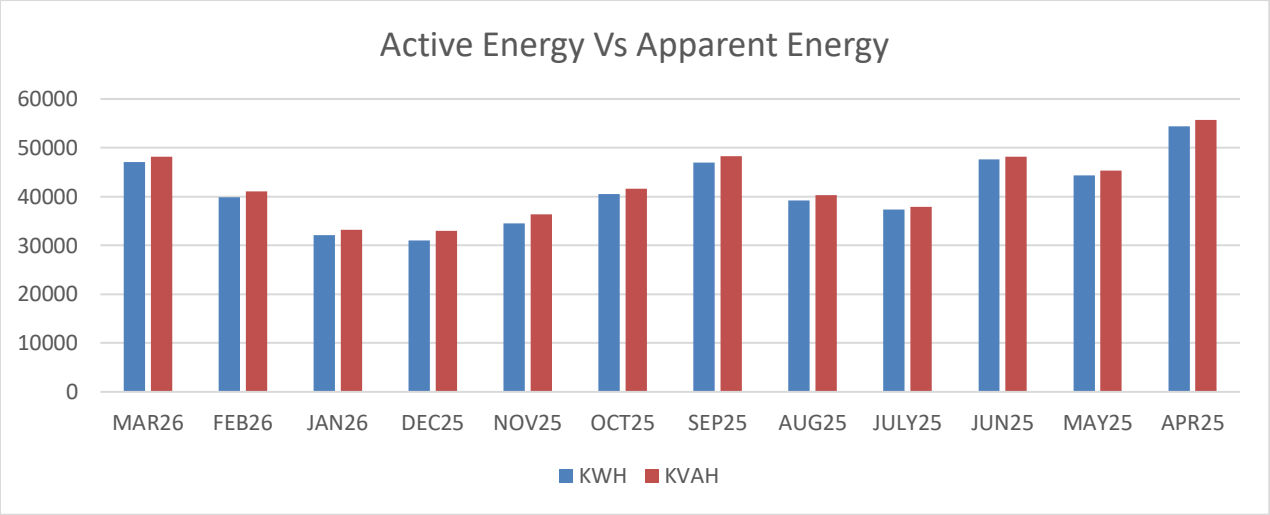
The Energy Bills Analysis is carried out to Understanding the Consumption pattern of the Institute

IARE College of Engineering and Technology ,Hyderabad 2025-26												
	UNITS								CHARGES			
Month	KWH	KVAH	PF	Recorded kVA	Billed KVA	Load Factor	TOD1	TOD2	Demand	Energy	TOD	Total
MAR26	47024	48173	0.976	200	367.04	17.64	5565	5294	267040	474840	12487	759913
FEB26	39857	41059	0.971	200	235.76	25.92	5221	4788	135760	357957	5221	759913
JAN26	32057	33208	0.965	200	165.68	26.94	4723	4951	82840	283395	9674	380395
DEC25	31040	33026	0.940	200	178	24.94	4110	4928	89240	281652	9038	383851
NOV25	34558	36338	0.951	200	208.48	24.21	4172	4744	108480	312628	8916	430024
OCT25	40554	41566	0.976	200	275.36	20.29	5043	5148	175360	408554	11719	595633
SEP25	46961	48240	0.973	200	320	20.94	5925	5502	120400	477724	13141	611265
AUG25	39256	40269	0.975	200	280.4	19.30	4749	4242	180400	403342	10339	594081
JULY25	37330	37924	0.984	200	246.64	20.67	4331	4505	146640	376929	10161	533730
JUN25	47579	48157	0.988	200	364.8	18.33	5347	4692	164800	484545	11544	660889
MAY25	44310	45284	0.978	200	479.92	12.68	5580	4730	379920	477755	12372	870047
APR25	54408	55743	0.976	200	446.24	17.35	6010	4808	346240	581328	12981	940549

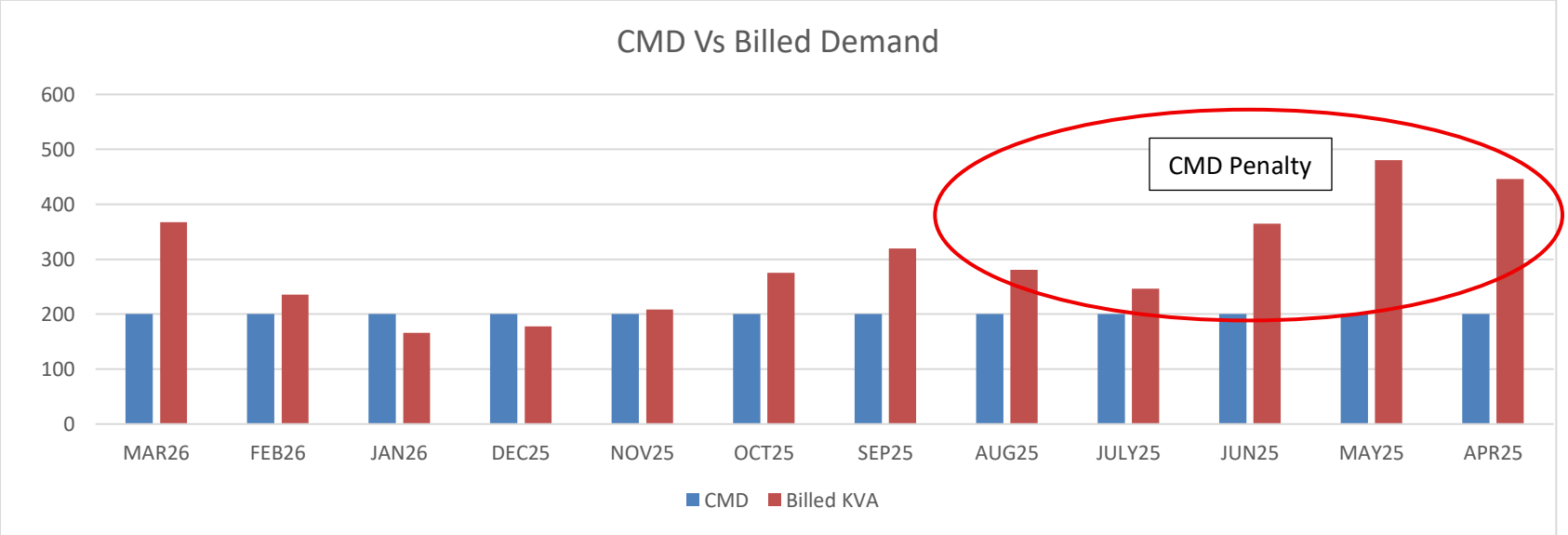
Saving Opportunities

1. The Billed Demand is observed to be high compared to CMD , it is informed that the institute recently enhanced the CMD to 300 kVA
2. The Individual Block wise Power Factor to be improved to reduce the losses at some of the blocks.
3. The load factor of the Institute is very low , it is recommended to improve the load factor .

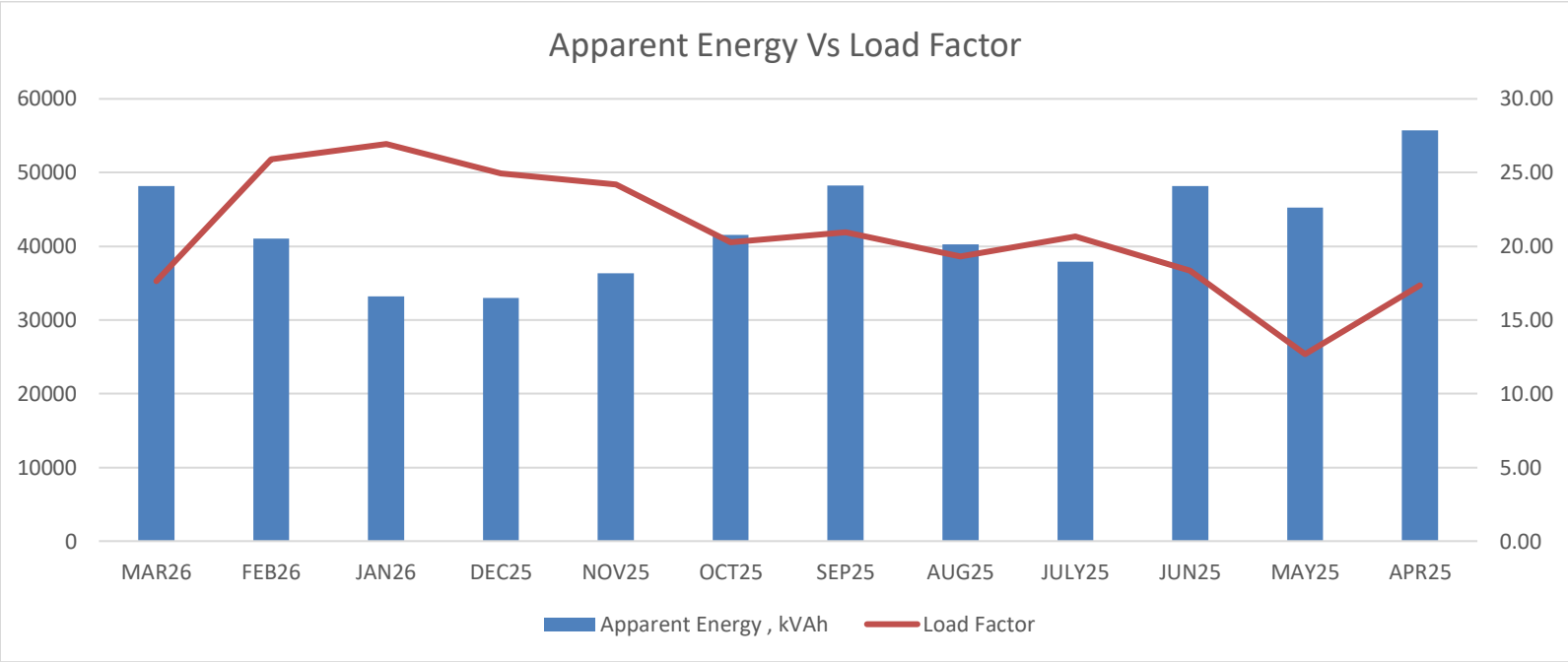
Active Energy Vs Apparent Energy : The PF is maintained satisfactory .



CMD Vs Billed Demand : Institute paid penalty of Rs 9,97,120/- in an year



Apparent Energy Vs Load Factor : Very Low Load Factor , it is recommended to improve the same .



Maintenance & Electrical Safety

1. **Electrical Single Line Diagram / Lay Out Diagram / Equipment Layout / Electrical Control diagram**
   i. Check for Unauthorized Temporary Installations

   ii. Modification to be Updated

   iii. SLD reflects the actual installation

   iv. Duly approved by statutory authorities

2. **Importance of Electrical Safety in the Overall Safety System**

   Periodicity of comprehensive Electrical Safety check

   i. Understanding of electrical hazards
   ii. Electrical checkpoints in the safety checklist
   iii. Implementation priority for electrical hazards
   iv. Electrical Work Permit System
   v. Safe Electrical Operating Procedures

3 **Electrical Preventive Maintenance**

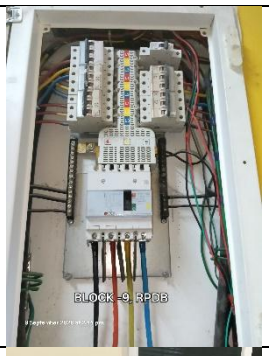
i. Is there an Electrical Preventive Maintenance programme in place
ii. Is the programme implemented? What is the slippage?
iii. Are the relevant standards (statutes and non-statutory) referred and incorporated in the EPM programme?
iv. Electrical Tests, Records, Test Procedure and periodicity (earth resistance, insulation resistance tests)
v. Is the EPM programme only documented?
vi. Transformer tests (dielectric strength, acidity, sludge deposits, dissolved gases, etc.) and periodicity
vii. Periodic calibration of meters (ammeter, voltmeter, relays, temperature gauges) and test instruments (insulation resistance megger, earth resistance megger, multi-meters, etc.)

4 **Earthing System**

i. Installation as per approved design?
ii. Installation and Maintenance as per IS 3043?
iii. Earth resistance measured periodically?
iv. Test procedure
v. Acceptable earth resistance values
vi. Is the earthing system modified when electrical installation is modified?
vii. Are neutral earth pits independent and separate?
viii. Are earth pits identified?
ix. Are two and distinct earth connections provided?
x. Is the earth continuity tested?
xi. Is bonding and earthing carried out to avoid ESD hazards?

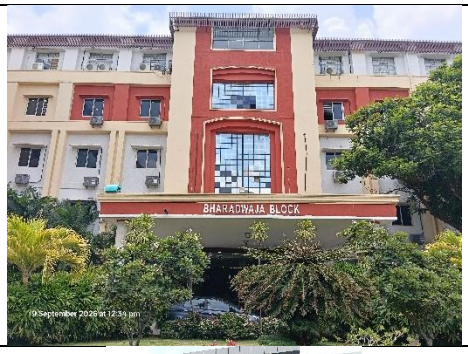
Physical Inspection – Photos


BLOCK -9 DG


BLOCK -9 RPDB


APEC PANEL


BLOCK -9 PANEL


BHARADWAJA BLOCK


ARYABHATTA BLOCK


ARYABHATTA BLOCK


LECTURE HALL COMPLEX

Annexures

Annexure – I Conversion factors

1 Kcal	3.9685 Btu
1 KWh	3413 Btu
1 KWh	860 kcal
1 Btu	1.055 kJ
1 calorie	4.186 joules
1 hp	746 Watts
1 kg	2.2 lb (pounds)
1 meters	3.28 feet
1 inch	2.54 cm
1 kg/cm²	14.22 psi
1 atmosphere	1.0332 kg/cm²
1 kg/cm²	10 meters of water column @ 4 °C
1 kg/cm²	9.807 × 10 4 passels
1 Ton of Refrigeration	3023 kcal/hour
1 Ton of Refrigeration	12000 Btu/hour
1 US Gallon	3.785 liters
1 imperial Gallon	4.546 liters
°F	1.8 × °C + 32
°k	°c + 273

Annexure -II -Abbreviations &Definitions

Abbreviations

°C	degrees Celsius
°F	degrees Fahrenheit
Btu	British thermal unit
Btu/ft2	British thermal units per square foot
J/m^2	Joules per square meter
kVA	kilovolt-amperes
kW	kilowatts
kWh	kilowatt-hours
kWh/m^2	kilowatt-hours per square meter

Definitions :

Basic definitions of terms

Absorber. The component of the vapour absorption chilling package wherein the refrigerant vapour is absorbed by the liquid absorbent.

Air Handling Unit. An air cooling unit, consisting of a blower or blowers, heat exchanger and filters with refrigerant, chilled water or brine on the tube side to perform one or more of the functions of circulating, cooling, cleaning, humidifying, dehumidifying and mixing of air.

Brine. Solution of anti-freeze substances like Sodium Chloride, Calcium Chloride, Mono-ethylene Glycol, Ethyl Alcohol etc.

Coefficient of Performance. The ratio of Net Refrigerating Effect divided by Compressor Shaft Power Or Thermal Power Input. The numerator and denominator should be in the same measuring units.

Compressors. Machines in which compression of refrigerant vapour is effected by the positive action of linear motion of pistons, rotating elements (screws, vanes, scrolls etc.) or conversion of velocity energy to pressure in a centrifugal device.

Compressor, hermetic. Sealed compressor & motor unit, where the electric motor is cooled by the refrigerant and both the compressor and electric motor are not accessible for maintenance.

Compressor, open. Compressor is externally coupled to the prime mover and the refrigerant does not cool the prime mover.

Compressor, semi-hermetic. Compressor motor unit, where the electric motor is cooled by the refrigerant and the compressor is accessible for maintenance.

Condenser. The heat exchanger, which utilizes refrigerant to water/air heat transfer, causing the refrigerant to condense and the water/air to be heated. De-superheating or sub-cooling of the refrigerant may also occur.

Energy Efficiency Ratio. The ratio of Net Refrigerating Effect (Btu/hr) divided by Shaft Power (Watts) or Thermal Power Input (Watts) consumed.

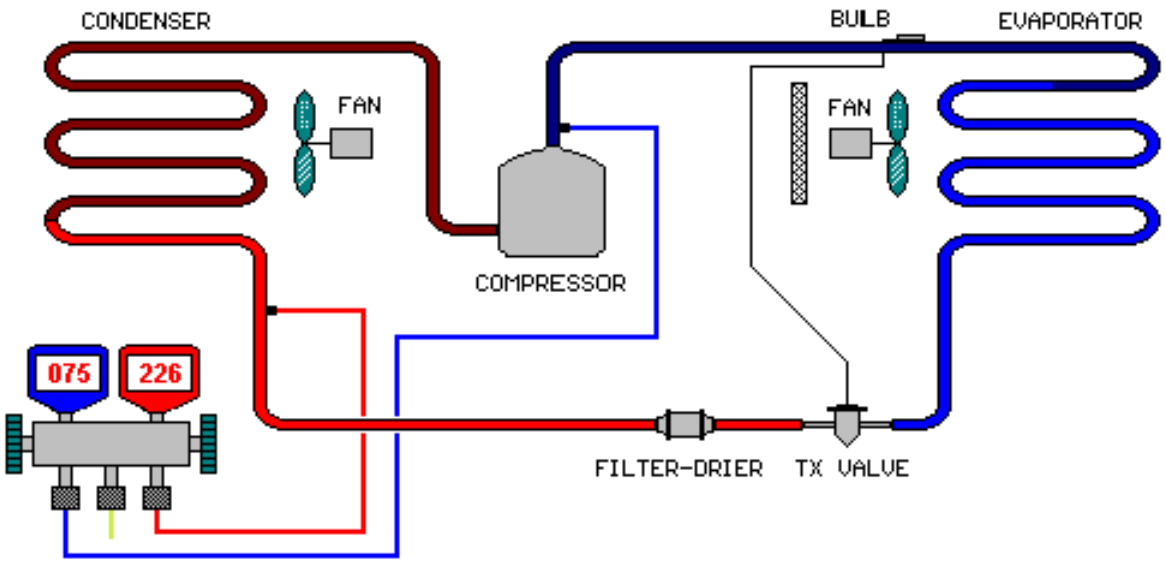
Electric Motor. Electrically operated rotary prime mover.

Enthalpy. The heat content of a substance at a particular temperature.
Engine. Internal combustion engine used as prime mover.
Evaporator. The heat exchanger wherein the refrigerant evaporates and, in the process, cools another fluid I(generally water, brine or air).
Fluid. The substance that is usefully cooled in the chilling package (generally water, brine or air).
Generator. The component of a vapor absorption chilling package wherein the absorbent solution is heated to evaporate the refrigerant and concentrate the absorbent.
Gross Calorific Value. The amount of heat produced per unit of fuel when complete combustion takes place at constant pressure, the products of combustion are cooled to the initial temperature of the fuel and air, and the vapor formed during combustion is condensed.
Net Refrigeration Effect. The useful cooling effect (or heat removal) in the evaporator.
Psychometric Chart. A chart or plotted curves showing the various parameters of air at different temperatures at atmospheric pressure. The parameters shown include dry bulb temperature, wet bulb temperature, relative humidity, moisture content, enthalpy and sensible heat factor.
Refrigerant. The substance that evaporates in the evaporator to provide cooling effect.
Shaft Power. Power at the shaft of any rotary equipment.
Specific Fuel Consumption. The ratio of Thermal Power Input (kg/h of liquid fuel or m3/h of gaseous fuel consumed to the Net Refrigerating Effect (Tons of Refrigeration).
Specific humidity. Mass of water vapor per unit mass of dry air.
Specific Power Consumption. The ratio of Shaft Power (kW) to the Net Refrigerating Effect (Tons of Refrigeration).
Specific Steam Consumption. The ratio of Thermal Power Input (kg/h of steam) to the Net Refrigerating Effect (Tons of Refrigeration).
Speed. The number of revolutions per minute of the shaft.
Temperature, dry bulb. The temperature indicated by any temperature sensing element when held in air.
Temperature, Inlet. Temperature measured at the inlet stream of the heat exchanger.
Temperature, Outlet. Temperature measured at the outlet stream of the heat exchanger

Annexure :III HVAC

Introduction & back ground

Refrigeration Basics



- Refrigeration is the removal of heat from a material or space, so that it's temperature is lower than that of it's surroundings.
- When refrigerant absorbs the unwanted heat, this raises the refrigerant's temperature ("Saturation Temperature") so that it changes from a liquid to a gas — it evaporates. The system then uses condensation to release the heat and change the refrigerant back into a liquid. This is called "Latent Heat".
- This cycle is based on the physical principle, that a liquid extracts heat from the surrounding area as it expands (boils) into a gas.
- To accomplish this, the refrigerant is pumped through a closed looped pipe system.
- The closed looped pipe system stops the refrigerant from becoming contaminated and controls its stream. The refrigerant will be both a vapor and a liquid in the loop.

Annexure - IV Lighting

Recommended illumination Levels as Per IS 3646 Part I-1992			
Type of Interior Activity	Range of Service Illuminanace in Lux	Quality Class of Direct Glare Limitation	Remarks
Education			
Assembly Halls	200-300-500	3	
Teaching Spaces	200-300-500	1	
Lecture Theatres			
i) General	200-300-500	1	
ii) Demo Benches	300-500-700	1	Localized Lighting may be appropriate
iii) Seminar Rooms	300-500-750	1	
iv) Art Rooms	300-500-750	1	
v) laboratories	300-500-750	1	
vi) Libraries	200-300-500	1	
vii)Music Rooms	200-300-500	1	
viii) Sports Hall	200-300-500	1	
ix) Work Shop	200-300-500	1	
x)Computer Work station	300-500-750	1	
xi)Bath Rooms	50-100-150		Supplementary local lighting near mirror
xii) Office Rooms	300-500-750	1	
xiii) Entrance Halls, Lobbies	150-200-300	2	
xiv) Corridors, Passageway, Stairs	50-100-150	2	

Light Source Comparison			
Attributes	**Incandescent**	**CFL**	**LED**
Colur Rendering Index	100	Greater than 80	40-80
Watts/ Lamp	100	23	1
Lumen/Lamp	1600	1600	30
Lumen/Watt	16	60-80	20-30
Life (Hrs)	750	8000	50,000

Colour Rendenring Index

1500 K	Candlelight
2680 K	40 W incandescent lamp
3000 K	200 W incandescent lamp
3200 K	Sunrise/sunset
3400 K	Tungsten lamp
3400 K	1 hour from dusk/dawn
5000-4500 K	Xenon lamp/light arc
5500 K	Sunny daylight around noon
5500-5600 K	Electronic photo flash
6500-7500 K	Overcast sky
9000-12000 K	Blue sky