Detailed Energy Audit Report

Submitted to

Shaheed Udham Singh Government College

S.U.S College Road, Bakshiwala, Sunam,

Punjab 148028

Prepared and Submitted by

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GLOSSERY

APFC	Automatic Power Factor Correction Capacitor
DBT	Dry Bulb Temperature
DG	Diesel Generator
EL	Electronics
HSD	High speed diesel
HT	High Tension
HV	High Voltage
LT	Low Tension
LV	Low Voltage
MDI	Maximum Demand Index
PA	Power Analyzer
PBP	Payback Period
PSPCL	Punjab State Power Corporation limited
RH	Relative Humidity
SB	Stand By
SDA	State Designated Agency
SPV	Solar Photo Voltaic
THD	Total Harmonics Distortion
VFD	Variable Frequency Drive
WBT	Wet Bulb Temperature

ASSUMPTIONS FOR CALCULATIONS

Description	Value
Operating days per annum	250
Average Operating hours per day	8hrs
Unit Cost, Rs./kVAh	6.31

ACKNOWLEDGEMENT

Indona Innovative Solutions is thankful to Shaheed Udham Singh, Govt College, Sunam for providing an opportunity to conduct Detailed Energy Audit Study at college campus located at 4RC4+FFW, S.U.S College Road, Bakshiwala, Sunam, Punjab 148028.

We take the opportunity to express our profound gratitude towards Dr. Parminder Singh (Principal) for award of work. We are also very thankful to him for her advice and valuable support extended to this project.

We are also grateful to Mr Ashwani Goyal, Dr. Vikas Kumar, Mr Mohammad Anwar, Mr Satinder Singh and Mr Amit Kapoor for his valuable time and actively participation in discussion with audit team with tremendous patience and understanding.

Our sincere thanks to all respondents from different departments for clearing our doubts.

The Following Officers /representative from Indona Innovative Solutions under the guidance of Shri Devinder Singh have carried out the energy on 16/11/2021.

Name	Role
Shri Devinder Singh	Energy Auditor
Shri Yogesh Kumar	Consultant

We do hope that management will find the recommendations given in this report useful in energy conservation as well as improvement in system performance. We have made every attempt to adhere to high quality standards, in both data collection and analysis. We would welcome any suggestions from your side as to how we can improve further.

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Indona Innovative Solutions

EXECUTIVE SUMMARY

Shaheed Udham Singh, Govt College, Sunam has awarded the Detailed Energy Audit study to Indona Innovative Solutions with a target to identify the energy reduction key areas and submission of report. The facility has two 0.415kV power supply connections from PSPCL. The contract demand of the college is 72.378kVA for main campus and 14.82kW of sanctioned load for self finance campus inside the college premises. The annual energy consumption of the campus is around 24,760kVAh

The intensive energy audit is conducted by the energy audit team during November 2021 to understand the energy consumption pattern and found huge energy saving potential. Based upon the site visit and performance assessment of utilities, recommendations are given to capture energy saving potential. The various measures have been given in below table based upon the sample payback period:

Sr. No.	Description	Energy saving, kWh	Annual Saving, Rs. Lakh	Investment, Rs. Lakh	Simple Payback Period, months
1	Reduction in contract demand from 72.378kVA to 49.0kVA	0.0	22,440	Nil	Immediate
2	Ensuring switching off the lights when there is no occupancy in the respective class room or office areas	5,154	32,520	Nil	Immediate
3	Replacement of the conventional lights FTL- 12 with new (20W LED) energy efficient lights	3,915	24,704	40,500	19.7
4	Replacement of the conventional lights T- 5 with new (20W LED) energy efficient lights	2,681	16,919	49,500	35.1
5	Installation of 32.0kWp capacity Grid connected Solar PV System for lighting load and other load	26,151	1,65,010	9,62,500	70.0

Table 1: List of Energy Conservation Measures

- The annual energy saving potential from connected load is around 11,749kVAh of the annual energy consumption.
- The energy saving from the SPV installation is separate.
- The Installation of Energy Monitoring System is required for benchmarking and targeted energy reduction can help in further reduction in energy consumption.

1. INTRODUCTION

1.1. INTRODUCTION ABOUT SHAHEED UDHAM SINGH, GOVT COLLEGE, SUNAM

Shaheed Udham Singh Government College, Sunam was founded and established in 1969 under the name of Shaheed Udham Singh Memorial Degree College, Sunam. In 1974, when the ashes of the great martyr brought from London to Sunam with the efforts of Centre and State Government, the name of the institution was changed to Shaheed Udham Singh Government College, Sunam. The college is affiliated to the Punjabi University, Patiala at present carrying NAAC Accredited-Grade B. Along with facilitating the participation of village students in higher education, its efforts are directed at providing holistic education that encourages critical and independent thinking. The college has adequate infrastructural facilities such as class rooms, library, computer laboratory, playground etc. Apart from the regular teaching learning activities, the college strives for the overall development of the students by conducting various extra-curricular activities for them. The college has steadily grown, fulfilling its aims and goals. It offers undergraduate, graduate and post graduate courses in Science Commerce and Arts. The arial view of the campus is as below:

Figure 1: Location of College Campus

1.2. MAJOR ENERGY USE AREAS

In SUS College, Sunam Electricity is the only source of Electrical Energy to run day to run operations in the campus. In annual energy bill, major contribution is due to Electrical Energy only. The campus has two electrical connections from the grid; one for the main campus having and other for Self Finance Campus. The connected load of the entire campus is 112.7kW. The detail of the connected load is as below:

Description	Connected Load, main Campus, kW	Connected Load Self Finance Campus, kW	Total Load, kW
FTL- 12	10.10		10.10
T- 5	4.46	2.739	7.19
LED 20W	3.16	0.24	3.40
Metal Halide	0.40		0.40
CFL	0.20	0.014	0.21
Ceiling Fan	22.75	3.36	26.11
Wall Fan	0.50		0.50
Split AC	10.00	5.4	15.40
Window AC	1.80	1.8	3.60
Exhaust Fan	1.40		1.40
Laptop and Computer	5.44	7.14	12.58
Printer, scanner and Projector	14.40	4.5	18.90
Other	12.90		12.90
Total	**87.50**	**25.20**	**112.70**

Table 2: Connected load in the campus

The maximum load in the college premises is due to ceiling fan but the running load of the ceiling fan is less than lighting load. The lighting load is the sum of connected load of different type of fittings to maintain the lux level.

1.3. CLIMATE CONDITION OF SUNAM

Sunam city experiences extreme summer and winter season. The weather of the district Sunam has a humid subtropical, dry winter climate classification. The district's yearly temperature is 29.41ºC (84.94ºF) and it is 3.44% higher than India's averages. Sunam typically receives about 52.64 millimeters (2.07 inches) of precipitation and has 71.83 rainy days (19.68% of the time) annually. The seasonal temperature profile of Sunam is as below:

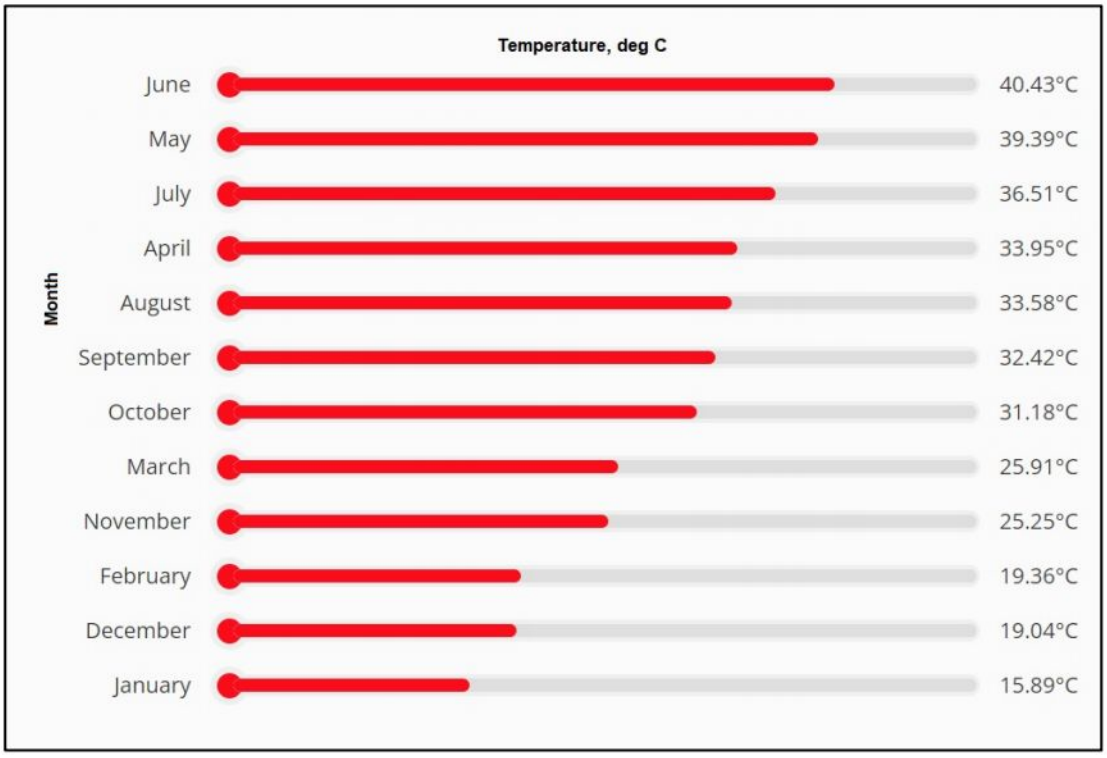


Figure 2: Annual temperature profile Sunam

The temperature profile contributes towards the trend of energy consumption. During extreme summer, the energy consumption increase as the running of AC units, fans etc. adds into the normal running load.

2. ENERGY AUDIT APPROACH AND METHODOLOGY

2.1 APPROACH

A team of Energy Auditors was involved in carrying out the study, the general scope of which was as follows:

- Conduct energy performance evaluation and process optimization study
- Conduct efficiency test of equipment and make recommendations for replacement (if required) by more efficient equipment with projected benefits
- Suggest improved operation & maintenance practices
- Provide details of investment for all the proposals for improvement
- Evaluate benefits that accrue through investment and payback period
- Discuss with the respective personnel, the individual Energy Saving Projects (ESPs) for agreement for implementation.
- Analyze various energy conservation measures and to prioritize based on the maximum energy saving & investment i.e. short, medium and long term.

Prioritization	Payback Period
Short Term Project	Less than 1 year
Medium Term Project	Between 1 and 3 years
Long Term Project	More than 3 years

2.2 MEHODOLOGY

The general methodology followed is captured in the following figure:

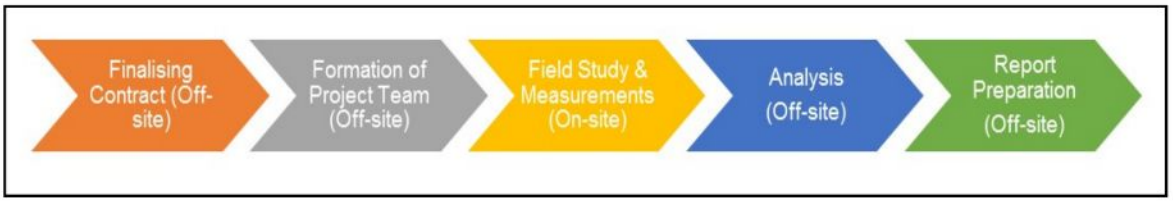


Figure 3: Methodology for Energy Audit

2.3 INSTRUMENTS USED FOR ENERGY AUDIT

The following portable instruments were used for data measurement:

- 3 – phase Power Analyzer
- Single phase Power Analyzer
- Ultrasonic Water Flow Meter
- Anemometer
- Hygrometer
- Digital Thermometer
- Infrared Thermometer
- Pressure gauge
- Lux Meter

3. ELECTRICAL SYSTM AND BILL ANALYSIS

3.1. ELECTRICAL SYSTEM

This facility is receiving 0.415kV power supply from Punjab State Power Corporation Limited (PSPCL). The direct power supply is coming in the campus premises at the distribution panel.

3.2. ELECTRICITY BILL ANALYSIS

Shaheed Udham Singh Government College, Sunam is getting electricity supply from PSPCL having account number 300733364. The contract demand for main campus is 72.378 and sanctioned load for self fiancé division is 14.82kW. This facility is billed on two-part tariff structure. One part for capacity or demand drawn basis i.e. fixed Charges and the second part for actual energy drawn during the billing cycle. Fixed Charges are calculated based upon the MDI. Actual Energy Consumption is calculated based upon the Meter reading. The following components are the part of tariff structure as per latest tariff order:

Sr. No.	Components	Description	Charges Self Finance	Charges Main Campus
1	Fixed Demand Charges	Charges for Fixed/Maximum demand registered during the month/billing period	Rs95/kVA	Rs.80/ kVA
2	Energy Charges	Billed on drawn kWh units	Rs. 4.64/kWh up to 100kWh Rs. 6.5/kWh for 200kWh Rs. 7.5/kWh for above 300kWh	Rs. 6.31/kVAh
3	Total Rent with Tax		Variable	
4	Total Surcharge		Variable	
5	Total Rebates		Variable	
6	MC Tax		2.0%	
7	Electricity Duty		13.0%	

Table 3: Energy Bill Components

The electricity bill analysis is done for main campus and various values for billing are as below:

Month	MDI, kVA	kWh	kVAh	Power Factor	Energy Charges, Rs	Fixed Charges, Rs	Bill Amount, Rs
Dec-18	6.00	1,265	1,505	0.84	9,497	4,624	35,710
Jan-19	6.00	977	1,043	0.94	6,581	4,624	24,660
Feb-19	7.00	2,027	2,118	0.96	13,365	4,624	18,200
Mar-19	7.00	1,192	1,260	0.95	7,951	4,624	23,140
Apr-19	16.00	1,665	2,718	0.61	17,151	4,624	23,680
May-19	28.00	2,256	2,913	0.77	18,381	4,624	19,660
Jun-19	28.00	4,275	4,279	1.00	27,000	4,624	44,230
Jul-19	17.00	2,378	2,583	0.92	16,299	4,624	45,640
Aug-19	36.00	4,421	4,628	0.96	29,203	4,624	78,840
Sep-19	34.92	4,141	4,332	0.96	27,335	4,721	38,250
Oct-19	21.28	4,221	4,416	0.96	27,865	4,112	39,150
Jan-20	8.58	2,317	2,445	0.95	15,428	5,025	25,070
Feb-20	3.82	1,685	1,769	0.95	11,162	4,708	19,800
Mar-20	6.80	1,190	1,272	0.94	8,026	4,101	15,300
Apr-20	8.20	1,400	1,522	0.92	9,604	4,708	15,630
May-20	11.30	1,269	1,335	0.95	8,424	4,624	14,680
Jun-20	4.62	1,422	1,567	0.91	9,898	5,392	22,160
Jul-20	8.44	2,129	2,239	0.95	14,173	5,695	25,290
Aug-20	11.30	1,984	2,085	0.95	13,156	4,624	23,780
Sep-20	6.78	2,108	2,252	0.94	14,255	5,885	26,970
Oct-20	8.38	2,740	2,871	0.95	18,173	5,695	28,880
Nov-20	2.52	1,062	1,188	0.89	7,520	5,885	18,170
Dec-20	4.18	1,689	1,720	0.98	10,888	6,265	20,630
Jan-21	4.56	1,317	1,319	1.00	8,349	6,265	14,997
Feb-21	3.72	1,060	1,062	1.00	6,722	5,901	15,610
Mar-21	3.20	906	911	0.99	5,767	4,569	12,780
Apr-21	3.56	1,161	1,192	0.97	7,545	6,092	15,050
May-21	4.50	1,173	1,270	0.92	8,039	6,112	16,900
Jun-21	6.70	1,575	1,767	0.89	11,242	6,187	21,090

Month	MDI, kVA	kWh	kVAh	Power Factor	Energy Charges, Rs	Fixed Charges, Rs	Bill Amount, Rs
Jul-21	8.90	2,582	2,873	0.90	18,473	6,568	30,240
Aug-21	18.82	2,821	3,066	0.92	19,714	6,786	33,200
Sep-21	27.46	3,617	3,923	0.92	25,225	6,786	38,640

Table 4: Major Components of Electricity Bill for main campus

The major outcomes of the bill analysis are as below:

- The annual energy consumption of the campus is 2063kVAh/month.
- The annual energy consumption charges are Rs Rs14137.8/month.
- The annual average bill amount is Rs 25,012/month.
- There is huge variation in energy consumption on monthly basis due to change in climate and students footfall.

3.3. ELECTRICITY BILL COMPONENTS

3.3.1 MAXIMUM DEMAND PATTERN

The contract demand for main campus is facility is 72.378kVA and billable demand is 80% of the contract demand. The monthly MDI should not exceed the contract demand; otherwise customer will pay a penalty on the electricity bill as defined in Tariff Order. The month wise MDI for main campus is as below:

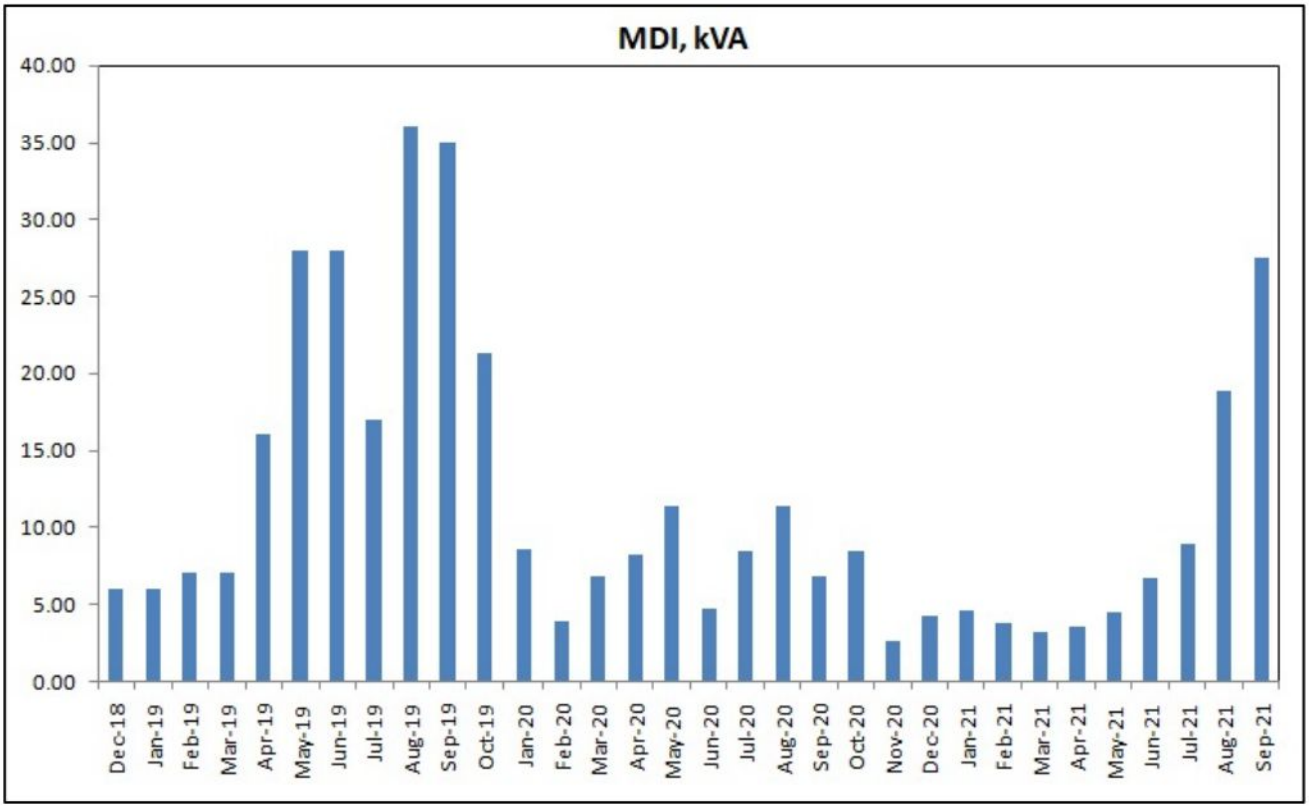


Figure 4: Month wise MDI for both the connections, kVA

As per electricity bill, MDI is varying from 2.52kVA to 36.0kVA however the facility is being charged for 57.9kVA as fixed charges as per tariff order. As per electricity bill analysis, it is clear that MDI in one year Electricity bill has not even exceeded contract demand or sanctioned load.

3.3.2 ENERGY CONSUMPTION PATTERN

There is huge variation in energy consumption in one year. Month wise energy consumption is as below:

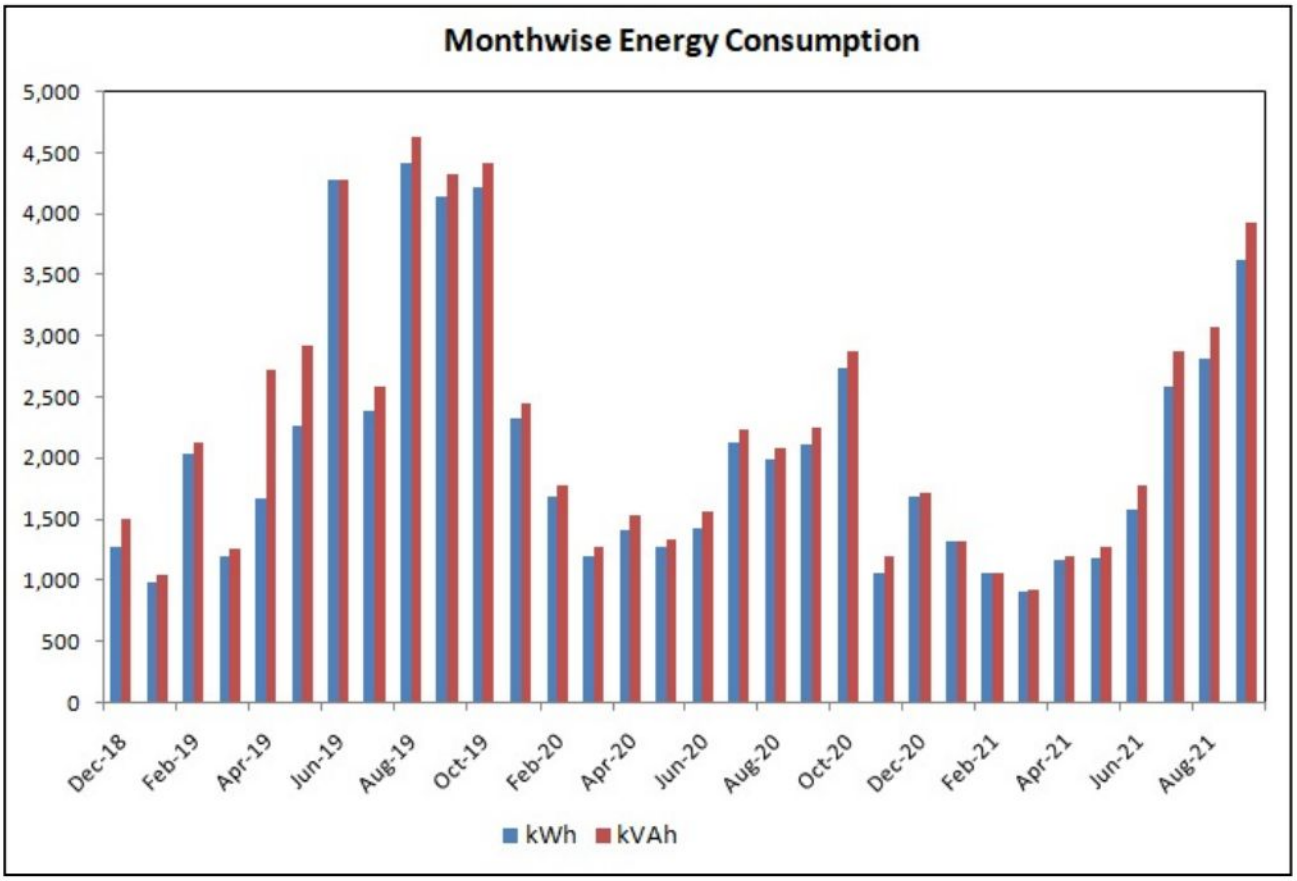


Figure 5: Month wise Energy Consumption kWh and kVAh

The major highlights from the energy consumption data from bill analysis are as below:

1. The billing for main campus is in Rs./kVAh however the energy consumption in electricity bill is mentioned in both kWh and kVAh.
2. The energy consumption varies from 1043kVAh to 4628kVAh on monthly basis.
3. The lower energy consumption is observed during very low foot fall in the college.

3.3.3 POWER FACTOR PATTERN FOR MAIN CAMPUS

The month wise power factor graph for main campus is as below:

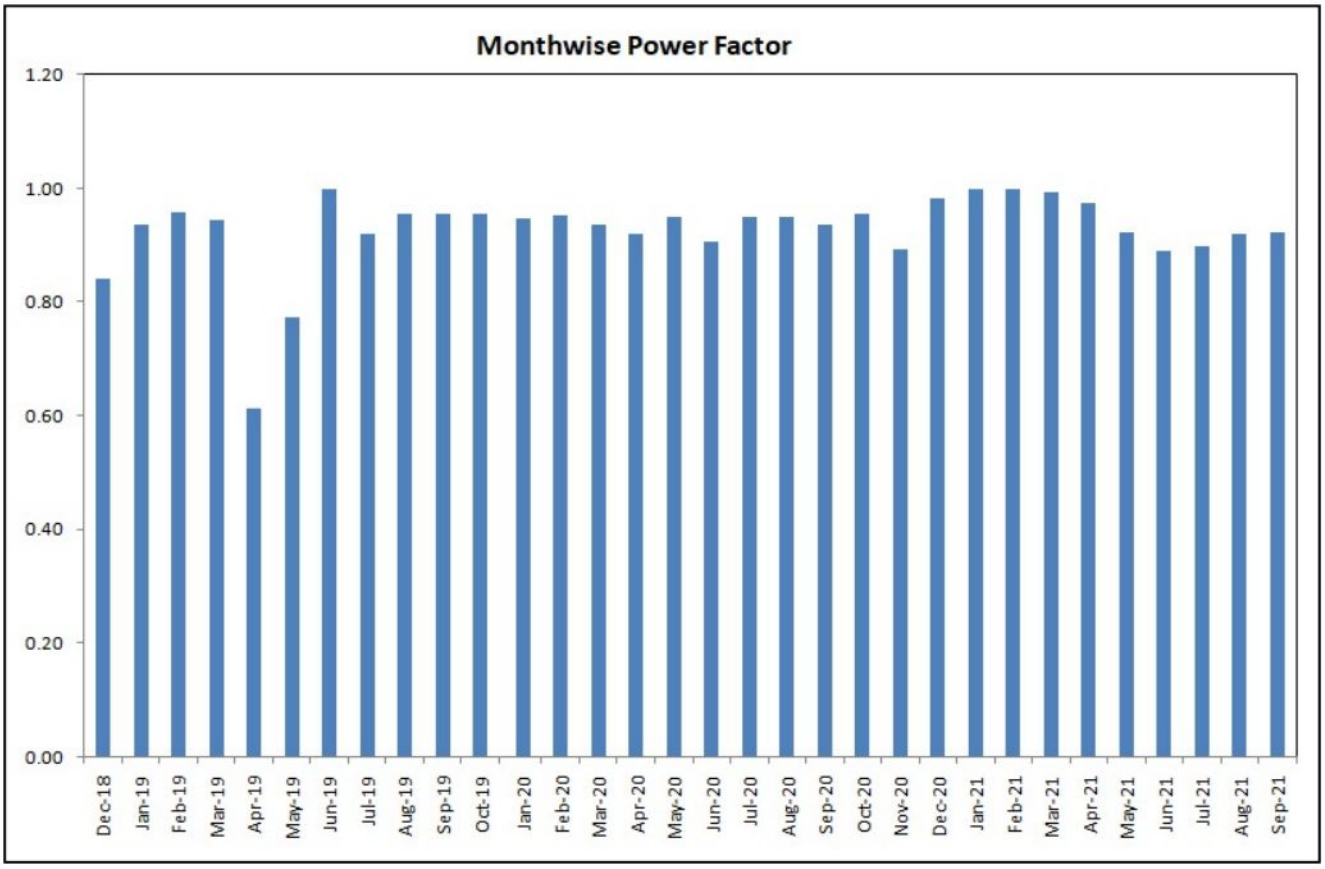


Figure 6: Month wise Power Factor for Main Campus

The major observations from the Power factor graph are as below:

1. There is potential for improvement in power factor.
2. The maximum power factor (1.0) and minimum power factor is 0.61.
3. On annual basis, the power factor for the facility is 0.927.
4. The power factor close to unity is preferred when billing is in Rs/kVAh.

4. Performance Assessment of Utilities

4.1 MAIN INCOMER SUPPLY

There is huge load variation based upon the occupancy in the class room, different office areas, library and running of pumps. Three phase power analyzer has been used for recording of parameters at Transformer. The location of Power Analyzer is as below:

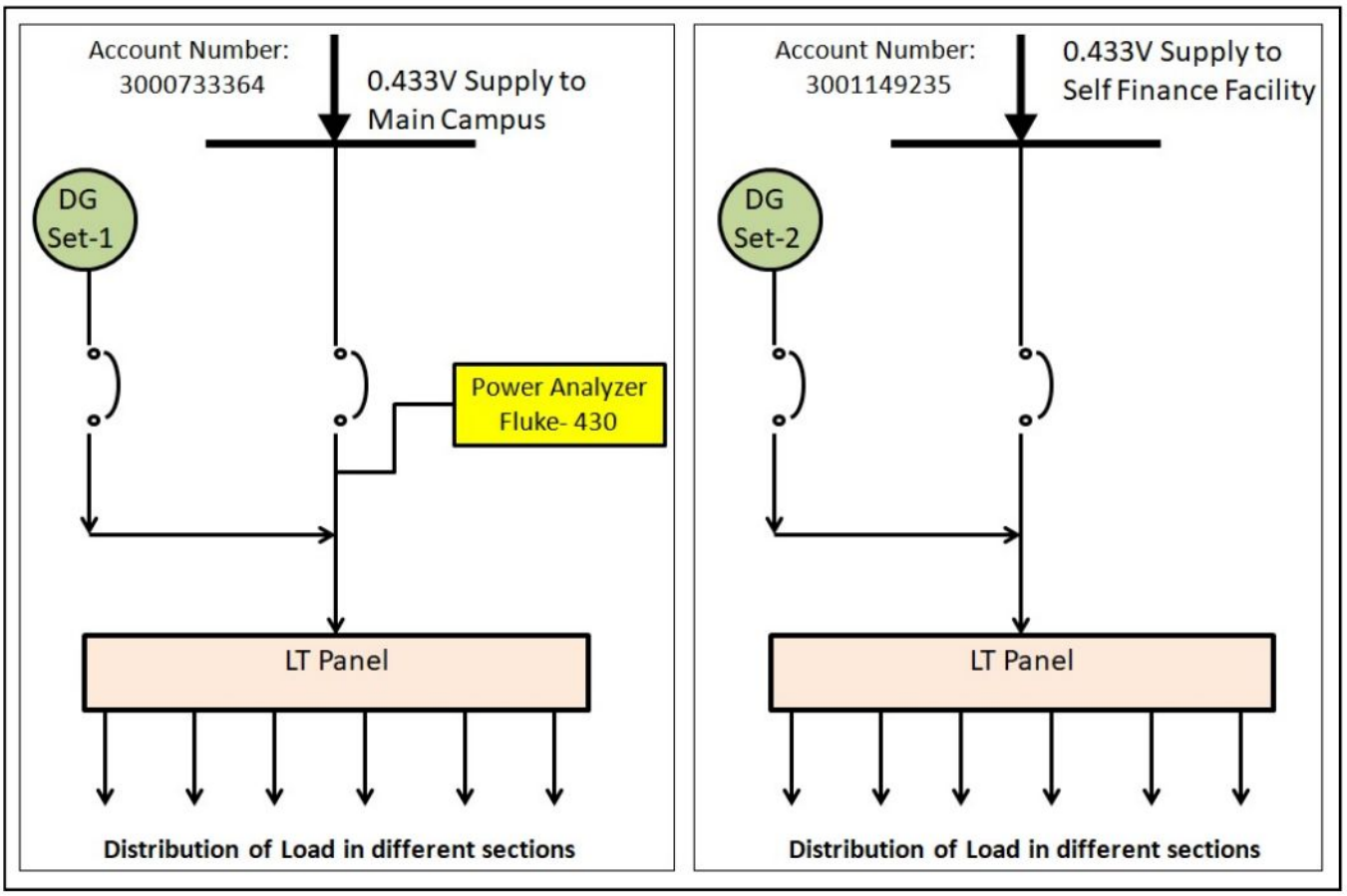


Figure 7: Position of Power Analyzer

Based upon the recorded parameters and physical inspection of the entire electrical distribution system.

4.2 POWER QUALITY

Power quality determines the fitness of electrical power to consumer devices. Synchronization of the voltage frequency and phase allows electrical systems to function in their intended manner without significant loss of performance or life. It is used to describe electric power that drives an electrical load and the load's ability to function properly. Without the proper power, an electrical device (or load) may malfunction, fail prematurely or not operate at all. There are many ways in which electric power can be of poor quality such as voltage unbalance, harmonics etc. We have use **Fluke make Power Analyzer** to check power quality of the system. Under Power Quality, the various parameters measured and calculated are as below:

1. Load Variation
2. Voltage Unbalance
3. Power factor variation
4. Harmonics level

As per design, this is 8hr running facility. The power analyzer was put at main incomers to record data. Based upon the recorded values for power and power factor are as below:

4.2.1 LOAD VARIATION

Since this is not a fully 24x7 operational facility so load behavior is different and depends upon the occupancy and weather condition. The activities which are performed continuously lead to continuously contribution towards energy consumption. The load trend on main incomers is as below:

The trend of Voltage variation at main incomer is as below:

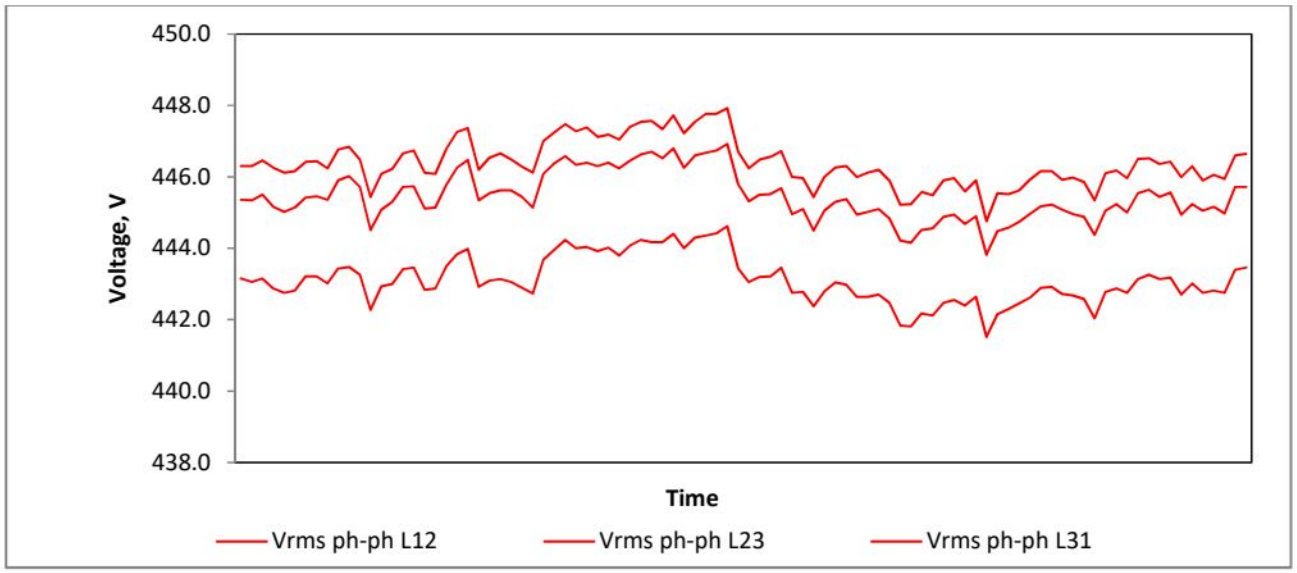


Figure 8: Trend of Voltage variation at main incomer

The trend of current variation at main incomer is as below:

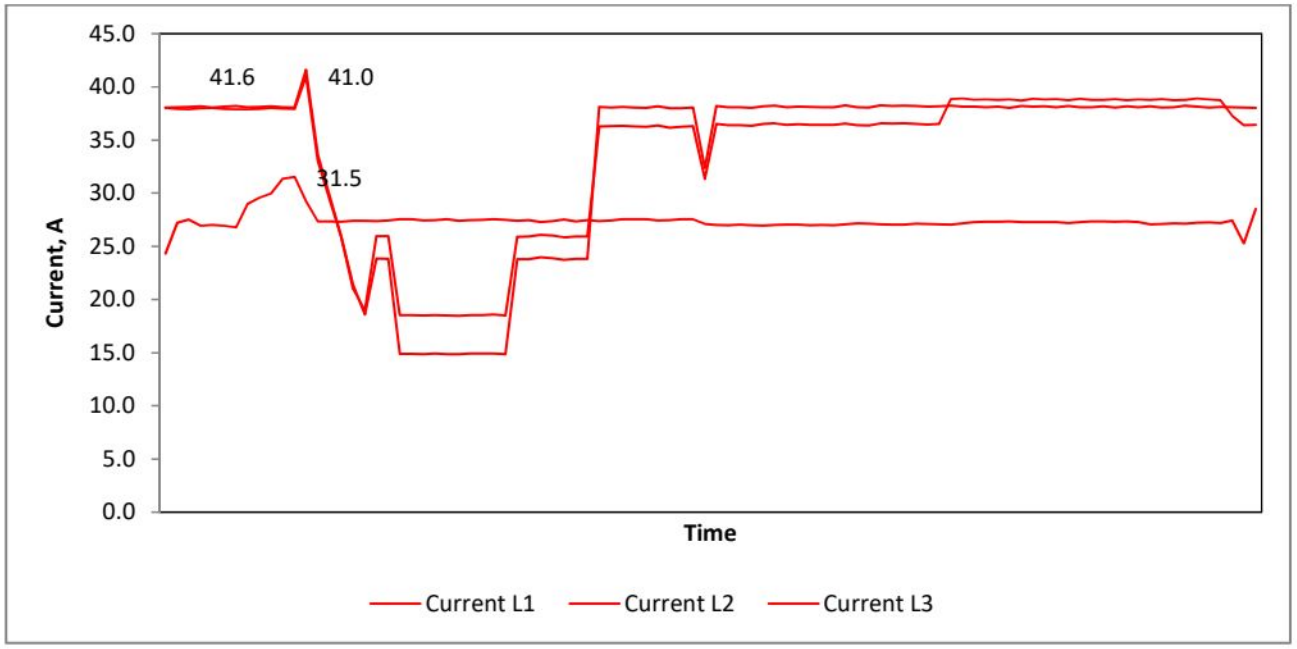


Figure 9: Trend of current variation at main incomer

The trend of load variation at main incomer is as below:

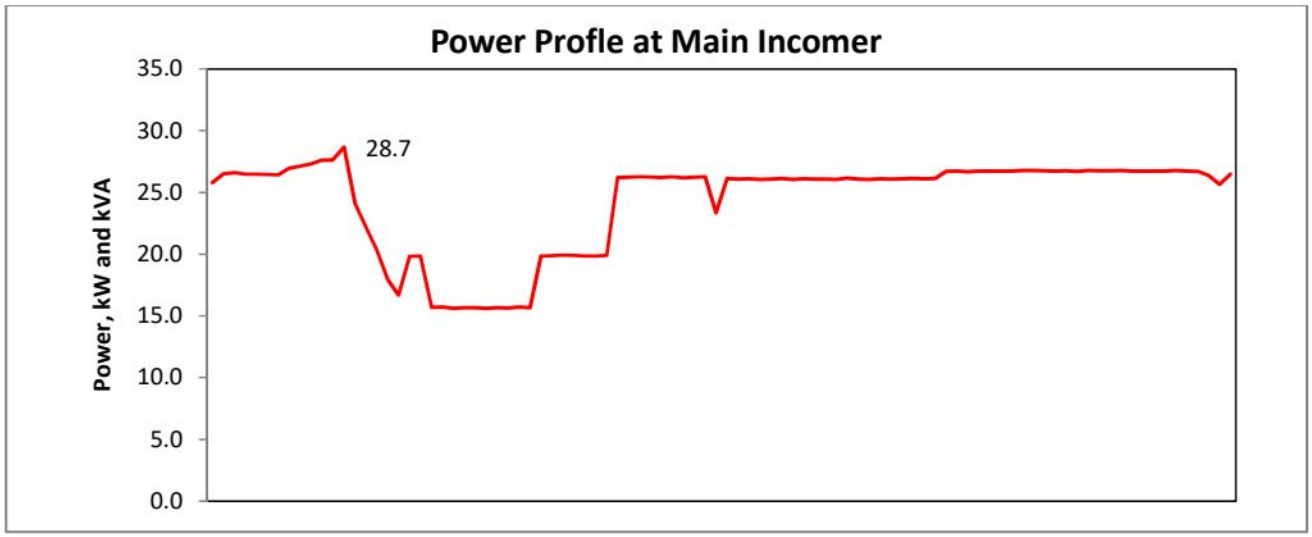


Figure 10: load trend at main incomer

The trend of Power Factor at main incomer is as below:

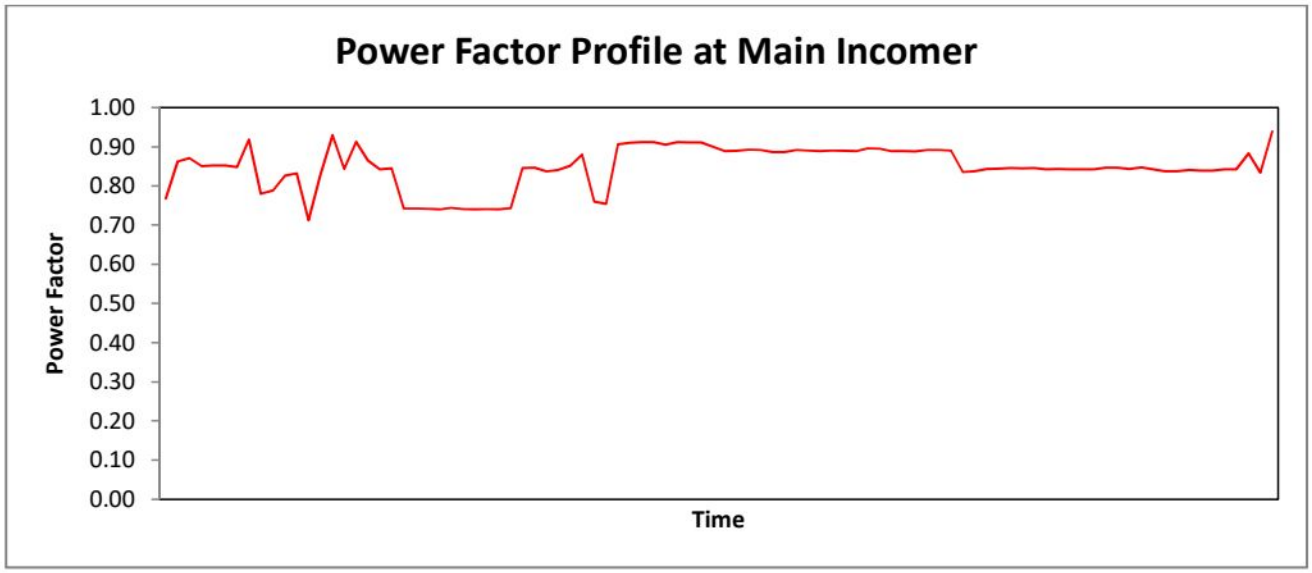


Figure 11: Power Factor trend at main incomer

From trend it is clear the maximum power is 28.7kVA observed during data logging. It is power when entire load was switched on and was only jerk load otherwise the power at normal operating hours was around 24.3kVA.

The power factor in the facility varies from 0.712 to 0.939 due to this reason the average power factor is low 0.848.

4.2.2 VOLTAGE UNBALANCE

Voltage unbalance occurs when the RMS line voltages on a poly-phase system are unequal. Voltages are seldom perfectly balanced between phases, but when this unbalance becomes excessive, it can create problems for poly-phase motors. Many of the newer induction motors are now more sensitive to unbalance than the older designs, and furthermore, adjustable speed drives can be even more vulnerable than standard motors. According to ANSI (American National standards Institute) codes voltage unbalance should be within 1%.

The main effect of voltage unbalance is motor damage from excessive heat. Voltage unbalance can create a current unbalance 6 to 10 times the magnitude of voltage unbalance. Consequently, this current unbalance creates heat in the motor windings that breaks down motor insulation causing cumulative and permanent damage to the motor. The relationship is exponential, and approximately increases by twice the square of the percent of voltage unbalance. Figure below, shows the percentage of temperature rise as related to the voltage unbalance:

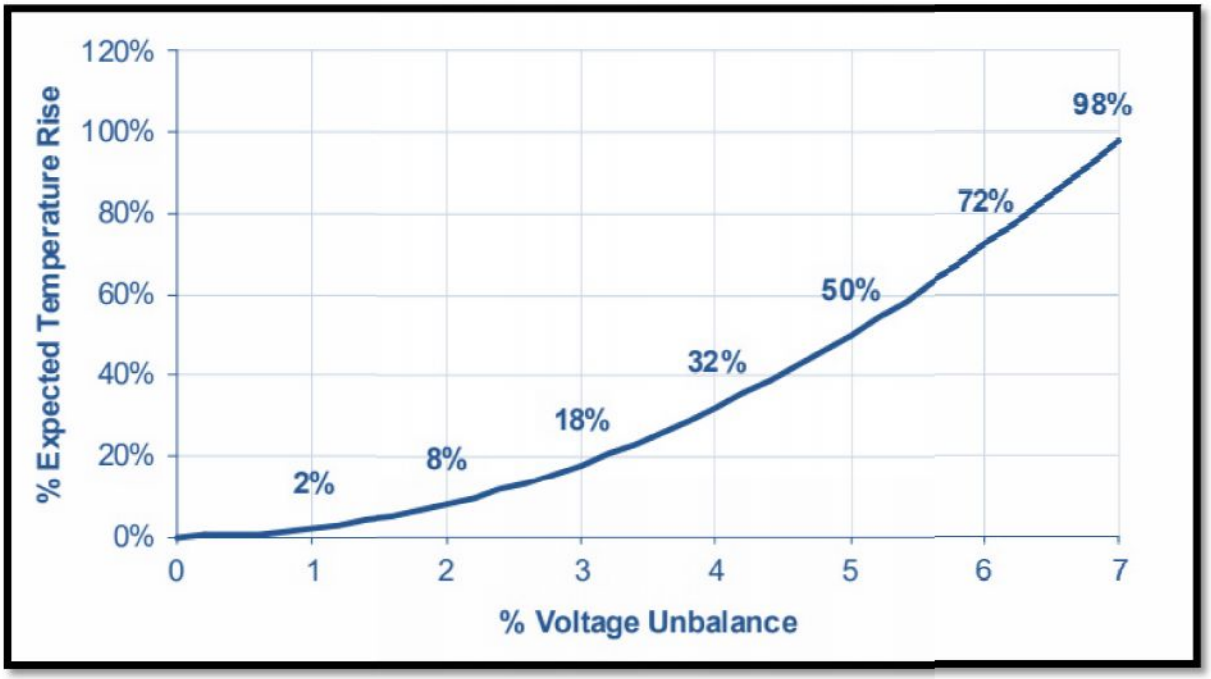


Figure 12: Relation between Voltage Unbalance and Temperature rise

There is huge load variation and also there is load shifting based upon requirement and there were chances of voltage unbalance. To verify the trend of voltage unbalance, data for voltage unbalance is recorded and trend is also attached.

Trend of Voltage Unbalance at main incomer is as below:

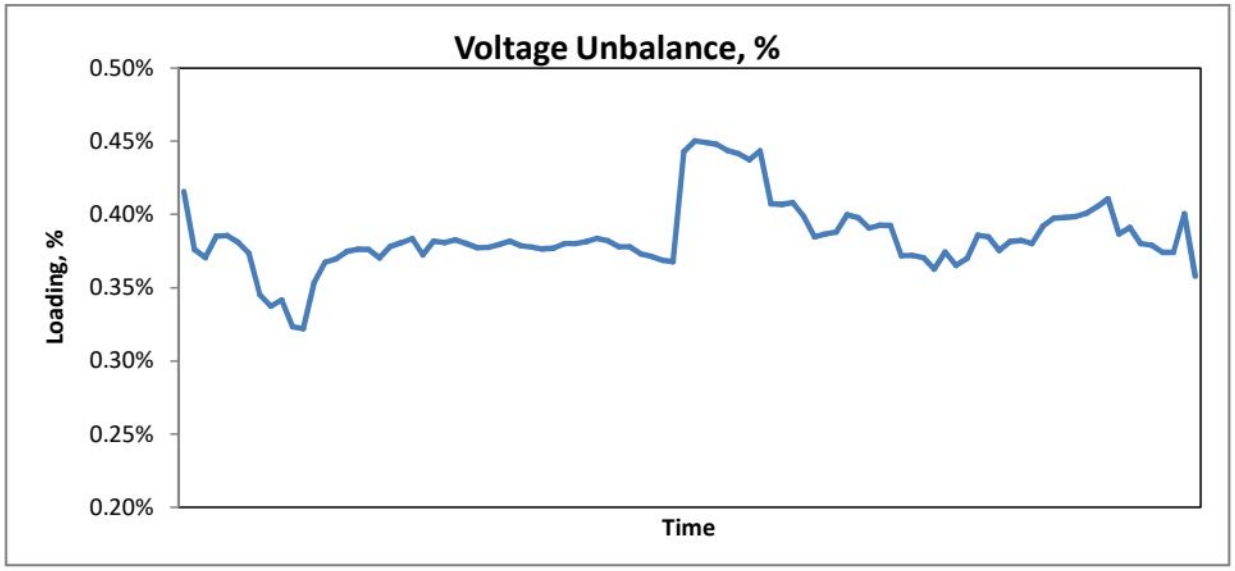


Figure 13: Trend of Voltage Unbalance at main incomer

It is clear that maximum recorded voltage unbalance 0.45% is within limit of 1%. This indicates that the electrical load is equally distributed.

4.2.3 CURRENT UNBALANCE

For a three-phase supply, current unbalance is defined as the maximum deviation of any current phase from the average current, divided by the average current, often expressed as a percentage. A current unbalance will generate excess heat which can melt insulation, leading to stator winding faults. Unbalance will also result in an uneven torque being produced by the electric motor, reducing its efficiency and increasing vibration. The trend of current unbalance at running load is as below:

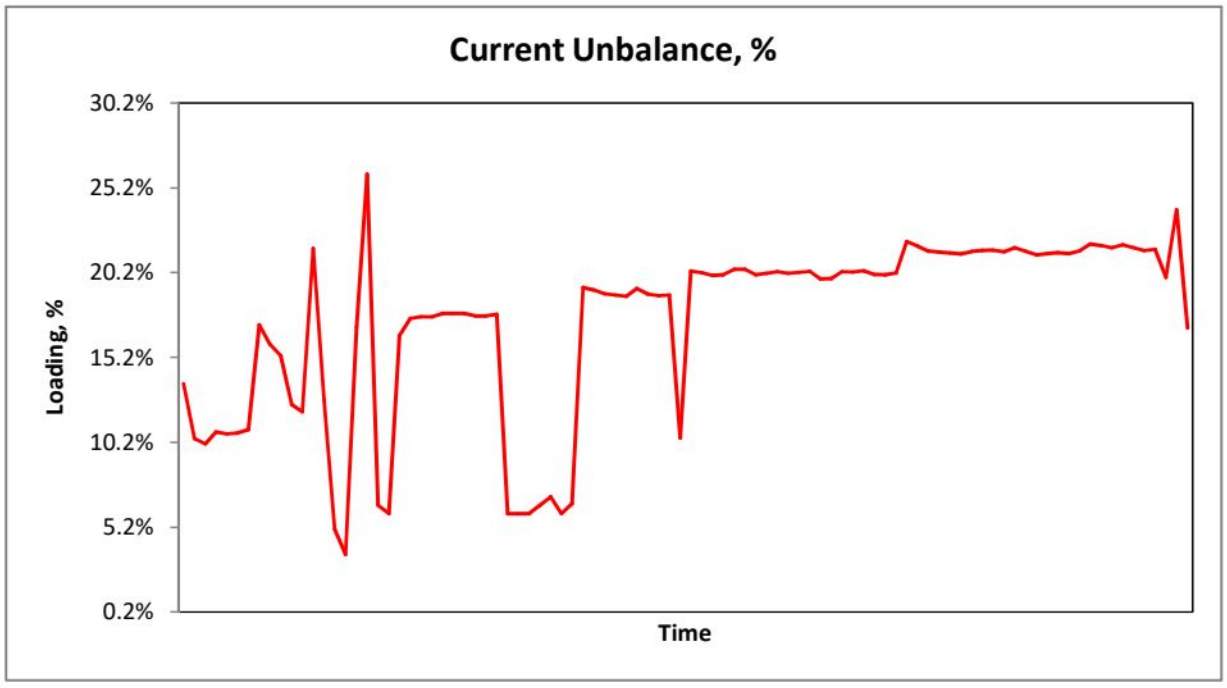


Figure 14: Trend of the current unbalance

The unequal distribution of loads between the three phases of the system cause the flow of unbalanced currents in the system, that produce unbalanced voltage drops on the electric lines. This increases neutral current which cause line and thus energy losses.

In this campus the load distribution is not properly done due to which the load on each is also not properly connected. To mitigate this problem, proper load balancing is recommended after correction in the power distribution in the electrical panel room.

4.2.4 HARMONICS LEVEL

Harmonics are currents or voltages with frequencies that are integer multiples of the fundamental power frequency. Ideally, voltage and current waveforms are perfect sinusoids. However, due to the increased popularity of electronic and other non-linear loads, these waveforms get distorted. This deviation from a perfect sine wave can be represented by harmonics—sinusoidal components having a frequency that is an integral multiple of the fundamental frequency. Thus, a pure voltage or current sine wave has no distortion and no harmonics, and a non-sinusoidal wave has distortion and harmonics. To quantify the distortion, the term total harmonic distortion (THD) is used. The term expresses the distortion as a percentage of the fundamental (pure sine) of voltage and current waveforms.

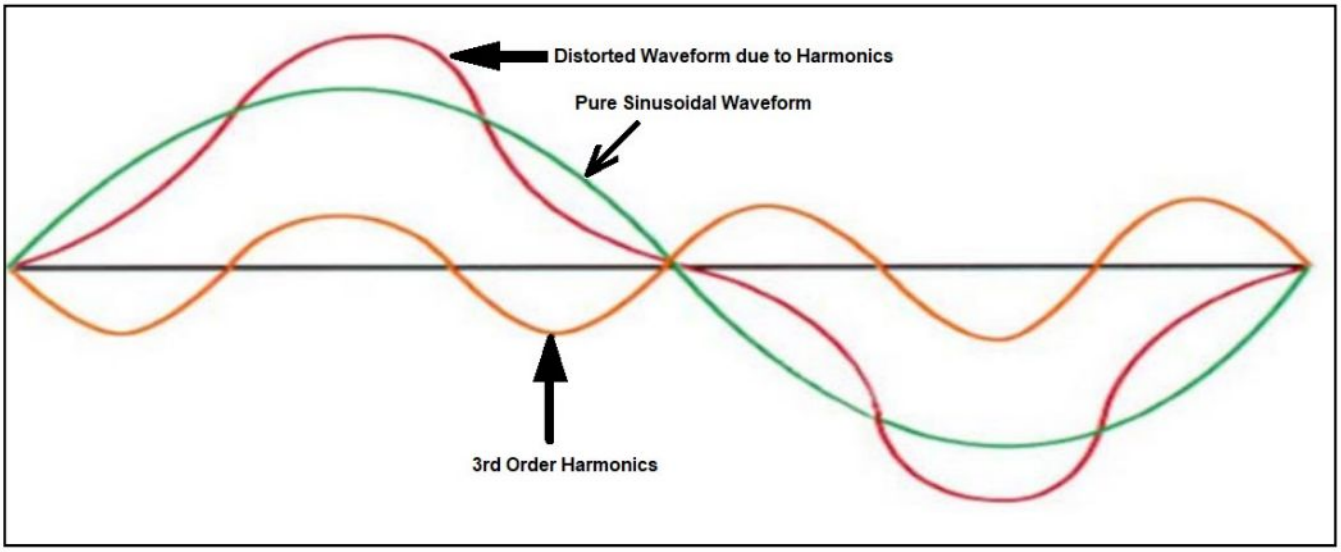


Figure 15: Harmonic distortion of the Waveform

When harmonic frequencies are prevalent, electrical power panels and transformers become mechanically resonant to the magnetic fields generated by higher frequency harmonics. When this happens, the power panel or transformer vibrates and emits a buzzing sound for the different harmonic frequencies. Harmonic frequencies from the 3rd to the 25th are the most common range of frequencies measured in electrical distribution systems.

Harmonics provides a mathematical analysis of distortions to a current or voltage waveform. Based on Fourier series, harmonics can describe any periodic wave as a summation of simple sinusoidal waves which are integer multiples of the fundamental frequency. These are steady-state distortions to current and voltage waves and repeat every cycle. They are different from

transient distortions to power systems such as spikes, dips and impulses.THD is a common measurement of the level of harmonic distortion present in power systems.

THD can be related to either current harmonics or voltage harmonics, and it is defined as the ratio of total harmonics to the value at fundamental frequency times 100%. Harmonics are created from equipment's containing electronics that control other apparatus, e.g. variable speed drives, soft starters, static compensators, rectifiers and heating furnaces, etc. The harmonic analysis is carried out based upon the data recorded in power analyzer and it is observed that and Current THD% is not within the permissible limits as per IEEE-519, 1992 of main incomer is highlighted in below table.

Description			**Main incomer**
Measured % of THD at maximum demand load (Fundamental) current (I_L)	Voltage	R	2.4
		Y	2.7
		B	1.36
	Current	R	2.9
		Y	2.75
		B	2.78

Table 5: THD parameters measured at main incomer

Both the current and the voltage harmonics distortion is within the limit of 3%, indicates that there is no problems of the harmonics.

4.3 DIESEL GENEARTING SETS

There are few general recommendations for DG Set as below:

1. The maximum permissible percentage unbalance in phase loads on DG sets is 10%.
2. Lower power factor of a DG set demands higher excitation currents.
3. Calibrate fuel injection pumps frequently and Improve air filtration.
4. Consider fuel oil additives in case they benefit fuel oil properties for DG set usage.
5. Ensure fuel oil storage, handling and preparation as per manufacturers.
6. Ensure compliance with maintenance checklist.
7. In case of a base load operation, consider waste heat recovery system adoption for steam.

The loading of DG Sets can be improved with automation in which all DG Sets can be connected with PLC system and the DG Sets will start based upon the loading of Master DG set. The monitoring if generation and fuel consumption of DG Set on regular basis also helps in taking corrective measure on time for improvement in DG Set Performance. The sample data sheet which can be used for DG Set Performance on monthly basis and for each DG Set is as below:

Description	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Generation, kWh												
Fuel Consumption in Generation, lit												
SFC, lit/kWh												
Generation, kWh/lit												

Figure 16: Sample Performance Assessment Sheet for DG Set

4.4 AC UNITS

There are 11 number of AC units installed in the campus and the connected load is around 18.5kW. The connected load of AC units is as below:

Area	Number	Rated power, W	Type	Measured power, kW	Remarks
Principal Room	1	1650	Window	1.26	Acceptable
Computer Lab.	1	2100	Split	1.74	Acceptable
RUSA Office	1	1650	Split		
Staff Room	1	1450	Split		
Administration Office	1	1850	Window		
Finishing School	1	1650	Split	1.48	Acceptable
Music room	1	2100	Split	1.83	Acceptable
Computer Lab- 1	2	2100	Split	1.60	Acceptable
Computer Lab- 2	1	1850	Window	1.62	Acceptable
Computer Lab- 3	1	2100	Split	1.80	Acceptable
Total	**11**	**18,500**			

Table 6: Connected load of AC units

The measured maximum power of the AC unit is less than rated power. The AC units are switching on/off based upon the temperature setting. There are few tips to Use Air Conditioner Effectively all around the season.

4.5 LIGHTING

The total connected lighting load in the entire campus is around 18.309kW. Total lighting load is sum of connected rated power of each luminary. The Mix of Incandescent Lamp, different type of LED fittings, CFL, T- 8, FTL- 12, LED lamp etc. The details of the connected load are as below:

Description	Number	Connected Load, main Campus, kW	Connected Load Self Finance Campus, kW	Total Connected lighting load, kW
FTL- 12	187	10.10	0	10.10
T- 5	218	4.46	2.739	7.19
LED 20W	81	3.16	0.24	3.40
Metal Halide	4	0.40	0	0.40
CFL	15	0.20	0.014	0.21
Total	**505**	**18.309**	**2.993**	**21.302**

Table 7: Connected Lighting Load

Most interior lighting requirements are for meeting average luminance on a horizontal plane, either throughout the interior, or in specific areas within the interior combined with general lighting of lower value. For assessing energy efficiency of lighting system, Inventory of the Lighting System is noted and the lux levels measurement at working level has been done with help of lux meter. The various values of lux levels based upon measurements are as below:

Block Name	Area	Maximum Lux	Average Lux	Minimum Lux	Remarks
Admin Block	Principal & Admin Office	245	189	137	Additional lights required
Girls Common Room	Girls Common Room	184	125	105	Light re-orientation is required
	Political Science Deptt.	81	71	68	Additional lights required
	Sanskrit Deptt.	71	60	58	Additional lights required
	English Deptt.	78	64	63	Additional lights required
	Physical Education Deptt.	143	102	89	Additional lights required

Block Name	Area	Maximum Lux	Average Lux	Minimum Lux	Remarks
	Placement Cell	228	180	116	Light re-orientation is required
	Record Room	86	71	63	Additional lights required
Arts Block	Indoor Sports Activity Room	83	68	59	Additional lights required
	Staff Room	80	74	80	Additional lights required
	Record Room -16	125	92	65	Additional lights required
	Room No-15	333	256	217	Light re-orientation is required
	Room NO-14	538	303	157	Light re-orientation is required
	Room No 13	649	432	227	Light re-orientation is required
	Room No. 9	190	132	77	Light re-orientation is required
	Room No. 12	176	147	132	
	Room No. 10	81	70	72	Additional lights required
	Room No. 22	190	90	40	Light re-orientation is required
	Room No. 21	135	103	77	
	Room No. 20	86	73	72	Additional lights required
	Room No. 19	518	384	275	
	Room No. 18	1278	817	667	Very High Lux level
Sports	Multi Station Gym	105	77	68	Additional lights required
	Badminton Court	213	137	88	Light re-orientation is required
Music deptt.	Music Deptt.	52	42	32	Additional lights required
	Language Lab	71	61	58	Additional lights required
Science Block	Fine Art Room No. 27	363	306	252	
	Red Cross Room No. 28	155	141	135	
	Youth Welfare Room No. 26	48	40	36	Additional lights required
	Zoology Lab Room No. 30	844	403	159	Light re-orientation is required

Block Name	Area	Maximum Lux	Average Lux	Minimum Lux	Remarks
	Room No. 29	220	149	101	Light re-orientation is required
	Room No. 32	242	198	192	
	Room No. 31	384	309	268	
	Room No. 33	260	214	192	
	Room No. 36	83	71	70	Additional lights required
	Room No. 35	772	484	203	Light re-orientation is required
	Room No.37	67	55	45	Additional lights required
	Room No. 40	179	166	153	
	Room No. 39	289	224	167	
	Room No. 41	138	115	93	
	Room No. 40 above Sci Deptt.	468	383	337	
	Room No. 40 small	102	89	81	Additional lights required
	Room No. 41	254	161	101	Light re-orientation is required
	Room No. 42	252	242	239	
	Room No. 43	468	235	116	
	Room No. 44	537	342	281	Light re-orientation is required
	Com Lab Room No. 45	245	201	182	
	Geog Lab Room No. 51	1128	606	161	Light re-orientation is required
	RUSSA office Room No. 53	138	82	64	Light re-orientation is required
	Finishing School Room No. 52	342	270	206	
Canteen	Canteen	791	505	257	Very High Lux Level
Security Room Gate	Security Room Gate	578	380	307	Light re-orientation is required
OSA	OSA	65	56	54	Additional lights required
Commerce Block	Room No. 71	136	110	74	Light re-orientation is required

Block Name	Area	Maximum Lux	Average Lux	Minimum Lux	Remarks
	Room No.72	143	113	84	Light re-orientation is required
	Room No.73	128	103	79	
	Room No.74	143	111	74	Light re-orientation is required
	Room No.75	133	109	68	Light re-orientation is required
	Room No.76	128	107	86	
	Staff Room	279	207	149	
Library	Library	456	218	91	Light re-orientation is required
	Seminar Hall Room No. 78	263	195	140	
	Staff Room Hist.	124	87	66	Light re-orientation is required
	Reading Room History Deptt.	219	162	127	Light re-orientation is required
	M.A.I Hist.	428	317	263	
	M.A.II Hist.	633	340	95	Light re-orientation is required
	Staff Room HOD Hist.	219	181	173	
	M.A. Punjabi Room No. 84	0	442	0	Very High Lux Level
	M.A. Punjabi Room No. 85	0	564	0	Very High Lux Level
	M.A. Punjabi Room No. 86	0	1043	0	Very High Lux Level
	M.A. Punjabi Room No. 87	1321	777	277	Very High Lux Level
Library HEIS	Library HEIS	349	302	326	
	Diploma in Dress Designing	244	216	204	
	Room No. 66	179	137	123	
	Room No. 67	184	170	189	
HEIS	C.R.01	54	44	44	Additional lights required
	C.R.02	59	47	46	Additional lights required
	C.R.03	50	41	42	Additional lights required
	C.R.04	54	46	50	Additional lights required

Block Name	Area	Maximum Lux	Average Lux	Minimum Lux	Remarks
	Staff Room	56	50	54	Additional lights required
	Comp Lab -01	246	141	53	Light re-orientation is required
	Comp Lab -02	85	65	61	Additional lights required
	Comp Lab -03	90	66	55	Additional lights required
	Admin Room	195	124	84	Light re-orientation is required

Table 8: Measured Lux level

The major observations based upon the lux level measurement are as below:

- There are few areas where lux level was very high. This indicates that few lights can be removed from fittings which lead to compliance with norms and energy saving.
- At many rooms, additional lights need to be installed to improve the lux level.
- Recommended light levels for different work spaces:

ACTIVITY	CATEGORY	LUX
Public spaces with dark surroundings	A	20-30-50
Simple orientation for short temporary visits	B	50-75-100
Working spaces where visual tasks are only occasionally performed	C	100-150-200
Performance of visual tasks of high contrast or large size	D	200-300-500
Performance of visual tasks of medium contrast or small size	E	500-750-1000
Performance of visual tasks of low contrast or very small size	F	1000-1500-2000
Performance of visual tasks of low contrast or very small size over a prolonged period	G	2000-3000-5000
Performance of very prolonged and exacting visual tasks	H	5000-7500-10000
Performance of very special visual tasks of extremely low contrast	I	10000-15000-20000

Figure 17: Standard Lux level

4.6 FANS

The ceiling fans are more affordable than air conditioners and the right size can make a difference. In different areas, two types of ceiling fans are installed. The rated power of most of the ceiling fans is 70W. Apart from ceiling fans, exhaust fans and wall fans are installed to maintain the required ambient temperature. The connected load of the fans is as below:

Description	Number of fans	Connected Load, kW
Ceiling Fan	373	26.11
Wall Fan	10	0.50
Exhaust Fans	35	1.40
Total	**232**	**28.01**

Table 9: Connected Fan Load

4.7 PRINTERS, SCANNERS AND MULTI-FUNCTION DEVICES

These devices are installed in the staff room, labs and the office areas for the supporting and main stream activities. The connected load of these devices is around 31.48kW. The

Description	Number	Connected load, kW
Computers and Laptop	74	12.58
Printer, Scanner and Projector	16	18.90
Total	**90**	**31.48**

Table 10: Details of multi-function device

4.8 MISCALANEOUS LOAD

These devices are installed in the staff room, labs and the office areas for the supporting and main stream activities. The connected load of miscellaneous load is 12.9kW.

Description	Number	Connected Load, kW
Refrigerator	14	4.550
Water Cooler	2	1.500
Microwave	4	6.100
R.O.	3	0.750
Total	**23**	**12.90**

Table 11: Details of miscellaneous load

5. ENERGY EFFICIENCY MEASURES

5.1 REDUCTION IN CONTRACT DEMAND FROM 72.378KVA TO 49.0KVA

Observation

From the trend of maximum demand index in the energy bill, it is clear that the maximum demand in the facility is only 28.3% of the contract demand. Due to higher contract demand, facility is being charged almost 40% higher side in form of fixed energy charges.

Recommendation

It is recommended to reduce the contract demand from 72.378kVA to 49.0kVA. As a caution, the recommended contract demand is 35.0% higher than the recorded maximum demand (36.0kVA). The reduction in contract demand will help in achieving lesser energy bill for the facility. The trend of maximum demand and the proposed demand is as below:

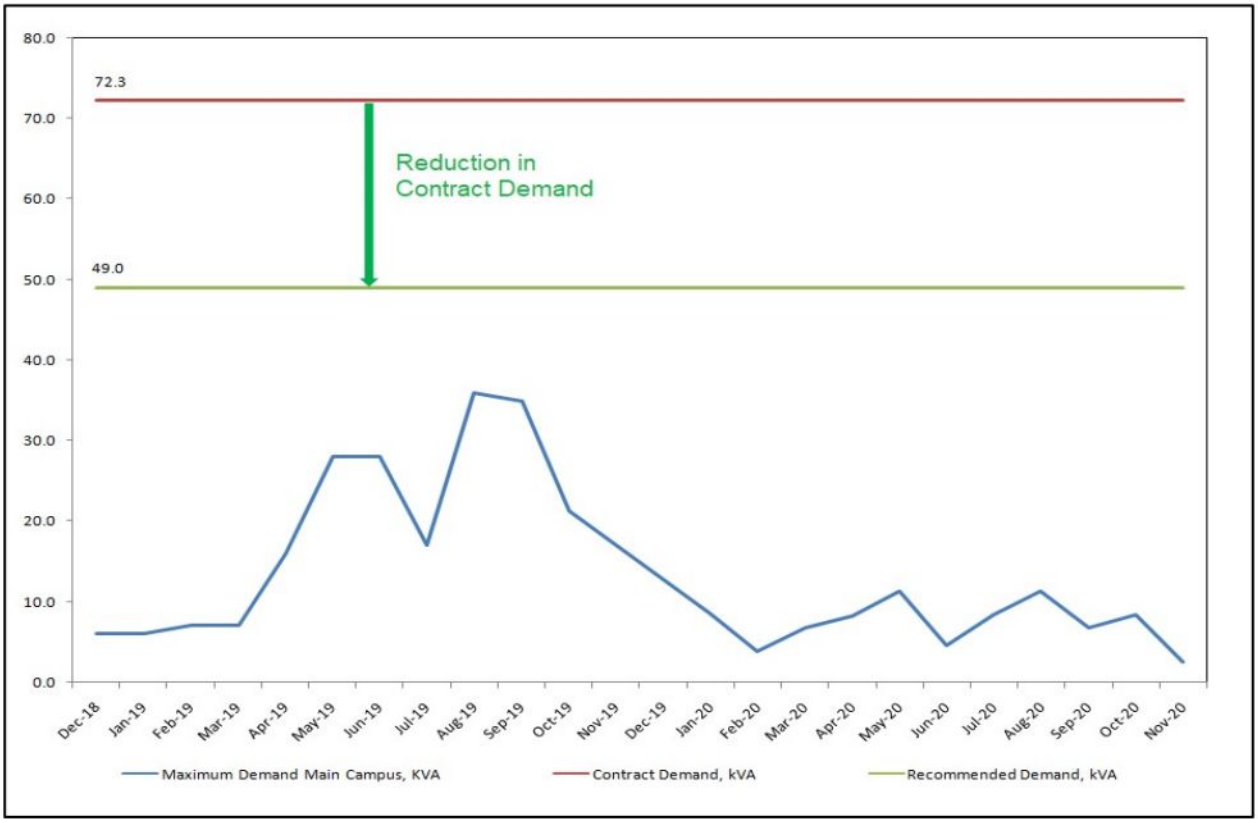


Figure 18: Demand trend of electricity bill main campus

The details of saving calculations based upon energy bill are as below:

Description	UoM	Values
Contract Demand as per latest Bill	kVA	72.378
Minimum Billable demand at present scenario	kVA	57.9
Recommended Contract Demand	kVA	49
Annual billed fixed charges at present contract demand	Rs.	69,480
Annual billed fixed charges at recommended contract demand	Rs.	47,040
Annual monetary saving	Rs.	22,440
Investment	Rs.	Nil
Payback period	months	**Immediate**

5.2 ENSURING SWITCHING OFF THE LIGHTS WHEN THERE IS NO OCCUPANCY IN THE RESPECTIVE CLASS ROOM OR OFFICE AREAS

Observations

During lux level measurement, it was observed that many rooms were locked but the ceiling fans and lights were running in the area. During college closing time, the running load was around 13.6kW which indicates that load was running considering minimum 30% (4.0kW) necessary running load, 70% load was which can be switched off.

Recommendation

The lighting controls such as motion detectors or timers and dimmers can help reduce your energy consumption by automatically controlling your lights efficiently. The turning off the lights when leaving the classrooms/office is a cost-effective way to reduce wasted energy. It can be achieved by capacity building of the students through training, awareness on energy conservation through different competitions and lectures and giving them the role of energy warriors to ensure that no lights/fans etc. is running when room are empty. This can lead to energy saving of 50- 60units on daily basis. The saving calculations are as below:

Description	Units	Value
Running load during closing time	kW	13.6
load which is nonessential and can be switched off	kW	2.7
Annual operating days		300
Operating hours	hours	6
Annual energy saving after capturing non-essential load	kVAh	5,154
Annual monetary saving	Rs Lakh	32,520
Investment	Rs Lakh	Nil
Payback period	months	Immediate

5.3 REPLACEMENT OF THE CONVENTIONAL LIGHTS FTL- 12 WITH NEW (20W LED) ENERGY EFFICIENT LIGHTS

Observations

The FTL and T- 8 fittings are considered for this measure. The connected load of these lights is around connected load of the conventional lights is around 10.10kW (187nos). Conventional lighting consumes more energy making it extremely inefficient.

Recommendation

It is recommended to replace the conventional lights with LED lights. Both types of fittings can be replaced with 20W LED lights. LED lighting is far more energy efficient; it will reduce electricity consumption and lower utility bill. For this measure, minimum 50% replacement is considered based upon the operation hours of the sections. The saving calculations are as below:

Description	Units	Value
Approximate Connected of lights considered for replacement	kW	4.86
Number of lights considered for replacement		90
Rated power of the LED lights considered for replacement	W	20
Annual energy consumption at present scenario	kWh	6,998
Annual energy consumption after implementation of measure	kWh	3240
Annual energy saving	kVAh	3,915
Annual monetary saving	Rs.	24,704
Investment@ Rs 450/fitting	Rs.	40,500
Payback period	months	19.7

5.4 REPLACEMENT OF THE CONVENTIONAL LIGHTS T- 5 WITH NEW (20W LED) ENERGY EFFICIENT LIGHTS

Observations

The connected load of T- 5 lights is around connected load of the conventional lights is around 7.19kW (218nos). Conventional lighting consumes more energy making it extremely inefficient.

Recommendation

LEDs offer increased light efficiency when dimmed as opposed to T- 5 fixtures and usually produce more lumens per watt in general, which decreases energy usage and thus, energy costs. A lower wattage of LED luminaries will usually be just as efficient as a higher wattage T5 fixture. Considering this fact, it is recommended to replace the conventional T- 5 lights with LED lights. For this measure, minimum 50% replacement is considered based upon the operation hours of the sections. The saving calculations are as below:

Description	Units	Value
Approximate Connected of lights considered for replacement	kW	3.60
Number of lights considered for replacement		110
Rated power of the LED lights considered for replacement	W	20
Annual energy consumption at present scenario	kWh	6,534
Annual energy consumption after implementation of measure	kWh	3960
Annual energy saving	kVAh	2,681
Annual monetary saving	Rs.	16,919
Investment@ Rs 450/fitting	Rs.	49,500
Payback period	months	35.1

5.5 INSTALLATION OF 32.0KWP CAPACITY GRID CONNECTED SOLAR PV SYSTEM FOR LIGHTING LOAD AND OTHER LOAD

Observation

The contract demand for the college campus as per electricity bill is 72.738KVA. Based upon the solar irradiance data of this region, there is enough solar irradiance in all these regions to produce solar PV-based electricity throughout the year. There is penalty of roof top available in facility where SPV can be installed. The SDA in this region has notification for promoting Renewable energy sources.

Recommendation

It is recommended to put Grid connected Solar PV System. The recommended rated power for the SPV system is 32.0kWp which is equivalent to the maximum recorded demand. In Grid connected Solar Rooftop PV system the DC power generated from SPV panel is converted to AC power using power conditioning unit. Generated Power by this system during the day time is utilized fully for powering captive loads and excess power is fed to the Grid. Grid connected Solar Rooftop system is operational so long as grid is available. In case, where solar power is not sufficient due to cloud cover etc., the captive loads are served by drawing power from the grid. The Advantages of Grid-Connected Rooftop Solar System is as below:

1. Electricity generation at the consumption point therefore Savings in transmission and distribution losses.
2. Low gestation time.
3. No requirement of additional land.
4. Improvement of tail-end grid voltages and reduction in system congestion with higher self-consumption of solar electricity.
5. Local employment generation.

The facility can also plan for system with battery back-up to shift lighting load from main power supply to solar power during day time. It will be a Hybrid system in which the battery bank could be charged both from Main, DG Set and SPV. The diagram for Hybrid System is as below:

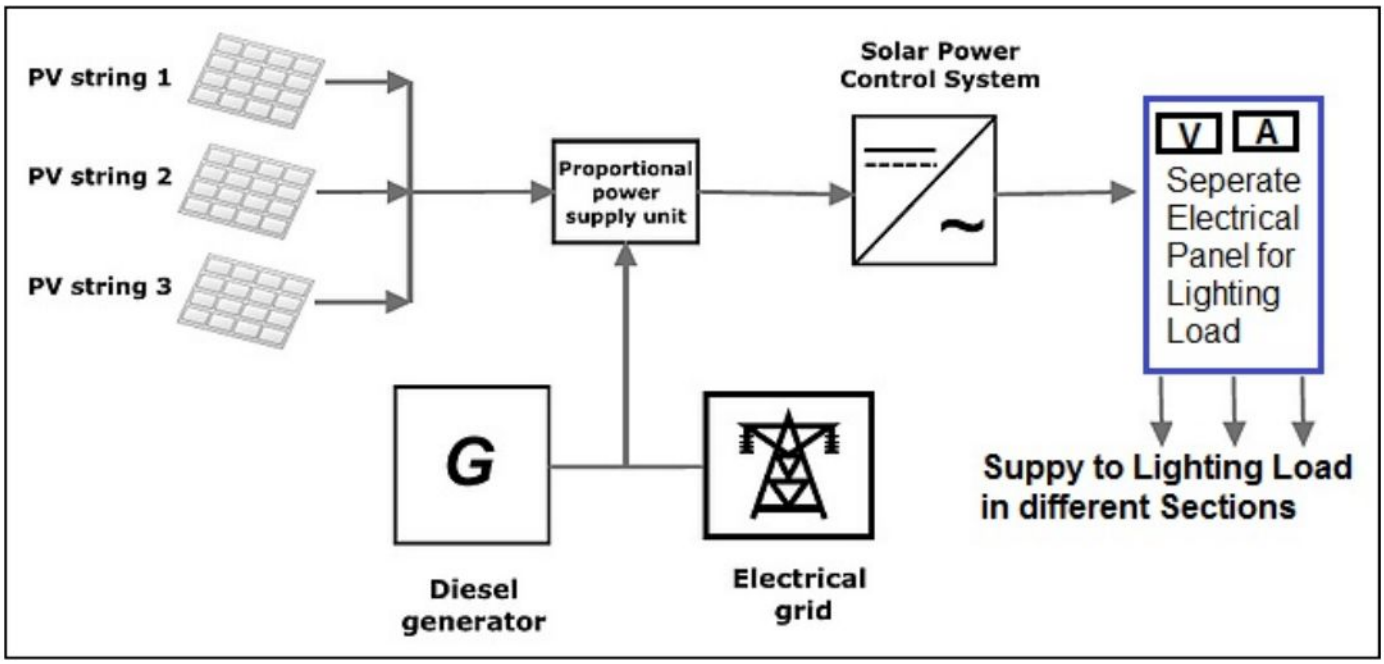


Figure 19: Grid Connected Hybrid SPV System

The saving calculation is done based upon grid connected system and cost is taken as per MNRE website. The detailed calculations are as below:

Description	Units	Value
Sanctioned load of Unit	kVA	72.378
Recommended capacity of SPV	kWp	25
Expected annual generation from SPV	kWh	25,000
Annual energy consumption at present scenario	kWh	28,549
Annual energy saving based upon the present energy consumption scenario	kVAh	26,151
Annual monetary saving	Rs.	1,65,010
Investment @Rs. 38,500/kWp	Rs.	9,62,500
Payback period	months	70

5.6 INSTALLATION OF ENERGY MONITORING SYSTEM

Observation

After discussion with the officials on observation during the site visit, following observations are concluded on energy consumption for batch size:

1. The bench making in terms of energy consumption for particular type of material and weight is in process and once it's done, standardization will be done. Section wise there are many factors which will lead to variation in energy consumption. Clearly written SOPs, along with proper training reduce the Energy Consumption because tasks are well defined with operating parameters. When SOPs are clearly documented, employees can help and coach each other when learning new processes. They also give employees the opportunity (and grounds) to correct/redirect their peers when tasks aren't being performed correctly.

2. Unit has installed energy meters in different section and energy consumption is recorded on daily basis. From this, on daily basis, section wise energy consumption is measured. The track of load variation is not possible with these energy meters.

3. There is production variation due to separate two wheeler and four wheeler lines. When two-wheeler production is more, the energy consumption could be relatively more for same mass of components for four-wheeler.

Recommendation

Considering all above facts we recommend the installation of Energy Monitoring System. Energy Monitoring System come with different software and parameters (regular and tailor made both) to best capture the process behavior. It has all the standard reports that one would expect from an EMS with following parameters:

- Real-time views & trends
- Historical views & trends
- Energy Reports
- Alarm Reports

The detail presentations of the parameters at standard screens and features make system understanding very easy. Each screen or feature offers all options needed to make best use of the data presented. Any other features or screens can also be customized as per the requirement e.g. with different type of material different parameters can be set. Once data is recorded, next time directly parameter will be captured for same quantity and material. This will lead to minimum variation of energy consumption with better control of parameter without human intervention. The one snapshot of report prepared is as below:

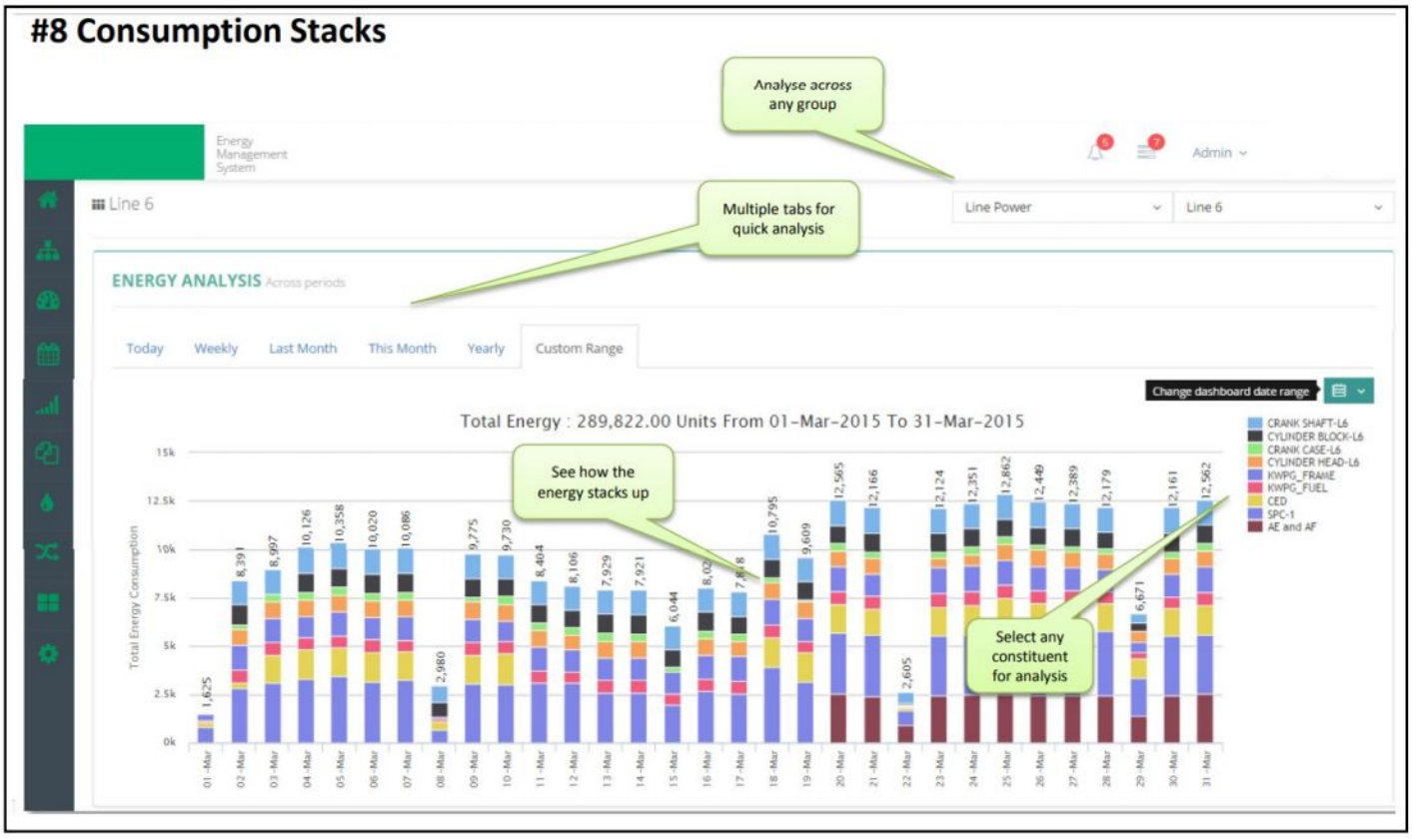
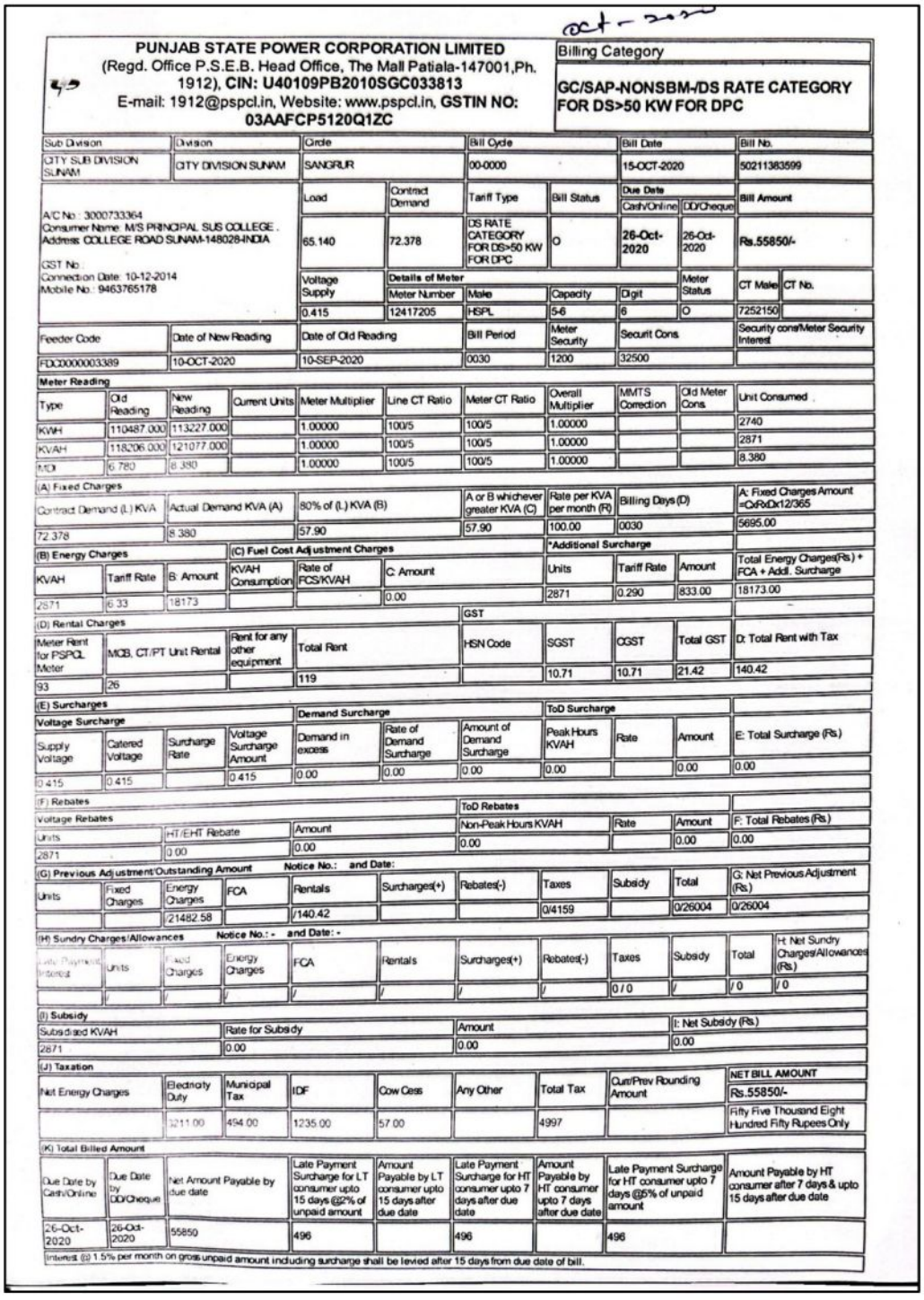


Figure 20: EnMS Report Snapshot

6. ANNEXURE

6.1 COPY OF LATEST ELECTRICITY BILL



Oct - 2020

PUNJAB STATE POWER CORPORATION LIMITED
(Regd. Office P.S.E.B. Head Office, The Mall Patiala-147001,Ph. 1912), CIN: U40109PB2010SGC033813
E-mail: 1912@pspcl.in, Website: www.pspcl.in, GSTIN NO: 03AAFCP5120Q1ZC

Billing Category: GC/SAP-NONSBM-/DS RATE CATEGORY FOR DS>50 KW FOR DPC

Sub Division	Division	Circle	Bill Cycle	Bill Date	Bill No.
CITY SUB DIVISION SUNAM	CITY DIVISION SUNAM	SANGRUR	00-0000	15-OCT-2020	50211383599

A/C No.: 3000733364
Consumer Name: M/S PRINCIPAL SUS COLLEGE .
Address: COLLEGE ROAD SUNAM-148028-INDIA
GST No:
Connection Date: 10-12-2014
Mobile No.: 9463765178

Load	Contract Demand	Tariff Type	Bill Status	Due Date Cash/Online	Due Date DD/Cheque	Bill Amount
65.140	72.378	DS RATE CATEGORY FOR DS>50 KW FOR DPC	O	26-Oct-2020	26-Oct-2020	Rs.55850/-

Voltage Supply	Details of Meter: Meter Number	Make	Capacity	Digit	Meter Status	CT Make	CT No.
0.415	12417205	HSPL	5-6	6	O	7252150	

Feeder Code	Date of New Reading	Date of Old Reading	Bill Period	Meter Security	Securit Cons	Security cons/Meter Security Interest
FDC0000003389	10-OCT-2020	10-SEP-2020	0030	1200	32500	

Meter Reading

Type	Old Reading	New Reading	Current Units	Meter Multiplier	Line CT Ratio	Meter CT Ratio	Overall Multiplier	MMTS Correction	Old Meter Cons.	Unit Consumed
KWH	110487.000	113227.000		1.00000	100/5	100/5	1.00000			2740
KVAH	118206.000	121077.000		1.00000	100/5	100/5	1.00000			2871
MD	6.780	8.380		1.00000	100/5	100/5	1.00000			8.380

(A) Fixed Charges

Contract Demand (L) KVA	Actual Demand KVA (A)	80% of (L) KVA (B)	A or B whichever greater KVA (C)	Rate per KVA per month (R)	Billing Days (D)	A: Fixed Charges Amount =CxRxDx12/365
72.378	8.380	57.90	57.90	100.00	0030	5695.00

(B) Energy Charges / **(C) Fuel Cost Adjustment Charges** / ***Additional Surcharge**

KVAH	Tariff Rate	B: Amount	KVAH Consumption	Rate of FCS/KVAH	C: Amount	Units	Tariff Rate	Amount	Total Energy Charges(Rs.) + FCA + Addl. Surcharge
2871	6.33	18173			0.00	2871	0.290	833.00	18173.00

(D) Rental Charges

Meter Rent for PSPCL Meter	MCB, CT/PT Unit Rental	Rent for any other equipment	Total Rent	HSN Code	GST: SGST	GST: CGST	Total GST	D: Total Rent with Tax
93	26		119		10.71	10.71	21.42	140.42

(E) Surcharges

Voltage Surcharge: Supply Voltage	Catered Voltage	Surcharge Rate	Voltage Surcharge Amount	Demand Surcharge: Demand in excess	Rate of Demand Surcharge	Amount of Demand Surcharge	ToD Surcharge: Peak Hours KVAH	Rate	Amount	E: Total Surcharge (Rs.)
0.415	0.415		0.415	0.00	0.00	0.00	0.00		0.00	0.00

(F) Rebates

Voltage Rebates: Units	HT/EHT Rebate	Amount	ToD Rebates: Non-Peak Hours KVAH	Rate	Amount	F: Total Rebates (Rs.)
2871	0.00	0.00	0.00		0.00	0.00

(G) Previous Adjustment/Outstanding Amount Notice No.: and Date:

Units	Fixed Charges	Energy Charges	FCA	Rentals	Surcharges(+)	Rebates(-)	Taxes	Subsidy	Total	G: Net Previous Adjustment (Rs.)
		21482.58		/140.42			0/4159		0/26004	0/26004

(H) Sundry Charges/Allowances Notice No.: - and Date: -

Late Payment Interest	Units	Fixed Charges	Energy Charges	FCA	Rentals	Surcharges(+)	Rebates(-)	Taxes	Subsidy	Total	H: Net Sundry Charges/Allowances (Rs.)
/	/	/	/	/	/	/	/	0 / 0	/	/ 0	/ 0

(I) Subsidy

Subsidised KVAH	Rate for Subsidy	Amount	I: Net Subsidy (Rs.)
2871	0.00	0.00	0.00

(J) Taxation

Net Energy Charges	Electricity Duty	Municipal Tax	IDF	Cow Cess	Any Other	Total Tax	Curr/Prev Rounding Amount	NET BILL AMOUNT
	1211.00	494.00	1235.00	57.00		4997		Rs.55850/-
								Fifty Five Thousand Eight Hundred Fifty Rupees Only

(K) Total Billed Amount

Due Date by Cash/Online	Due Date by DD/Cheque	Net Amount Payable by due date	Late Payment Surcharge for LT consumer upto 15 days @2% of unpaid amount	Amount Payable by LT consumer upto 15 days after due date	Late Payment Surcharge for HT consumer upto 7 days after due date	Amount Payable by HT consumer upto 7 days after due date	Late Payment Surcharge for HT consumer upto 7 days @5% of unpaid amount	Amount Payable by HT consumer after 7 days & upto 15 days after due date
26-Oct-2020	26-Oct-2020	55850	496		496		496	

Interest @ 1.5% per month on gross unpaid amount including surcharge shall be levied after 15 days from due date of bill.

6.2 LIST OF VENDORS

For Interlocking and Automation

- Monaco Energy
- Delta Cooling Tower Pvt. Limited
- ENCON India Pvt. Limited

For Energy Efficient Lighting

- EESL
- RL Consumer Products
- Philips India Limited
- Avni Energy Solutions Pvt Ltd

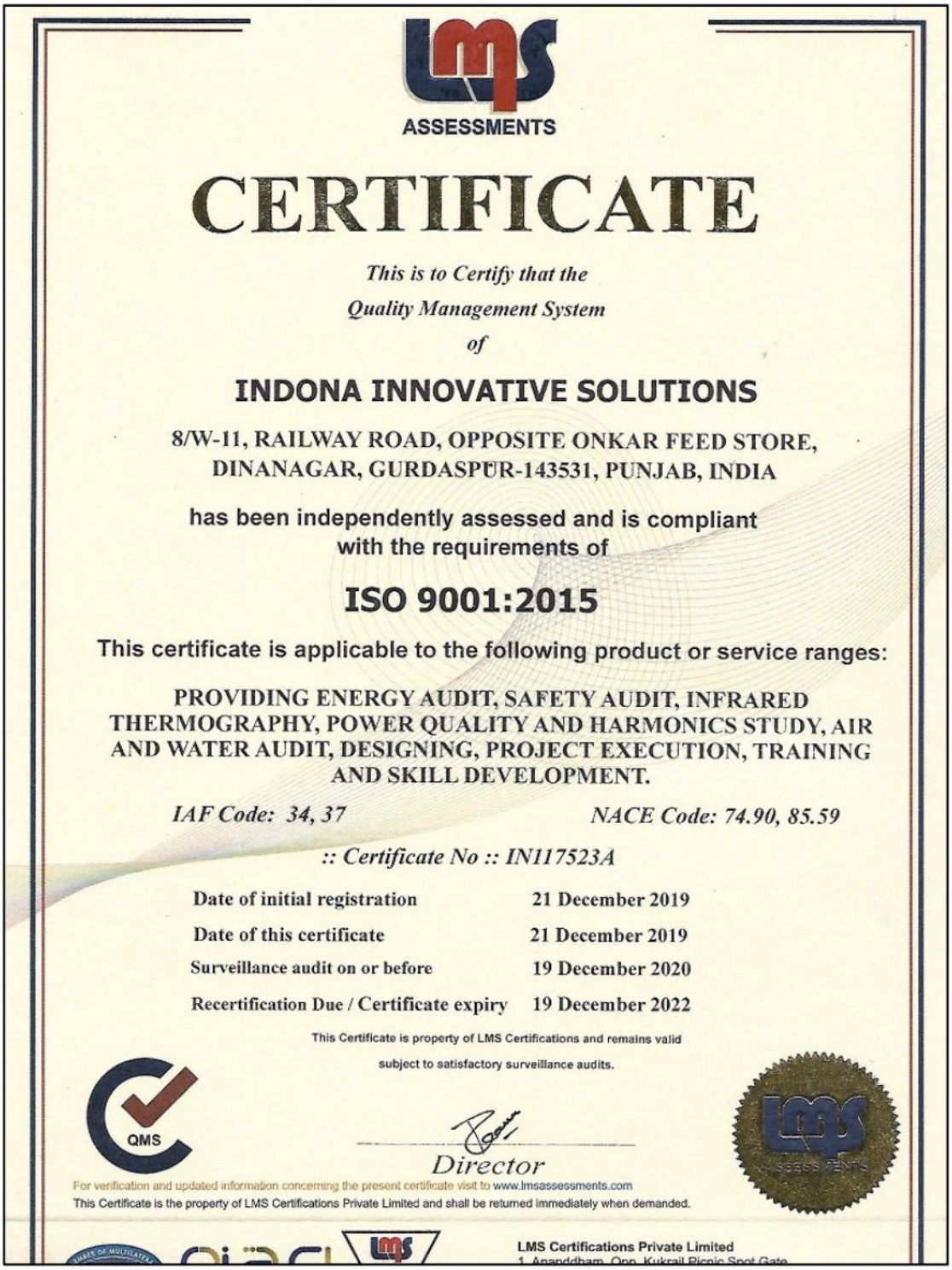
For Energy Efficient Lighting

- EESL
- Sawhney Electrical Works
- M.G Engineers

For SPV

- Azure Power India Private Limited
- Acme Roof Top Systems Private Limited
- Ujaas Energy Limited
- M/S Mittal Machines Pvt Ltd

6.3 ISO CERTIFICATE



ASSESSMENTS

CERTIFICATE

This is to Certify that the
Quality Management System
of

INDONA INNOVATIVE SOLUTIONS

8/W-11, RAILWAY ROAD, OPPOSITE ONKAR FEED STORE,
DINANAGAR, GURDASPUR-143531, PUNJAB, INDIA

has been independently assessed and is compliant
with the requirements of

ISO 9001:2015

This certificate is applicable to the following product or service ranges:

PROVIDING ENERGY AUDIT, SAFETY AUDIT, INFRARED THERMOGRAPHY, POWER QUALITY AND HARMONICS STUDY, AIR AND WATER AUDIT, DESIGNING, PROJECT EXECUTION, TRAINING AND SKILL DEVELOPMENT.

IAF Code: 34, 37 *NACE Code: 74.90, 85.59*

:: Certificate No :: IN117523A

Date of initial registration	21 December 2019
Date of this certificate	21 December 2019
Surveillance audit on or before	19 December 2020
Recertification Due / Certificate expiry	19 December 2022

This Certificate is property of LMS Certifications and remains valid subject to satisfactory surveillance audits.

QMS

Director

For verification and updated information concerning the present certificate visit to www.lmsassessments.com
This Certificate is the property of LMS Certifications Private Limited and shall be returned immediately when demanded.

LMS Certifications Private Limited
1 Anandbham, Opp. Kukrail Picnic Spot Gate

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/20-21/881-980

18th August, 2020

Ms. Hardeep Kaur, Partner
Indona Innovative Solutions
8/W- 11, Railway Road, opposite Onkar Feed Store,
Dinanagar, Punjab 143531

Sub: Empanelment of Energy Service Company (ESCO)

Dear Madam,

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 January, 2020.

Consequent to scrutiny and evaluation of your documents by SEBI accredited Rating Agencies CRISIL /CARE /ICRA/CART in terms of the approved parameters for evaluation, BEE is pleased to inform that your company **Indona Innovative Solutions** has qualified for empanelment with BEE as a **Grade 3** Energy Service Company (ESCO). This empanelment would be effective from 15th August, 2020 and will be valid till 14th August, 2022.

Further, the list of all the empanelled ESCOs along with grade assigned by CRISIL /CARE/ICRA/CART 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

6.4 LIST OF VENDORS

For Interlocking and Automation

- Monaco Energy
- Delta Cooling Tower Pvt. Limited
- ENCON India Pvt. Limited

For Energy Efficient Lighting

- EESL
- RL Consumer Products
- Philips India Limited
- Avni Energy Solutions Pvt Ltd

For SPV

- Azure Power India Private Limited
- Acme Roof Top Systems Private Limited
- M/S Mittal Machines Pvt Ltd

----------End of Report----------