ENERGY AUDIT REPORT

GOVT. COLLEGE, DERA BASSI

S.A.S. NAGAR

CONDUCTED BY:

Through Punjab Energy Development Agency (PEDA)
Sector-33D, Chandigarh

R.K. ELECTRICALS & ENERGY AUDIT SERVICES (An ISO Co.)

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2023-24

ENERGY AUDIT CERTIFICATE

(2023-24)

This is to certify that the **R.K. ELECTRICALS & ENERGY AUDIT SERVICES** conducted the Energy Audit of **"Govt. College Dera Bassi, S.A.S. Nagar, Punjab)"** from 14thJune to 15thJune for the year 2023-2024. This audit involved extensive consultation with all the related team, office record, data collection, measurements and cost benefit analysis

The study exhibited the Annual Energy saving potential of **0.37 Lacs KWH** with annual monetary saving: **Rs 2.41 Lacs** by investing **Rs. 10.83 Lacs**

For R.K. ELECTRICALS & ENERGY AUDIT SERVICES

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ACKNOWLEDGEMENT

R.K. ELECTRICALS & ENERGY AUDIT SERVICES places on record its sincere thanks to the management of Punjab Energy Development Agency Chandigarh for entrusting the Energy audit of Government College, Dera Bassi, SAS Nagar (Punjab)

We are thankful to all the officials of Punjab Energy Development Agency for their assistance and guidance available through their web site, circulars & workshops as well as during energy audit of this unit particularly: -

Sh. M P Singh: Director

Er. Kulbir Singh: Joint Director (EC)

Er. Money Khanna: Project Engineer

Government College, Dera Bassi, SAS Nagar: We also express sincere thanks to the campus administration & staff without whose constant support; we could not have carried this audit. Special thanks are to following:

1. Ms. Kamna Gupta	Principal
2. Ms. Salony	Nodal Officer
3. Sh. Ravinder Jeet	Assistant Professor
4. Ms. Sumita Katoch	Assistant Professor

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ABBREVIATIONS

A	Ampere
AC	Alternating Current
APFC	Automatic Power factor Controller
Avg.	Average
BEE	Bureau of Energy Efficiency
CEA	Certified Energy Auditor
CFL	Compact florescent lamp
EER	Energy Efficiency Ratio
FTL	Florescent Tube Light
Kcal	Kilo Calories
Kg.	Kilogram
KL	Kilo Liter
KV	Kilo Volt
kVA	Kilo Volt Ampere
KVAr	Kilo Volt Ampere Reactive
kW	Kilo Watts
kWh	Kilo Watt Hour
M or m	Meter
Mm	Millimeters
Max.	Maximum
Min.	Minimum
MT	Metric Ton
No.	Number
PF	Power Factor
TR	Tons of Refrigeration
V	Voltage
W	Wattage (watt)

EXECUTIVE SUMMARY

The Institution's management is conscious with regard to its Energy Efficiency Levels and they have initiated several measures to reduce the energy consumption. During field studies, it was observed that the management was found to be progressive as it has done very well on energy conservation front by implementing several energy conservation initiatives such as good usage of day light in campus, installation of LED light fixtures at few locations etc. We acknowledge and appreciate the commitment of the **Government College, Dera Bassi, SAS Nagar** management towards conservation of Energy.

However, energy conservation is a continuous process and there is always scope for further improvements.

The objective – The Energy Conservation Act (EC Act) was enacted in 2001 with the goal of reducing energy intensity of Indian economy. Bureau of Energy Efficiency (BEE) was set up as the statutory body on 1st March 2002 at the central level to facilitate the implementation of the EC Act. The Act provides regulatory mandate for: standards & labeling of equipment and appliances; energy conservation campus codes for commercial campus; and energy consumption norms for energy intensive industries.

India faces formidable challenge in meeting its energy needs and in providing adequate energy of desired quality in various forms in a sustainable manner and at competitive prices. Due to rising tariff, everybody is making efforts to reduce specific energy consumption with the twin aim of reducing energy bill, fast depleting natural resources and pollution. With this aim in mind, the management got this study done to explore energy saving potential to reduce further the energy consumption. This involved a detailed Energy:

i) Establish a baseline of the present energy consumption pattern,

ii) Identify Energy Efficiency Measures (EEM's) which can lead to sustained energy savings in the campus and

iii) Prepare an action plan to implement the same.

This report is an attempt to provide overview of energy consumption, its variation and energy reduction potential of **Government College, Dera Bassi, SAS Nagar** campus. The report also highlights the major energy saving opportunities available in the air conditioners, fans, lighting

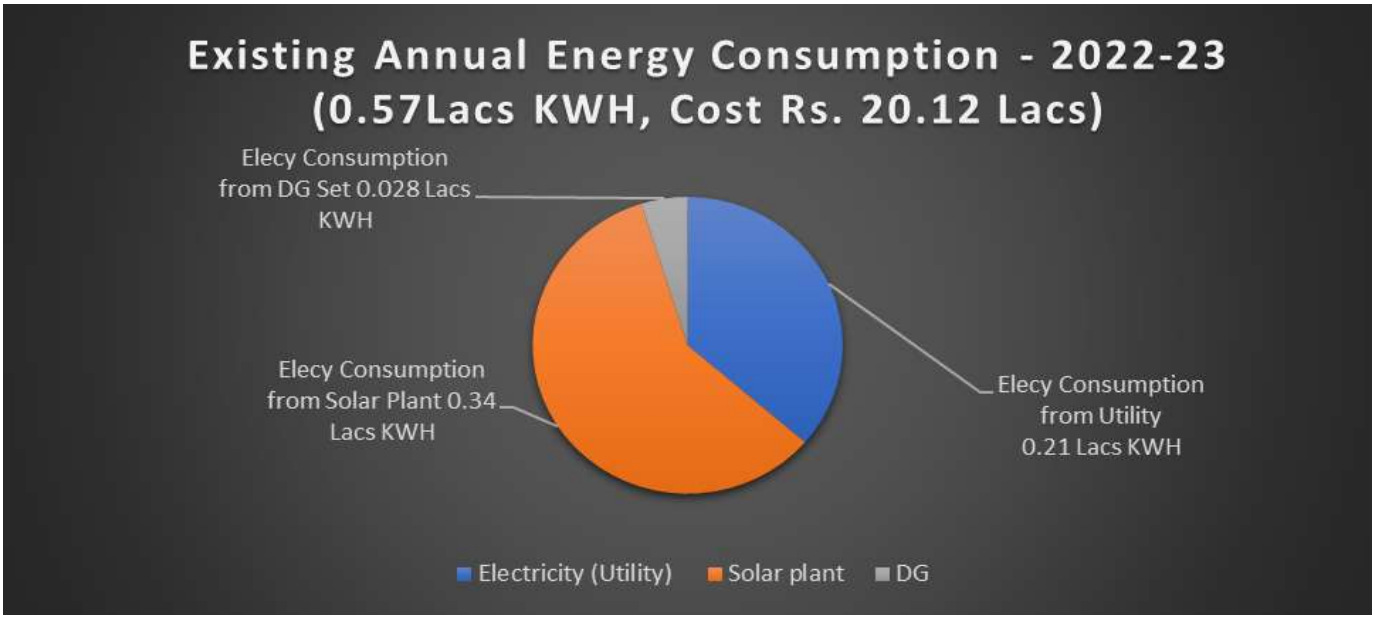
at the campus. A set of recommendations which will assist in improving energy efficiency has also been highlighted in this report.

Detail of Energy Consumption

Using the historical data, the total energy consumption of the building during the last 12 months was **0.57 Lacs KWH** with the annual energy cost amounting to Rs **20.12 Lacs**. Electricity, Solar and HSD are the sources of energy in the campus.

Annual Existing Energy Consumption

Energy Source	Annual Consumption- (Lacs KWH)	Energy cost (Rs. Lacs)
Electricity (Utility)	0.21	19.82
Solar plant	0.34	
DG	0.028	0.30
Total	**0.57**	**20.12**



SUMMARY OF GOVT.COLLEGE, DERA BASSI CAMPUS

Sr No.	Description	Details
1	Name of the campus	Government College, Dera Bassi, SAS Nagar
2	Location/Address	Government College, Dera Bassi, SAS Nagar
3	Project Title	Detailed Energy Audit of Government College, Dera Bassi, SAS Nagar
4	Project Report Number	RKS/EA-26/2023
5	Date of Audit	14 & 15thJune 2023
6	Date of this Report	30.06.2023
7	Ground covered area of the campus	4626.32 sq ft
8	Connected load/Contract demand of the campus	68.35 KW
9	No. Of Gen sets with capacity	82 KVA & 40 KVA
10	Average annual consumption of the Diesel	345 Liters/yr. App.
11	Nature of the campus	Educational Institute
12	Storey	Ground, + 2 Floors
13	Hours of normal operation of the campus	7 hrs.
14	Percentage of air-conditioned floor area	Less than 50%
15	a) Annual Electricity Consumption purchased from utility	0.21 Lakh kWh
	b) Annual Electricity Consumption through DG set	0.028 Lakh KWh
	c) Annual Electricity Consumption through Solar plant	0.34 KWh
	d) Total annual existing Electricity consumption, Utility+ through Solar Plant + DG	0.21+0.34+0.028=0.57 Lakh KWh
16	Energy Performance Index (EPI of the bdg)	134.27 kWh/Sqm/Annum
17	a) Annual Electricity Cost purchased from utility	Rs.19.82 Lakh
	b) Annual cost of electricity through DG Set	Rs.0.30 Lakh
	c) Total annual existing Electricity cost, (Utility+ DG)	Rs. 20.12 Lakh
18	Electricity rate/KWh as per Tariff – NRS more than 50 KW	Rs.6.35/KWh+11Paise / kWh as electricity duty=Rs.**6.46/KWh**
19	Proposed Annual Electricity Units saving	**0.37 Lakh KWh**
20	Proposed total annual monetary savings	**2.41 Lakh**
21	Proposed investment	**10.83 Lakh**
22	Payback	**4.4 Years**

SUMMARY OF ENERGY EFFICIENCY MEASURES

EEM (Energy Efficiency Measures)	Proposed Energy Efficiency Measures	Nos.	Annual energy consumption -Kwh	Annual energy consumption after replacement-Kwh	Annual energy saving -Kwh	Annual monetary saving-Rs.	Total investment including installations-Rs.	Simple pay back period (years)
EEM-1	Improving the power factor of the system by checking & installing 2KVAr capacitor & balancing the load and on main LT distribution panel.				1678	10840	3000	0.2
EEM-2	Suppression of excess current harmonics by installing 3 phase 4 wire 30 A Active harmonic filter in the main LT distribution panel				500	3230	15000	4.6
EEM-3	Replacement of Existing 110 nos. FTL 4' long 40 Watt with energy efficient 18-watt LED tube light	110	7623	2495	5128	33127	33000	0.9
EEM-4	Providing and fixing of Occupancy/motion (PIR) sensors for controlling of lights at various locations in the campus	55			4102	26499	165000	6.2
EEM-5	Replacement of existing 85-watt old inefficient ceiling fan with BLDC BEE 5 star rated 26-watt 1200 mm sweep ceiling fan in the campus	263	28167	8615	19552	126306	736400	5.8

EEM (Energy Efficiency Measures)	Proposed Energy Efficiency Measures	Nos.	Annual energy consumption -Kwh	Annual energy consumption after replacement-Kwh	Annual energy saving -Kwh	Annual monetary saving-Rs.	Total investment including installations-Rs.	Simple pay back period (years)
EEM-6	Replacement of 80 W old inefficient exhaust fan with 20 W Energy efficient BLDC star rated of air delivery 1150 CHM,250 mm2 and speed 1300 rpm exhaust fans	23	3091	772	2319	14980	54050	3.6
EEM-7	Replacement of existing 1.5 T old inefficient, conventional window air conditioner with BEE 5 star rated 1.5 T window AC	3	7560	3780	3780	24419	72000	2.9
EEM-8	Expected extra generation from existing Solar power plant by improving cleanliness of solar panels	1			366	2364	5000	2.1
	TOTAL	455	46441	15662	**37,425**	**2,41,765**	**10,83,450**	**4.4**

NET SAVINGS
Units Savable: 0.37 Lakh KWH
Amount Savable: Rs. 2.41 Lakh
Investment: Rs. 10.83 Lacs
Simple Payback Period – 4.4 Years

For R.K. ELECTRICALS & ENERGY AUDIT SERVICES

INTRODUCTION

The Bureau of Energy Efficiency **(BEE),** Ministry of Power Government of India has enacted the Energy Conservation Act, 2001 (No. 52 of 2001, 29th September, 2001) which came into force on 1st March 2002. This Act provides a legal framework, institutional arrangement and a regulatory mechanism at the Central and State level to embark on an energy efficiency drive in the country

Punjab Energy Development Agency **(PEDA)** has been declared as the State Designated Agency by the Govt. of Punjab under the guidelines of Bureau of Energy Efficiency to coordinate, regulate and enforce the Energy Conservation Act – 2001 within the state of Punjab since January, 2005

The objectives of PEDA include:

- Promotion, development and implementation of alternative/non-conventional energy technologies programs and projects.
- Implementation of comprehensive energy conservation programme in the industrial, agricultural, commercial and household sector.
- Promotion and development of new and emerging technology areas (e.g., biomass co-generation).
- Collection of energy data to build a reliable database to provide required information to the State Government to form its energy policy and planning for future.

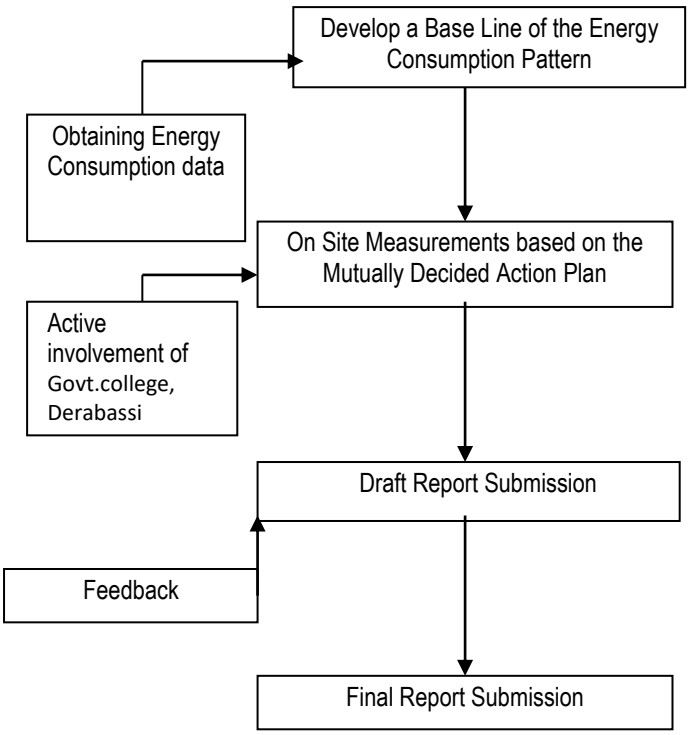
Back ground of Government College, Dera Bassi, SAS Nagar

Government College, Dera Bassi is a premier Institute established in **1983**. It is located in Punjab. Institute offers Degree courses including 4 UG course. These programs are offered in Full Time mode. Government College, Dera Bassi is a reputed institute for B.A., B. Com, B.Sc., BCA courses. Students can choose from these programs to peruse their career in higher studies. Institute enjoys a good reputation for courses like B.A., B. Com, B.Sc., BCA in the streams of Humanities & Social Sciences, Accounting & Commerce, Science, IT & Software Students can opt courses from these. Government College, Dera Bassi offered courses for 417 seats. Institute has a well-supported campus with facilities like Auditorium, Cafeteria, Gym, Hospital / Medical Facilities, Labs, Library, Sports Complex, Wi-Fi Campus.

METHODOLOGY

Methodology adopted for achieving the desired objectives viz: Assessment of the Current operational status and Energy savings include the following:

- Discussions with the concerned officials for identification of major **areas of focus** and other related systems;
- A team of engineers visited the campus and had discussions with the concerned officials/ supervisors to collect data/ information on the operations and Load Distribution in the campus. The data was analyzed to arrive at a **base line energy consumption pattern**.
- **Measurements and monitoring** with the help of appropriate instruments including continuous and/ or time lapse recording, as appropriate and visual observations were made to identify the energy usage pattern and losses in the system.
- Computation and **in-depth analysis** of the collected data, including utilization of computerized analysis and other techniques as appropriate were done to draw inferences and to evolve suitable energy conservation measure/s for improvements/ reduction in specific energy consumption.



The entire recommendations have been backed up with techno-economic calculations including the estimated investments required for implementation of the suggested measures and payback period.

INSTRUMENT SUPPORT

Some of the instruments used for undertaking the audit include the following:

- Digital Pressure Meter
- Anemometer with Vane Type Probe &Hygrometer
- Three Phase Power Analyzer ALM-31 with appropriate CT's & PT's
- Single Phase Power Analyzer with appropriate CT's
- Digital Temperature Meter
- Ultrasonic Flow meter
- Infrared Temperature Meter
- Lux Meter and digital distance meter

Engineers Who Participated in Audit & Report Preparation

1. Er Rakesh Kumar Sharma MIE, FIV	BEEs Energy Auditor (EA: 10080)
2. Er Varun Sharma	Energy Engineer, B Tech, MBA, PGDC (Ind. Safety)
3. Er Vibhor Aggarwal B Tech	BEEs Energy Manager(M-300062/21)

CHAPTER- I. BASE LINE SCENARIO & REVIEW OF ENERGY CONSUMPTION

1.1 OVER VIEW OF THE BUILDING

1.2 Total area

Area of plot-15 Acre (108900 sq ft)

Covered area of the building-4626.32 sq ft

1.3. Area wise summary and detail of rooms:

The building has four blocks, Ground +First floors

Admn. Block-Comprises of 9 rooms, Lobby

Academic Block - comprises of about 13 rooms

Science Block-10 rooms

New Academic Block-4rooms

First Floor-Comprises of Library,8 rooms and 5 rooms computer lab, student centre

Canteen- In ground floor having one hall and 2 rooms

Sports Department- 6 rooms and

Security room

1.4. PURCHASED POWER

Government College, SAS Nagar (Mohali) draws power from PSPCL through dedicated feeder at 0.440 KV. The building has main LT distribution panel. The connected/sanctioned load of the building is 68.35 Kw

1.5. SELF GENERATED POWER

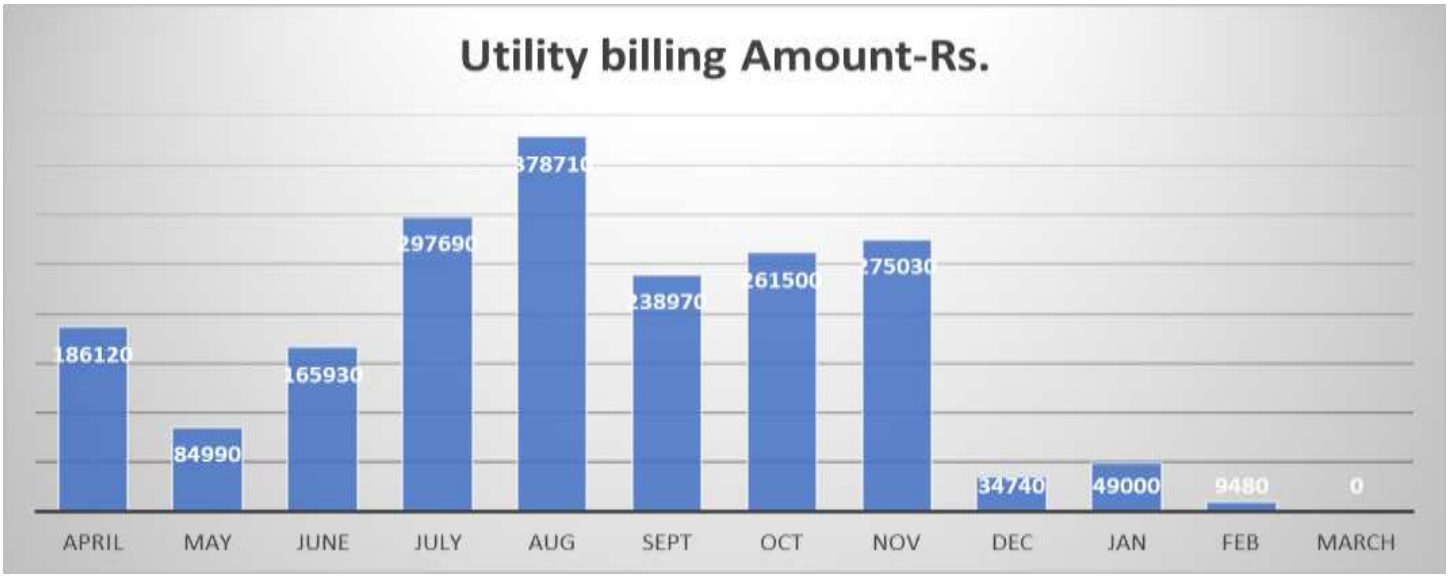
The campus has 02 Nos. of DG Set 82.5 & 40 kVA installed in acoustic covers for in-house power generation. The operation of the DG set is limited to power cuts only.

1.6 REVIEW OF PRESENT ENERGY CONSUMPTION & BILLING: The details of electrical consumption copied from electricity bills for 2022-23 is shown below:

Energy Consumption Profile for FY 2022-2023 KWh Vs Month

MONTH 2022-23	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	March	TOTAL
Total consumption-KWH	5041	5124	8209	4992	5458	10035	2192	3059	2272	2755	2626	3111	**54874**
Utility Energy Consumption-KWH	1100	2300	4740	2340	2280	4800	480	260	1260	760	280	140	**20740**
Solar Energy Consumption-KWH	3941	2824	3469	2652	3178	5235	1712	2799	1012	1995	2346	2971	**34134**

Billing Amount Profile for FY 2022-2023 Rs. Vs Month



Financial Year	22-23
Annual electricity consumption purchased from utility- Lacs kWh	O.21
Annual electricity consumption through solar system- Lacs kWh	0.34
Annual electricity consumption through DG set-(2839 KWh) -Lacs kWh	0.028
Total annual electricity consumption (Utility+ Solar+ DG) - Lacs kWh	0.57
Utility+ Solar+ DG) + amount of DG fuel billing (19.82+0.30) – Rs lacs	20.12
Electricity tariff rate –Energy charges +electricity duty (6.35+0.11) -Rs / kWh	6.46

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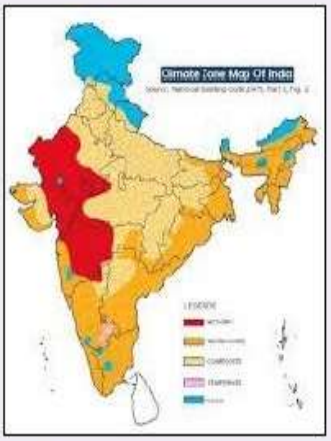
Thus, Total (Utility+ Solar+ DG) electrical energy of about **0.57 Lakh kWh** costing **Rs. 20.12 Lakh** is consumed annually

1.7. ENERGY PERFORMANCE OF THE CAMPUS (EPI): Energy performance index (EPI) is total energy consumed in a campus over a year divided by total built up area in kWh/sq m/year and is considered as the simplest and most relevant indicator for qualifying a campus as energy efficient or not

Benchmarking for EPI is as below



Based on the data collected from different categories of commercial buildings, the following tables show the indicative EPI benchmarks.

EPI benchmarks for Office Buildings

Climate Zone	Less than 50% AC	More than 50% AC
	EPI (kWh/m²/yr)	
Warm & Humid	101	182
Composite	86	179
Hot & Dry	90	173
Moderate	94	179

EPI benchmarks for Shopping Malls

Climate Zone	EPI (kWh/m²/yr)
Warm & Humid	428
Composite	327
Hot & Dry	273
Moderate	257

EPI benchmarks for Hospitals

Climate Zone	EPI (kWh/m²/yr)
Warm & Humid	275
Composite	264
Hot & Dry	261
Moderate	247

EPI benchmarks for Hotels

Climate Zone	Upto 3 star	Above 3 star
	EPI (kWh/m²/yr)	
Warm & Humid	215	333
Composite	201	290
Hot & Dry	167	250
Moderate	107	313

EPI benchmarks for Institutes

Climate Zone	EPI (kWh/m²/yr)
Warm & Humid	150
Composite	117
Hot & Dry	106
Moderate	129

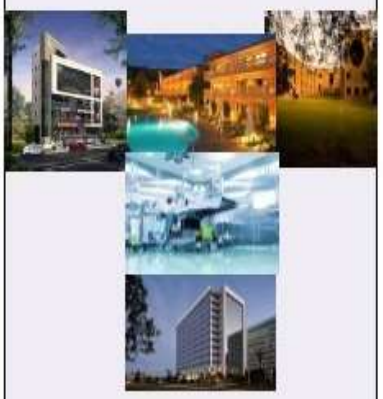
EPI benchmarks for BPOs

Climate Zone	EPI (kWh/m²/yr)
Warm & Humid	452
Composite	437
Hot & Dry	-
Moderate	433

Disclaimer : The EPI benchmarks should be considered as an indicative figure as it largely depends upon the operating hours, energy efficiency measures, sample size, climatic zone and lack of detailed information by building owners.

UNDP gef

Energy benchmarks for Commercial Buildings



Bureau of Energy Efficiency
4th Floor, Sewa Bhawan, R.K. Puram,
New Delhi – 110066
Website : www.beenet.in

Calculation of EPI

Considering composite climate as Punjab falls under Composite climate zone

Total Annual energy consumption (utility +from DG) during the year 2022-23=57713 KWh

Total built up area of the campus – 429.799 sqm

EPI=57713/429.799

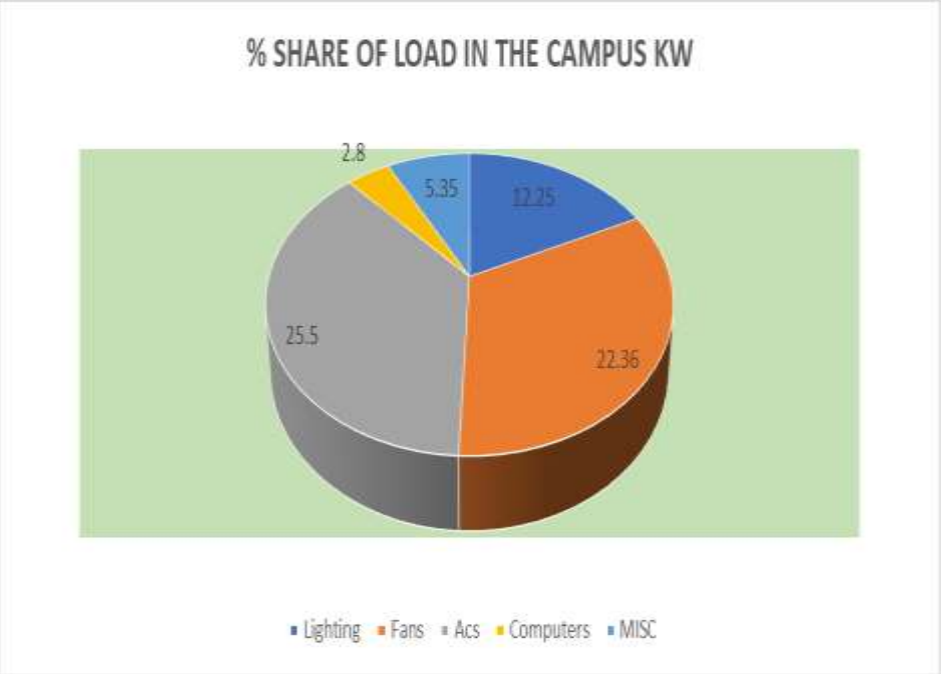
EPI=134.27/sqm/year

1.8 CAMPUS LOAD PROFILE

It was noticed during onsite assessment that no transformer was installed for the entire premises and there exist one no. LT connection for Connected /Sanctioned load of 68.35 KW

The auditors checked and calculated the electric load of the campus and found within the limits and the load detail is as under:

% SHARE OF LOAD IN THE CAMPUS		
Item	**KW**	**% Share**
Lighting	12.25	17.95
Fans	22.36	32.76
Acs	25.5	37.36
Computers	2.80	4.10
MISC	5.35	7.84
TOTAL	**68**	**100**

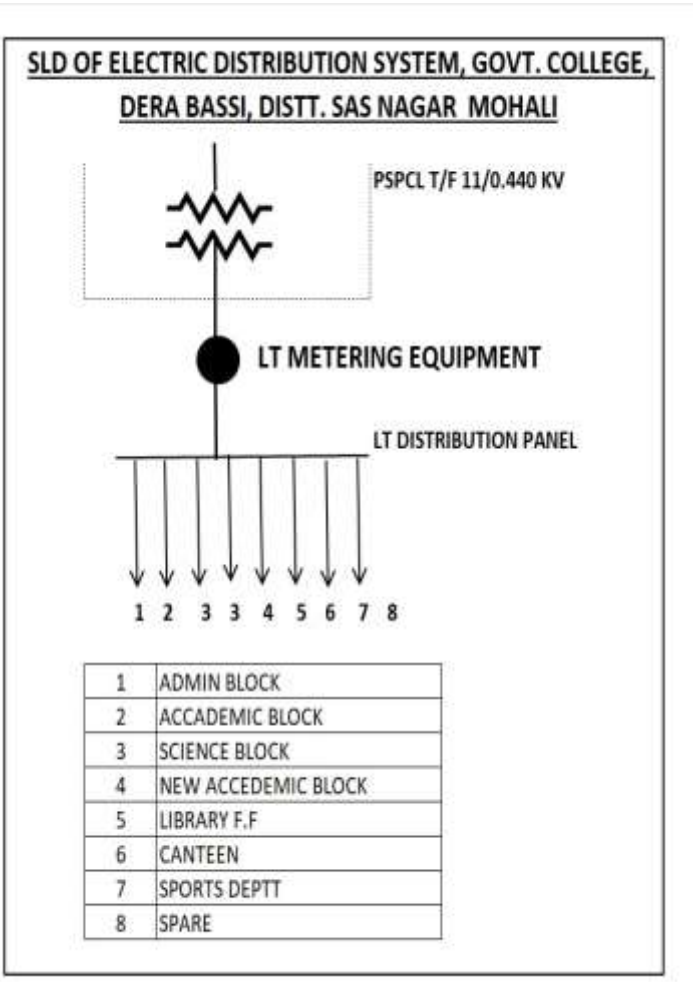


CHAPTER- II. ELECTRICAL DISTRIBUTION SYSTEM

a) **Review of present electrical distribution like Single Line Diagram (SLD),** loading, cable loading, normal & emergency loads, electricity distribution in various areas/floors etc.

2. Main LT Distribution Panel

The Campus has one electricity connection of 68.32 KW on LT supply and further power distribution is made.

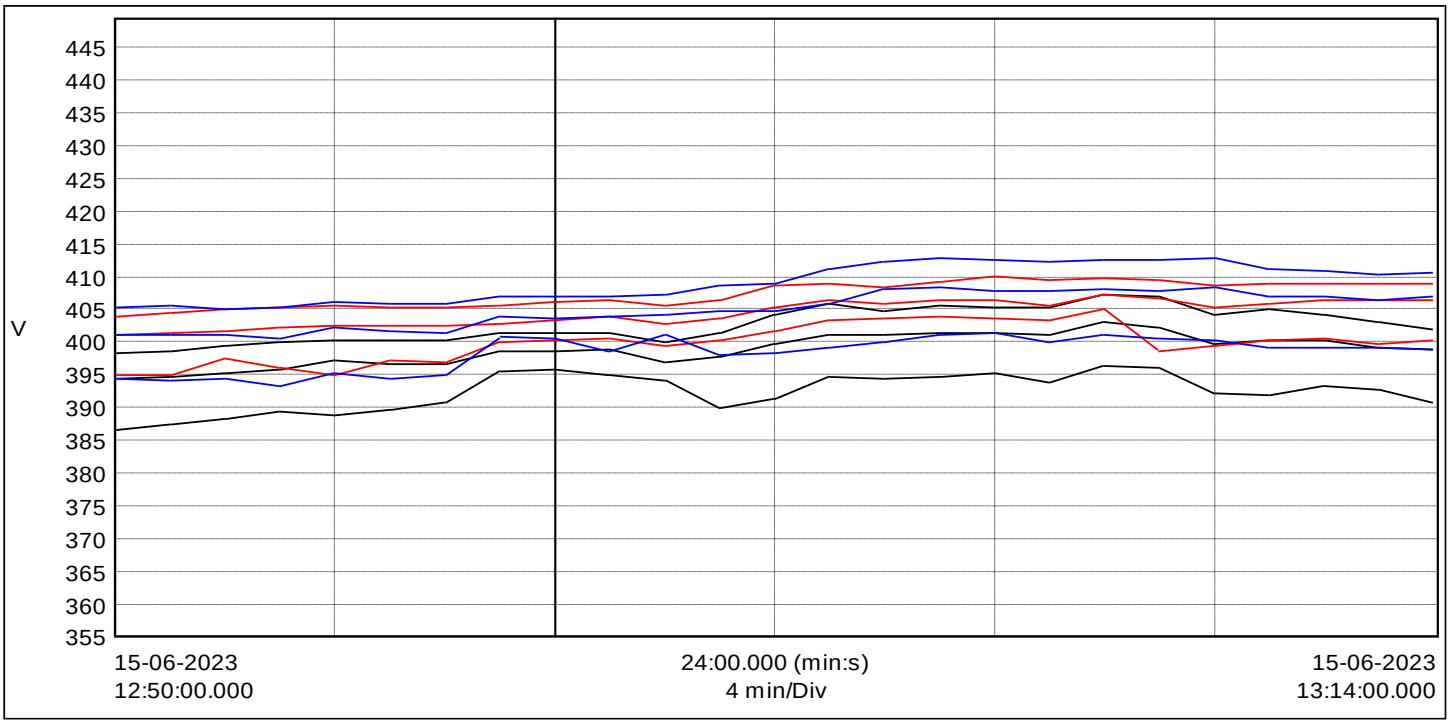


Main LT Distribution Panel and SLD

2.1.1. VOLTAGE PROFILE – LT MAIN IN SUPPLY

During the audit, quality of in-coming power is measured through 3 Phase Power Analyzer in order to measure the power quality parameters at incomer panel. Thus, various parameters were recorded which included Voltage, Current, Power Factor, Total Harmonic Distortion (THD), and Unbalancing of Load:

VOLTAGE PROFILE



Voltage profile of Incoming supply

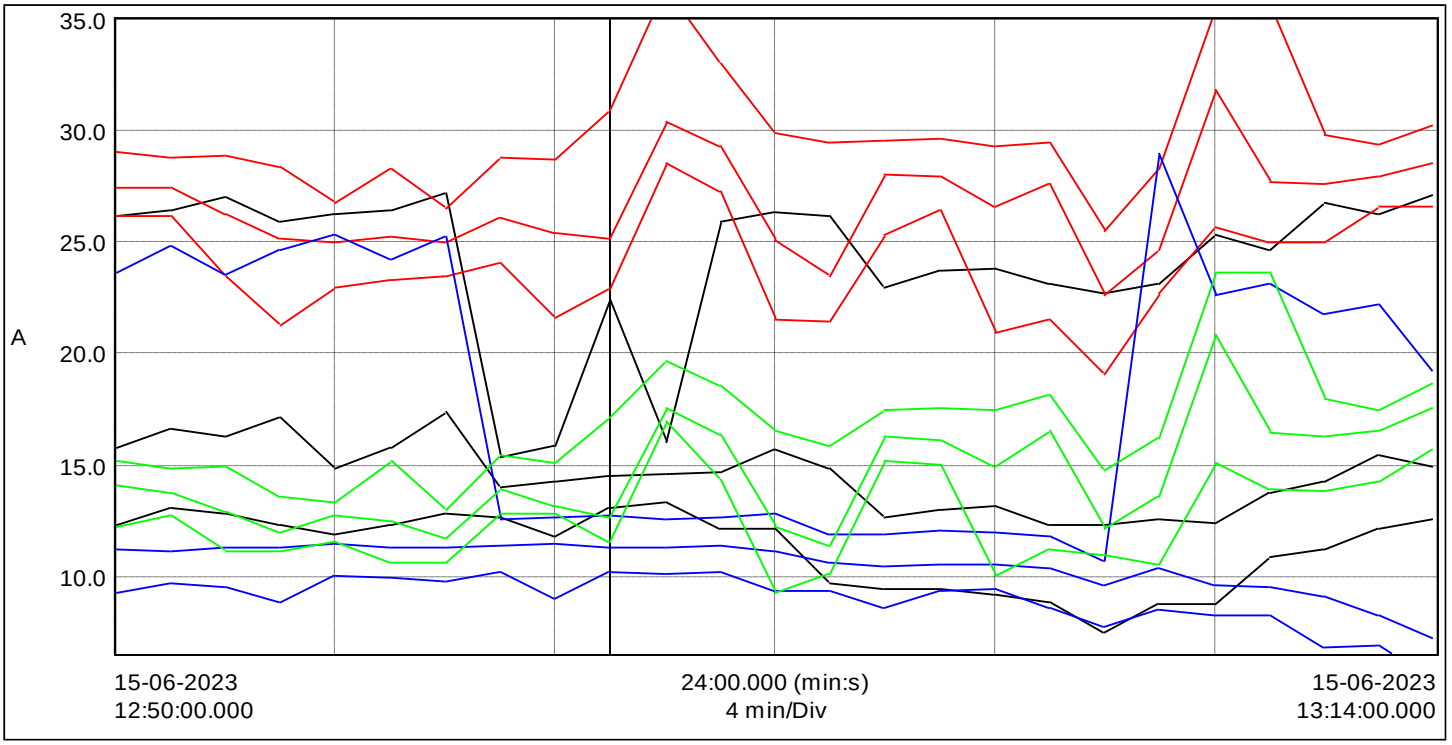
Urms	Urms	Urms	Average	%age
Line 1	**Line 2**	**Line 3**		**im-balance**
399	404.6	405.1	402.9	**1.5**

Imbalance voltage

IMBALANCE VOLTAGE

The unbalanced voltage is 1.5 % which is in the prescribed limit as per IEEE standards. An unbalance of 2% is acceptable as it doesn't affect the cable.

2.1.2. CURRENT PROFILE



Imbalance current

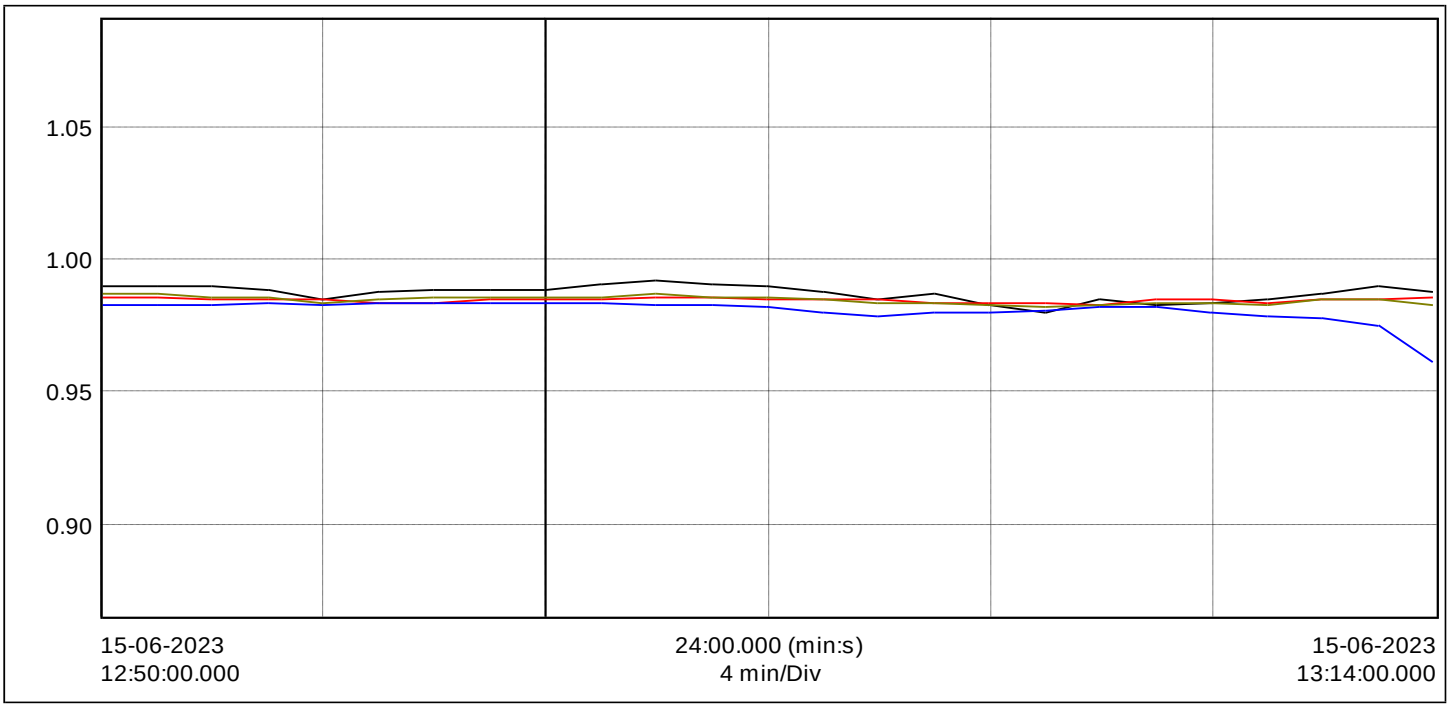
Arms	Arms	Arms	Average	%age
Line 1	**Line 2**	**Line 3**		**im-balance**
14.63	26.82	10.62	17.4	**93.37**

IMBALANCE CURRENT

The unbalance current was observed to be 93.7 %. and does not indicate any fault. Any large single-phase load, or a number of small loads connected to only one phase cause more current to flow from that particular phase causing voltage drop on line. All the single-phase loads should be distributed on the three-phase system such that they put equal load on three phases. The unbalance current is not within the permissible limit of 2%.

2.1.3. POWER FACTOR PROFILE

Item	Date	Time	Av	Min	Max
PF1	15-06-2023	01:00.0	0.988	0.98	0.992
PF2	15-06-2023	01:00.0	0.985	0.983	0.986
PF3	15-06-2023	01:00.0	0.981	0.961	0.984
PFT	15-06-2023	01:00.0	0.985	0.982	0.987



FINDINGS

Average power factor of the system found 0.985, still it can improve to 0.99

2.2. HARMONICS

2.2.1. HARMONIC GENERATIONS

Equipment based on frequency conversion techniques generates harmonics. With the increased use of such equipment, harmonics related problems have enhanced which are leading to heating of cables, bus bars and transformers, overloading of electrical distribution system, frequent tripping of switchgears, frequent failure of costly mother boards and capacitors of equipment etc.

The harmonic currents generated by different types of loads, travel back to the source. While travelling back to the source, they generate harmonic voltages, following simple Ohm's Law. Harmonic voltages, which appear on the system bus, are harmful to other equipment connected to the same bus, In general sensitive electronic equipment connected to this bus, will be affected.

System Problem	Common Causes	Possible Effects	Solutions
Harmonics (non sinusoidal voltages and /or current wave forms)	Office – Electronics, UPSs, variable frequency drives, high intensity discharge lighting and electronic and core coil ballasts.	Over- heating of neutral conductors, motors. transformers, switch gear. Voltage drop, low power factors, reduced capacity.	Take care with equipment selection and isolate sensitive electronics from noisy circuits.

Common causes and solution of harmonics

The Harmonic Voltage and Current Limitations set forth by IEEE 519 1992 are:

- Maximum Individual Frequency Voltage Harmonic: 3%
- Total Harmonic Distortion of the Voltage: 5%

harmonic current limitations

Maximum Harmonic Current Distortion in Percent of IL
120 Volt through 69 KV
Individual Harmonic Order (Odd Harmonics)

ISC/IL	h<11	11<h<17	17<h<23	23<h<35	35<h	TDD
<20*	4.0	2.0	1.5	0.6	0.3	5.0
20<50	7.0	3.5	2.5	1.0	0.5	8.0
50<100	10.0	4.5	4.0	1.5	0.7	12.0
100<1000	12.0	5.5	5.0	2.0	1.0	15.0
>1000	15.0	7.0	6.0	2.5	1.4	20.0

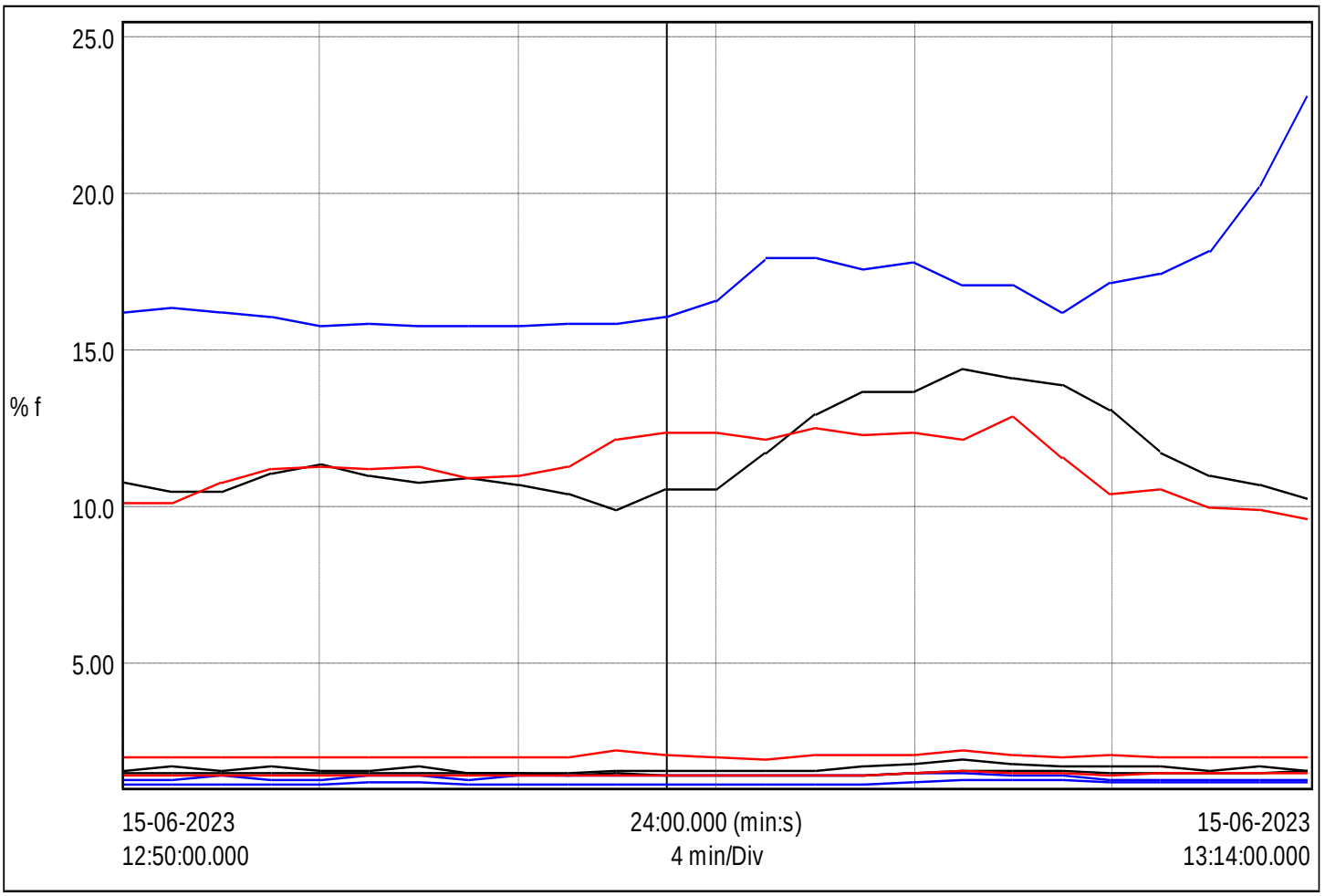
Even harmonics are limited to 25% of the odd harmonic limits
TDD refers to Total Demand Distortion based on the average demand current at the fundamental frequency and measured at the PCC (Point of Common Coupling).
*All power generation equipment is limited to these values of current distortion regardless of ISC/ IL value.
ISC = Maximum short-circuit current at PCC.
IL = Maximum demand load current (fundamental) at the PCC.
h = Harmonic number.

Harmonics (%) in incomer supply

During the assessment, Audit team also measured the harmonics level. Details are mentioned below:

Voltage THD & Current THD (%) in incoming supply

Name	Date	Average	Mini	Max	Units
A1 THDf	15-06-2023	11.62	9.9	14.4	% f
A2 THDf	15-06-2023	11.312	9.6	12.9	% f
A3 THDf	15-06-2023	17.068	15.8	23.2	% f
U12THDf	15-06-2023	1.492	1.4	1.6	% f
U23THDf	15-06-2023	1.436	1.4	1.6	% f
U31THDf	15-06-2023	1.156	1.1	1.3	% f
V1 THDf	15-06-2023	1.648	1.5	1.9	% f
V2 THDf	15-06-2023	2.036	1.9	2.2	% f
V3 THDf	15-06-2023	1.368	1.3	1.5	% f



Harmonics profile of incoming supply

2.2.2. OBSERVATIONS

It is evident from the above table that the average voltage THD (%) in main LT distribution panel was observed to be in range of average 1.1% to 2.0 % which is in the prescribed limit as per IEE standard of Voltage harmonics of 5%.

It is also evident from the above table that the average current THD (%) was observed to be in range of average 11.3 % to 17.0 % which is not in the prescribed limit of 12%

2.3. REACTIVE LOAD MANAGEMENT

2.3.1. The measured power factor of the system and found to be 0.985, still it can improve up to 0.99

At present there is no reactive load management for improving power factor of the system in the campus

Install shunt capacitors of 2 KVAr on main LT distribution panel for improving the power factor of the system

i)Calculations for improving the power factor of the system

Item	Value
Cos θ	0.985
θ	9.93
Sin θ	0.156
Cos	0.985
Tan θ	0.158
KVAr=Measured KW*Tan	11.793
KVAr	1.868
Say KVAr	2

Measured parameters at main LT distribution panel	Value
Measured Power-KW	11.93
Measured PF	0.985
Desired PF	0.99
Measured KVA	12.11
Estimated KVA;(11.93/0.99)	12
Saving in KVA;(12.11-12)	0.11
Running Hrs/day	24
Rate/KWH-Rs.	6.46
Annual saving in consumption - KVAh/kwh;(0.11x24xx365 daysx0.99)	954
Annual monetary saving @ Rs. 6.46/-	6163
Investment- Lacs Rs.	5000
SPB-year	1.2

1.Thus, by improving the power factor, **Saving in KWH=954**

ii) Calculation for Losses (I2R) due to unbalance current on main LT distribution panel (93.37% unbalance)

Arms	Arms	Arms	Average	%age
Line 1	**Line 2**	**Line 3**		**im-balance**
14.63	26.82	10.62	17.4	**93.37**

Line 1	Line 2	Line 3	R	I2	I2	I2	Total I2	Total I2R	KW	KWh
14.63	26.82	10.62	0.079	214	719	113	1046	83	0.083	0.83*24*365=724

2.Thus, by balancing the load on main distribution panel, **Saving in KWH=724**

Total savings:(954+724) =1678 KWh

Encon measures

Checked the parameters on main distribution panel i.e., voltage, current, power factor, harmonics, power, loading position and reactive load management with the help of portable three phase power analyzer (page 19-24) along with observations and recommendations. Thus, Encon option measures derived as above. i) by improving the PF and ii) by balancing the load on main distribution panel

EEM- 1 Improving the power factor of the system by checking and installing 2 KVAr capacitor & balancing the load on main LT distribution panel

Energy Saving calculation

Equipment	Ann Saving-kwh	A/Monetary saving-Rs	Investment-Rs	SPB
1. Improving power factor of the system to 0.99 by checking and installing 2 KVAr shunt capacitor on main LT distribution panel	954	6163	3000	
2. By Balancing the load on main LT distr. panel	724	4677		
Total	1678	10840	3000	0.27

HARMONICS

Conclusion: From the observations at Sr No. 2.2.2. It is concluded that, current harmonics are on high side as average current harmonics are in the range (11.3-17 %)

i) Loss due to harmonics: It is not easily possible to calculate losses due to harmonics.

ii) Equipment like motors, transformers, cables: Increase in losses

iii) Loss due to damage to equipment: As stated earlier, high harmonics level causes excessive damage to electronic equipment

Tariff: Central electricity authority under Ministry of Power, Government of India has already approved rules for charging penalty for high harmonics level. Some state regulatory commissions have also approved same but it's implementation not started yet.

Recommendations:

Active harmonics filters-These filters inject negative of the harmonics current resulting in practically no harmonic distortion. Phase balancing and power factor correction also achieved so; it is recommended to install 30 Amperes 3 phase 4 wire active harmonics filter. we assume saving potential of 500 electricity units with the investment of Rs. 15,000**/-**

EEM- 2 Install 30 Amperes 3 phase 4 wire active harmonic filter in the main LT distribution panel

Equipment	Ann Saving-kwh	A/Monetary saving-Rs	Investment-Rs	SPB yrs.
Suppression of excess current harmonics by installing 30 Amperes 3 phase 4 wire Active harmonic filter in the main LT distribution panel	500	3230	15000	4.6

CHAPTER- III. LIGHTING SYSTEM

3.1. COLLEGE LIGHTING SYSTEM

Adequate and proper lighting contributes both directly and indirectly towards productivity, safety and towards providing an improved atmosphere. Primary considerations to ensure energy efficiency in lighting systems are:

a. Selection of most efficient light source as far as possible in order to minimize power cost and energy consumption.
b. Matching proper lamp type to the intended work task or aesthetic application, consistent with color, brightness control and other requirements.
c. Establish adequate light levels to maintain productivity improve security and improve safety.

3.2. LIGHTING INVENTORY

During the onsite assessment, Audit team has carried out the lighting survey for various locations in the Campus

The Total lighting details installed in the premises are given below

Type of Luminary	No.	Watt
FTL 4' long	110	40
LED TL 20 W	257	20
LED Hanging light	10	35
LED spot light	8	14
LED Flood Light	10	60

3.3. Electricity consumption of existing lighting system of the campus

Type of Luminary	No.	Watt	Ballast Watt	Total- Watts	Hrs	Days	LF	Total KWH
FTL 4' long	110	40	15	55	7	240	0.75	7623
LED 4' long T/L	257	20		20	7	240	0.75	6476
LED hanging light	10	35		35	7	240	0.75	441
LED spot light	10	35		35	7	240	0.75	141
LED FL	10	60		60	11	365	1	2409
						KWH		**17091**

3.4. LUX MEASUREMENT

A high-quality DIGITAL LUX METER was used to measure the illumination levels at various locations of Government College Dera Bassi, SAS Nagar and the recommended level of lightning in these areas is given in the table

The recommended light level as per standard is shown below:

Location	Recommended LUX
Normal work station space, open or closed office	500
Conference Rooms	300
Training Rooms	500
Internal Corridors	200
Auditorium	150-200
Entrance Lobbies, Atria`	200
Stairwells	200
Toilets	200
Dining Areas	150-200

Recommended Standard Light Level Details

3.5. STUDY FINDING OF LIGHTING

The college authorities provided the details of luminaries installed within their Campus premises. The auditors surveyed area and compared type of fittings, their height, and type of reflectors. Based upon this survey and data obtained from the authorities, hours and days of running, the energy consumption is calculated as follows

Assessment of the Lighting

Sr. No	LOCATION	Measured Lux	REMARKS
1	RUSA office	262	Satisfactory
2	Staff room conference room	155	unsatisfactory
3	Barsar office	296	Satisfactory
4	Office room	237	Satisfactory
5	Physics department	266	Satisfactory
6	Chemistry lab	275	Satisfactory
7	Faculty room	213	Satisfactory
8	Library	309	Satisfactory
9	Computer lab 1	300	Satisfactory
10	Computer lab 2	300	Satisfactory

OBSERVATIONS & RECOMMENDATIONS

- Lux level found to be **satisfactory**
- During Audit, It was observed that some fluorescent tubes are fitted with magnetic blasts on conventional 40W luminaries It was also observed during the audit that reflector/diffuser were provided for some of the fluorescent tubes to distribute the uniform lighting in the room.
- It is recommended for converting the remaining installation to use more efficient lighting equipment

RECOMMENDATION

3.5.1 Installation of Energy Efficient Light

EEM-3 Replacement of existing 110 nos. 1x4'x40W T-12 WITH 1x4'18 W LEDTUBE LIGHT

In the existing system 110 nos. 40 W, T-12 FTLs are being used to provide general illumination to part of the campus. The proposed scenario includes replacement of T- 12 type with 18 W LED 4' long Tube Light. The energy saving calculations is shown below.

Energy Saving Calculation		Units	Value
Total Number of fittings	=	Nos.	110
Electricity Consumption of existing 1*40W FTL (including ballast) as per "above at Sr No.3.3. Electricity consumption of existing lighting system of college"	=	kWh	7623
Electricity Consumption of proposed 1x18W LED tube light, (110 no18wx7hrx240daysx0.75LF/1000=3118 KWH)	=	kWh	2495
Cost Benefit Analysis			
Annual Electricity Savings potential	=	kWh	5128
Per Unit cost	=	Rs.	6.46
Annual Monetary Savings	=	Rs.	33127
Investment/ fixture (including replacement cost)	=	Rs.	300
Total Investment	=	Rs.	33000
Simple Payback Period	=	Years	0.9

The payback period is calculated to be 0.9 years. Since the product life is much more than that, the move is economically beneficial and energy saving

3.6. Occupancy Sensors (PIR) for existing Lighting System

Lighting is the biggest energy consuming area. The **Occupancy sensor, Passive infrared type (PIR)** detects presence of people in the target monitored area. They provide convenience by turning lights on automatically when someone enters a room, and save energy consumption by turning lights off room or reducing light output when a space is unoccupied.

The motion sensor responds to moving objects only. The difference between them is occupancy sensor produce signals whenever an object is stationary or not while motion sensor is sensitive to only moving objects. These types of sensors utilize some kind of a human body's property or body's actions. For instance, a sensor may be sensitive to body weight, heat, sounds, dielectric constant and so on. Occupancy sensors differ from motion sensors in that they don't require significant motion in order to work. Their purpose is not to detect motion, but to detect whether people are present, even if they're not moving around. Many occupancy sensors will use a combination of sensors and various technologies

Observations

It is observed that in many room the light, fans and AC units were running even when no occupant in the room. After office hours in few rooms, the FCU fan supply was on lead to energy consumption irrespective of useful output.

Recommendation

It is recommended to install the occupancy sensor for individual room to switch off running load when there is no occupant. Occupancy sensors are one kind of devices used for detecting occupancy in space automatically deactivates the light so that the energy can be conserved. This sensor may also activate the lights. This device can also activate the lights routinely by detecting the occurrence of people and provides security and convenience help. the calculated energy saving is as below:

3.6.1. Providing and fixing of Occupancy Sensors (PIR) for existing lighting at various locations in the building.

Based on the laboratory like Lawrence Berkeley National, the strategies based on occupancy can generate 24% of normal savings of lighting energy Lighting load of the rooms, labs, wash rooms and at some other locations is 11.6 KW

EEM-4 providing and fixing of Occupancy/motion Sensors (PIR) for existing lighting

Energy Saving Calculations:

Description		Units	Value
Locations-Rooms and other connected area of the building	=	Nos.	55
Annual existing electricity consumption of existing lighting load, as per "above at Sr No.3.3. Electricity consumption of existing lighting system of college" (17091KWh)	=	KWh	17091
Proposed annual Saving in electricity Consumption after fixing the proposed occupancy (PIR) sensors with existing lightings @ 24%(17091x24%) =4102 KWh	=	KWH	4102
Cost Benefit Analysis			
Per Unit cost	=	Rs.	6.46
Annual Monetary Savings=6.46x4102	=	Rs.	26499
Investment/fixt. per sensor	=	Rs.	3000
Total Investment	=	Rs.	165000
Simple Payback Period	=	year	6.2

The payback period would be 6.2 years, which is viable. Since the product life is much more than that. Move is economically beneficial and energy saving.

CHAPTER- IV. STUDY OF COMPUTER SYSTEM

This office has about 56 nos. of computers with LED monitors. The computers are generally for students

An equivalently sized LED monitor is upwards of 80% smaller in size and weight compared to a CRT/LCD. The larger the screen, the bigger the size difference. The other major drawback of LCD deals with the power consumption. The energy needed for the electron beam means that the monitors consume and generate a lot more heat than the LED monitors. On an average, CRT Monitors and LCD monitors consume more Watt while LED computer consume low power. Auditors found no savings in it.

CHAPTER- V. HEATING VENTILATION AND AIR-CONDITIONING SYSTEM

5. STUDY FINDING OF FANS

The Fan details installed in the premises are given below

Sr No	Specification Item	Total nos
1	Ceiling fan	263
3	Wall fan	10
4	Exhaust fan	23

5.1. CEILING FANS

The standard fans are installed in the premises. 75/80 W Ceiling fan may consume up to 90 watts. Thus, these should be replaced with BEE 5 star rated energy efficient BLDC fan comparatively with same air Flow but reduced in their wattage.

Service Value= Minimum Air Delivery (m3/min) / Power Consumption (kWh)Star: Service Value ≥ 3.2 to <3.4
2 star: Service Value ≥ 3.4 to <3.6
Star: Service Value ≥ 3.6 to <3.8
Star: Service Value ≥ 3.8 to <4.5star: Service Value ≥ 4.0

Existing ceiling fan in the campus

OBSERVATIONS

- During Audit, Air delivery was not observed on their name plate

RECOMMENDATION

There are 263 nos. ceiling fans installed in the college area are taken for replacement with energy efficient BEE star rated 26-watt BLDC Fans

5.2. Energy consumption of existing fans in the college

EEM-5 Replacement of 263 nos. existing old inefficient ceiling fans with 26 W Energy efficient/5 star rated BLDC ceiling fans in the colleges

Energy Saving Calculation		Units	Value
Total Number of ceiling fans	=	Nos.	263
Electricity Consumption of existing old inefficient 85 watt Ceiling fan , 263no.x85wx7hrx180days/1000=28167	=	Watt	28167
Electricity Consumption of proposed 26 W energy efficient fans(263no.x26wx7hrx180days/1000=8615)	=	Watt	8615
Cost Benefit Analysis			
Annual Savings potential	=	kWh/year	19552
Per Unit cost	=	Rs.	6.46
Annual Monetary Savings	=	Rs.	126306
Investment-1200 mm sweep 26watt BLDC ceiling fan	=	Rs.	2800
Total Investment -Rs	=	Rs.	736400
Simple Payback Period	=	year	5.8

The payback period is calculated to be 5.8 year, which is high. Since the product life is much more than that, the move is economically beneficial and energy saving

5.3. Wall fans

Lower wattage wall fans are being used for air circulation and lowering the temperature of the rooms. It is generally seen that these are rarely used, thus, it is not viable to replace these.

Existing exhaust fan in the campus

5.4. EXHAUST FANS

Presently 23 no. old inefficient 80 W exhaust fans are being used to provide general ventilation to the washrooms/mess, labs in the campus and these may consume up to 100 watts. These are recommended to replace with 20watt energy efficient BEE star rated BLDC exhaust fans with air delivery 1150 CHM,250 mm2 and speed 1300 rpm (which are readily available in the market, as annexure- List of Vendors)

5.5. Energy consumption of existing E/fans in the colleges

EEM-6 Replacement of 23 nos. of 80 W inefficient exhaust fan with 20W Energy efficient BEE 5 Star rated BLDC exhaust fan

The energy saving calculation is shown below

Energy Saving Calculation		Units	Value
Total Number of Exhaust fans	=	Nos.	23
Electricity Consumption of existing old inefficient E/F, 80watt (23 no.x80wx7hrx240 days/1000=3091 KWH)	=	kwh	3091
Electricity Consumption after replacement with 20 W energy efficient BEE 5 star rated BLDC E/fans with air delivery 1150 CHM,250 mm2 and speed 1300 rpm (23no.x20wx7hrx240 days/1000=772 KWH)	=	kwh	772
Cost Benefit Analysis			
Annual Savings potential	=	kWh/year	2319
Per Unit cost	=	Rs.	6.46
Annual Monetary Savings	=	Rs.	14980
Investment/ fixture replacement	=	Rs./fixture	2350
Total Investment-Rs	=	Rs.	54050
Simple Payback Period	=	year	3.6

The payback period is calculated to be 3.6 years, which is high. Since the product life is much more than that, the move is economically beneficial and energy saving.

5.6. AIR CONDITIONERS

The main purpose of an Air Conditioning (AC) system is to help maintain good indoor air quality through adequate ventilation with filtration and provide thermal comfort. AC systems are among the largest energy consumers in campus. The choice and design of the AC system can also affect many other high-performance goals, including water consumption (water-cooled air conditioning equipment) and acoustics.

5.6.1. DESCRIPTION OF AC SYSTEM

Campus has installed 3 nos. Window Acs. 11 nos. Split Air Conditioners make mostly Hitachi, carrier in various blocks of the campus and are new or BEE star rated.

5.6.2. POWER CONSUMPTION MEASUREMENT OF EXISTING AIR CONDITIONERS

The auditors measured the power consumption of some of air conditioners installed at RUSA room and staff cum conference room no. and in the reception, area shown in shown below:

Measured data:

AC	Date	Volts	Amps	PF	KW
Window at RUSA	15-06-2023	228	13.7	0.71	2.22
Split in the staff	15-06-2023	224.4	10.66	0.782	1.72

Power consumption of the Air Conditioners

Performance analysis of Air Conditioner

5.6.3. PERFORMANCE OF AIR CONDITIONERS: The audit team has carried out the performance of some of the Air Conditioners by measuring the actual Tonnage (Cooling Capacity) using hygrometer and anemometer. The performance of the Air conditioner is shown below:

Description	Window-AC in RUSA	Split staff office
Tons	1.5	1.5
Make	Hitachi	Hitachi
Year		
Ambient air temp - Dry	28.1	28.5
Dry bulb temperature at inlet -°C	15	14.1
Wet bulb temperature at inlet -°C	14.1	12.2
Enthalpy of inlet air - K J / kg	42	38.5
Dry bulb temperature at outlet -°C	12.0	11.8
Wet bulb temperature at out let-°C	9.2	7.1
Enthalpy of outlet air - K J / kg	34	24.5
Heat shed at evaporator - KJ/kg	8	14
outlet duct area -square m	0.0419	0.1597
Air speed - m/second	5.86	1.63
Flow- Cubic meter/ hour	883.5	934.2
Flow - Kg/ hour at inlet temperature	1094	1158
Total enthalpy KJ/ hour	8755	16211
Total enthalpy KCal/ hour	2092	3875
Total tons/ hour	0.69	1.28
Power consumption - kw	2.09	1.72
Power consumption - kw/ ton	3.02	1.34
Heat shed at evaporator - kw	2.43	4.51
EER of AC	1.2	2.6

OBSERVATIONS & RECOMMENDATIONS

The Performance assessment of units was done only for the purpose of comparison. .

The detailed analysis of the power consumption and performance of AC's were checked and shown above in the tabulated form.

1. The power consumption of ACs is 2.09 kw & 1.7 kw. EER of window A C is low.
2. The performance of this checked window AC's is unsatisfactory.
3. Split Acs are new their performance is satisfactory
4. Regular Maintenance of the A/C is required for proper refrigeration effect by attending the gas leakages if present and cleaning of the filters.

5.It is recommended to replace the window ACs with BEE 5star rated AC's which is a mandatory phase as per star rated plan of BEE.

EEM-7 3 Nos. old inefficient AC'S are proposed to be replaced with new BEE 5 star rated ACs installed in various rooms in the campus. The energy saving calculations is provided below:

Energy Saving Calculation	Units	1.5T/ window
Total Number of Air conditioners	Nos.	3
Electricity Consumption of existing old inefficient Air conditioners,3x2000x7x180/1000= 7560 kwh	KWh	7560
Electricity Consumption after replacement with energy efficient 1.5 T W/S BEE star rated AC (3x1200x7X180/1000) =3780 KWH)	KWh	3780
Annual Savings potential after replacement with energy efficient 1.5 T W/S BEE star rated AC (7560-3780=3780 KWh)	kWh/year	3780
Cost Benefit Analysis		
Per Unit cost	Rs.	6.46
Annual Monetary Savings	Rs.	24419
Investment/ fixture replacement	Rs. /fixt.	24000
Total Investment	Rs.	72000
Simple Payback Period	year	2.9

The payback period would be 2.9 years, which is viable. Since the product life is much more than that. Move is economically beneficial and energy saving

5.7. Water Coolers

4 Nos. of water coolers are installed in the building premises to enable the employees, students and visitors to get cool water. The water temperature is controlled with a thermostat. Normally it is kept at tap no. 4. Refrigerant R-22 is used in these coolers. No pressure gauges are installed on refrigerant circuit. The normal temperature of water is 24 °C. The reasonable chilled water temperature is 17 °C. For energy saving it should be kept around 16-17 °C

5.7.1. Energy consumption of existing water coolers

Nos	Watts	Hrs.	Days	kWh
3+1 small (700)	1550	7	180	6741
			Total	6741

Measured parameters of water cooler

Measured the parameters of the cooler installed near reception office and the Performance is as below:

5.7.2. Performance of water coolers

water cooler	Units	Value
Normal water temperature	°C	24
Reasonable chilled water temperature	°C	14
Water Temperature measured	°C	14
Difference in temperature	°C	-
Excess energy consumption @ 3%/ °C rise in temperature per degree centigrade	%	-

Thus, performance of water coolers found satisfactory. Auditors found no saving in it

CHAPTER- VI DIESEL GENERATOR SETS

6.1. SELF GENERATED POWER

GJIMT campus has 2 Nos. DG Set of 40 KVA & 82.5 KVA capacities installed in acoustic covers for in-house power generation. The operation of the DG set is limited to power cuts only.

HSD Consumption of DG Sets

Diesel Consumption Details	FY 22-23
Annual- Lts	345
Rate Rs / lts	87.43
Amount – Rs lacs	0.30

6.2 DG SET 1 of 250 KVA

6.2.1 Rated parameters of DG Sets

Description	Details
Make	KIRLOSKAR
Capacity-KVA	40
Volts	415
Amps	55.6
Power factor	0.8 lag
Rpm	1500
Connection	Series
Rated Power-KW	32
Frequency-HZ	50

6.2.7 DG SETs, OBSERVATIONS & RECOMMENDATIONS

Following is supplemented in management's efforts to further bring down energy costs.

1. Specific energy consumption: -The most important thing is to know specific energy consumption. Log book is maintained for DG. At present only hours of operations is being monitored.

2. Effect of temperature & suction pressure - For every 3.5 °C increase in inlet air temperature, fuel consumption increases by 1%. The DG Sets is normally designed for ambient temperature of 25 to 30 degree centigrade. Higher temperature & lower suction pressure decreases efficiency. The position of set is as below: -

3. As verbally informed, normally lubricating oil pressure reaches 79 psi, oil temperature 80 °C & voltage is kept around 415 volts. All these are satisfactory.
4. All are placed in a big covered in open space. The side from where air is sucked by sets is open.
5. Thus, fresh air at ambient conditions is sucked in. It is good
6. All are housed in accosted cover. The exhaust pipe inside is well insulated. It is also good so that temperature inside does not unnecessarily increase.

Typically, a diesel generator will run at about 40 percent efficiency in its designed optimum operating range, usually up to 80 percent of total load capacity. That means for every 100 units of energy input, 40 units are delivered as output.

-It is recommended to use additive in lubrication oil in HSD for DG it will increase the average and efficiency and will reduce the carbon deposit on the burner nozzles in the DG Set. **The auditors found nil saving in it**

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CHAPTER-VII. MOTOR & PUMPING SYSTEM

No provision of water pumping has been made as the water in the campus directly comes from the municipal corporation which is directly stored in the overhead tanks provided for storage in the campus. Thus, there is no any of pump-motor etc. installed in the campus.

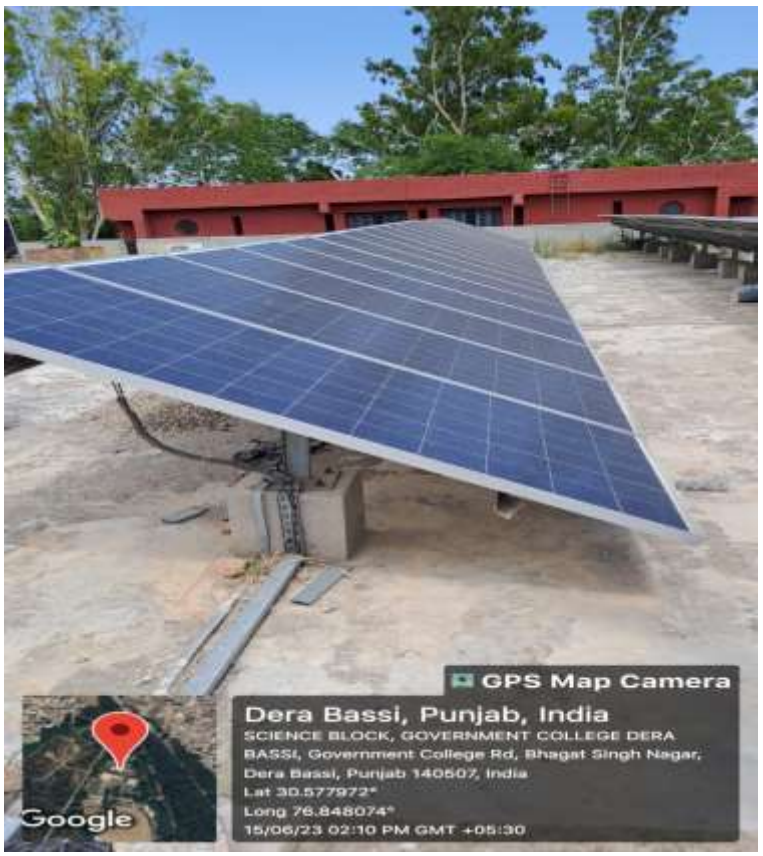
CHAPTER-VIII. SOLAR POWER PLANT

Detailed Report of 25 KWp Solar Roof Top Grid Interactive Power Plant

Solar energy is one of the most widely used renewable source of energy one can use renewable energy technologies to convert solar energy in to electricity, it is very reliable source of energy and can significantly reduce the electricity bills

8.1. Installation of 25 KWp roof top Solar Power Plant:

At present, power is sourced from the PSPCL at 0.440 kV. Power is also generated using 2 DG sets of 40 KVA & 82.5 KVA The college has ample space i.e., Roof top area on campus. The average power generation from a 1 KWp SPV System is around 4-5 kWh per day. Since the proposed SPV system does not have a battery backup grid connection would be required to meet the power requirements during the day. Also, the SPV power generation varies with time of day, the balance power requirements are automatically met by the grid supply during this period.



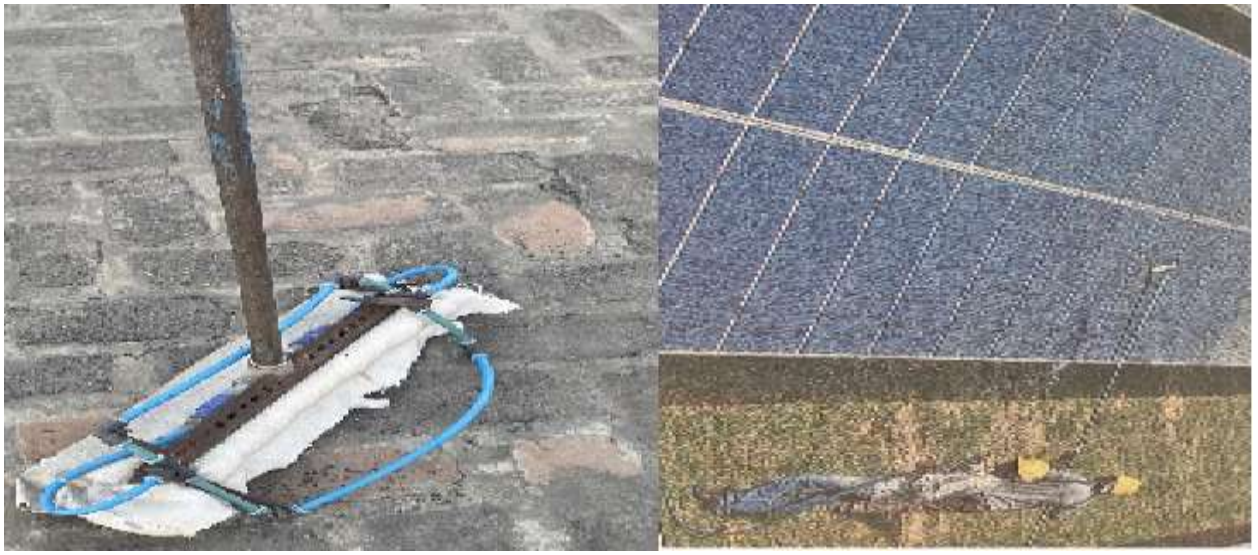
One 25 KWp solar plant for generating own electricity is installed on roof top. The electricity generated by unit installed for which 12 months data is available is as follows:

MONTH 2022-23	Total
Solar Generation-KWH	34134

8.2. The generation of electricity from above table is as follows:

Narration	Value
Total for 2022-23	34134
Average /day; (34134/365=93.5) KWH	93.5
Energy /kw installed capacity ;(93.5/25 KWp=3.7)	3.7

The Solar panel is expected to generation an average over the year 4.6 kWh of electricity per day (considering 5.5 sunshine hours). If we consider 300 sunshine days, it comes to 4.6*25*300 = 34500 KWH/annum for one 25 kW panel. We do not expect 4.6kwh/kw/day in this campus due to some deficiencies. Cleaning at roof top is difficult. The campus authorities may install a water pipe connection at certain locations. But it is not sufficient. Water pipe with proper tee off & valves be laid all around & each panel washed with water & cleaned with cloth at least once a week instead of fortnightly as done now. Practices at some buildings are shown below:



In the first image, a locally made scrubber with water pipe connected is used. The water pipe is connected at handle top & one person can do all cleaning. Here, both manpower & water is saved but cleaning is not very perfect. In second method, one person spays water & 2nd cleans it. It involves lot of water. Secondly a good approach & safety be provided for person going up for cleaning so that he feels secure.

We expect extra generation

8.3. Expected saving potential & investment for it are as follows:

EEM-9

Energy Saving Calculations

Item	Value
Solar Generation capacity-taking 300 sunny days,4.6*25*300 = 34500 - KWH	34500
Total generation in 22-23-KWh	34134
Extra expected generation from solar power plant-KWH	366
Amount salvable @ Rs 6.46/ kWh - Rs	2364
Appr investment for improving stairs, water piping, safety, extra lab charges	5000
Pa back period	2.1

The payback period is calculated to be 2.1 year. Since the product life is much more than that, the move is economically beneficial and energy saving

CHAPTER-IX. ENERGY MONITORING & ACCOUNTING SYSTEM

9.1. Detail review of present energy monitoring & accounting system terms of metering record keeping, data logging, periodic performance analysis etc.

9.2 Energy management monitoring system

Energy is costly & its consumption cause environmental degradation. So, without sacrificing production & growth, it is worthwhile saving it to the extent possible

Monitoring and targeting is an important management tool to control energy consumption. Monitoring gives existing energy consumption pattern and targeting is desirable/achievable energy consumption pattern. By proper monitoring & targeting, it is possible to save 2 to 5% energy. For its effectiveness, proper record of energy consumption and production needs to be maintained.

Somehow, the auditors feel that proper record is either confined to 1-2 persons or not maintained. It is necessary to maintain & monitor& record following things:

i Electricity consumption, power factor & maximum demand

ii Maximum, minimum voltage from grid. This will enable them to install Servo stabilizer at important locations.

9.3. For maintenance:

Transformer – No transformer exists, but main LT distribution panel, which is proposed to be shifted.

Generator set- Some maintenance schedule should be prepared for DG Set. It can be as follows

L D System

9.3.1. Initially tightening of all connections. Later on, once a month &after 1-2 months, once a year

Thermo graphic images: Be taken after tightening all connections.

There after once in 2 years.

9.3.2. Bench marking

Benchmarking of energy consumption is a powerful tool for performance assessment and logical evolution of avenues for improvement. Historical data, well documented, helps to bring out energy consumption and cost trends month-wise / daily. Trend analysis of energy consumption, cost, relevant production features, specific energy consumption, help to understand effects of capacity utilization on energy use efficiency and costs on a broader scale.

9.3.3. Suggestions to carry out this monitoring & bench marking: Presently, the campus building is being looking after by the competent technical staff provided by the Govt. & accounts staff of the college. But, monitoring, targeting etc. is itself a professional work. The energy consumption in this campus is about 57713 KWH. It can hire a professional energy manager to visit & guide their staff –initially once afterwards 1 visit once in 6 months.

CHAPTER-X. CHECKLISTS AND ENERGY SAVING TIPS

Below are some of the energy efficiency tips in electrical utilities

10.1. ELECTRICITY

- Optimize the tariff structure with utility supplier
- Schedule your operations to maintain a high load factor
- Shift loads to off-peak times if possible.
- Stagger start-up times for equipment with large starting currents to minimize load peaking.
- Use standby electric generation equipment for on-peak high load periods.
- Correct power factor to at least 0.99 under rated load conditions.
- Relocate main distribution panel close to main loads.
- Install active harmonic filter to suppress current harmonics in the main LT distribution panel
- Balance the load in the main LT distribution panel
- Export power to grid if you have any surplus in your captive generation
- Check utility electric meter with your own meter.
- Shut off unnecessary computers, printers, and copiers at night.

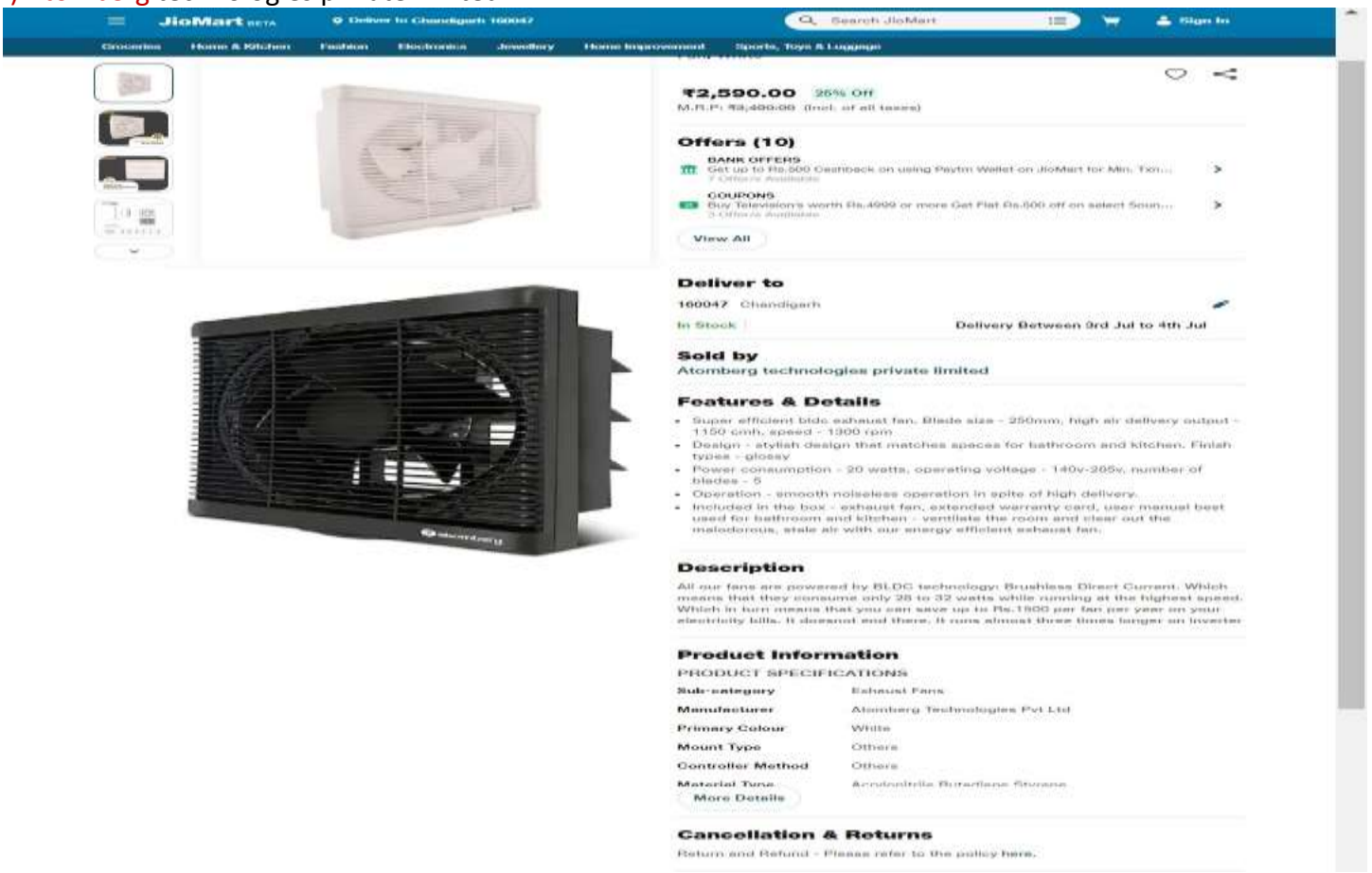
FOR R.K. ELECTRICALS & ENERGY AUDIT SERVICES

(END OF THE REPORT)

10.2. ANNEXURES - LIST OF SOME VENDORS

For Fans (Celling / Exhaust): 1. Havells Galaxy, SCO 19, Madhya Marg, Sector 7 C Chandigarh

2. Orient Fans, Gupta Electronics, SCO 1117, Sector 22, Chandigarh M – 7947243304
Apart from above, Online Shopping Portals like Jio Mart, Amazon IndiaMart etc. may also be referred such as:
i) Atomberg technologies private limited



For Lighting: 1. SYSKA LED DELHI, D-, 108, Patpar Ganj Rd, South Ganesh Nagar, Block D, Ganesh Nagar 1, Ganesh Nagar, New Delhi, Delhi 110092 Phone: 099101 11242

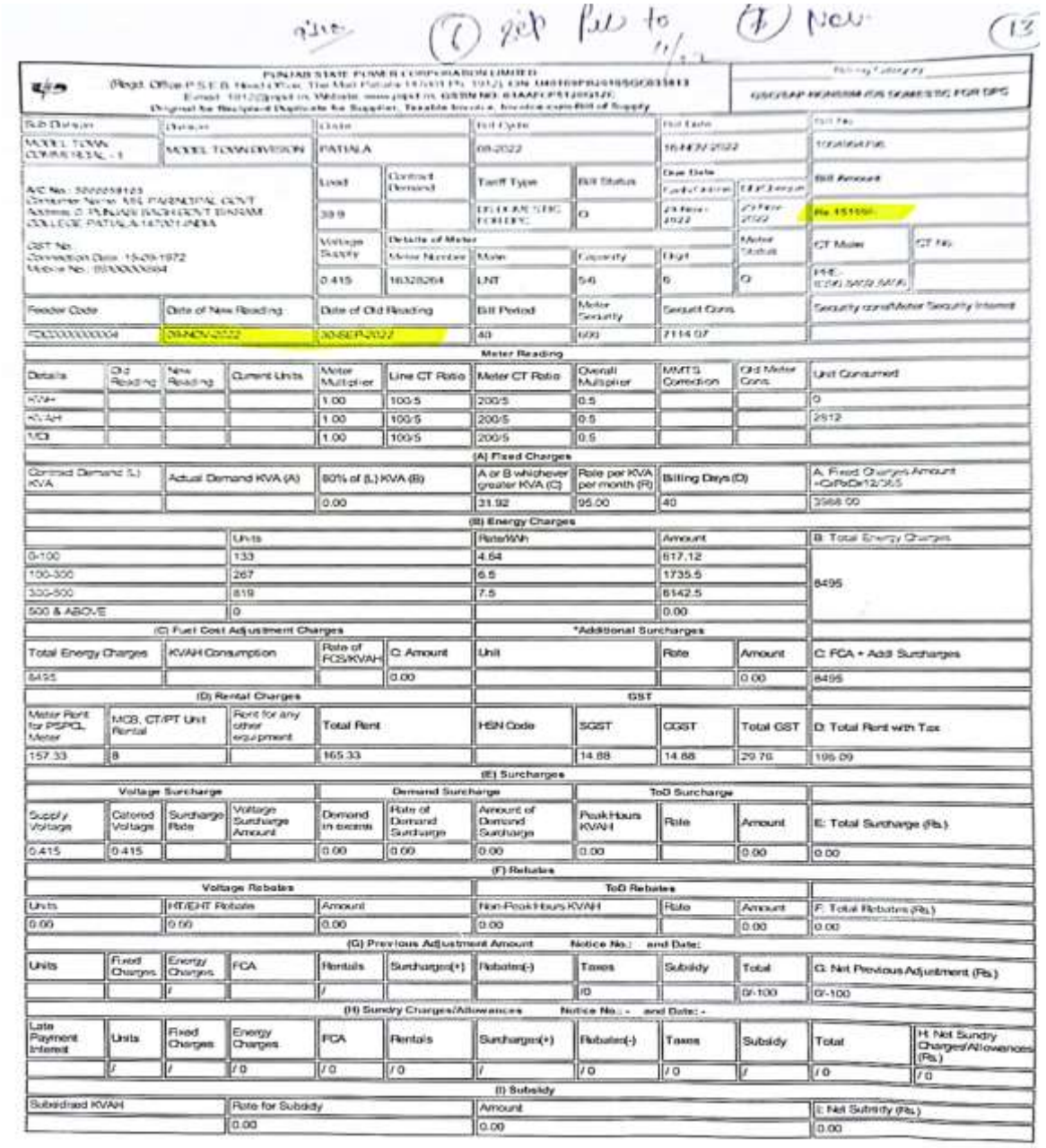
2. Philips Lighting India Limited,9th Floor, DLF 9-B, DLF Cyber City DLF Phase-3, Gurgaon – 122002, India

For Pumps: 1. Grundfos Pumps India Pvt. Ltd. 301C, 3rd Floor, D21, Corporate Park, Dwarka Depot, Near Sector 8 Metro Station, Sector 21, Dwarka, New Delhi – 110075, India

2. Kirloskar Brothers Limited, M-11, 3rd Floor, Middle Circle, Connaught Place, New Delhi - 110 001 Tel: 011 – 41501055

10.3. Annexures - Copies of electricity bill

i)



PUNJAB STATE POWER CORPORATION LIMITED

Sub Division	Division	Unit	Bill Date	Bill No.
MODEL TOWN COMMERCIAL - I	MODEL TOWN DIVISION	PATIALA	08-2022	

Load	Contract Demand	Tariff Type	Bill Status	Due Date	Bill Amount
39.9			O		

Voltage Supply	Details of Meter					CT Make	CT No.
	Meter Number	Make	Capacity	Digit			
0.415	16328264	LNT	5/6	6	O		

Feeder Code	Date of New Reading	Date of Old Reading	Bill Period	Meter Security	Sanctl Cons.	Security cons/Meter Security Interest
	28/NOV/2022	30/SEP/2022	40	600	7114.07	

Meter Reading

Details	Old Reading	New Reading	Current Units	Meter Multiplier	Line CT Ratio	Meter CT Ratio	Overall Multiplier	MMTS Correction	Old Meter Cons.	Unit Consumed
KWH				1.00	100/5	200/5	0.5			0
KVAH				1.00	100/5	200/5	0.5			2912
MD				1.00	100/5	200/5	0.5			

(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 =CxRxD/12/30.5
		0.00	31.92	95.00	40	3968.00

(B) Energy Charges

	Units	Rate/Wh	Amount	B. Total Energy Charges
0-100	133	4.64	617.12	8495
100-300	267	6.5	1735.5	
300-500	819	7.5	6142.5	
500 & ABOVE	0		0.00	

(C) Fuel Cost Adjustment Charges

Total Energy Charges	KVAH Consumption	Rate of FCS/KVAH	C. Amount
8495			0.00

***Additional Surcharges**

Unit	Rate	Amount	C. FCA + Add Surcharges
		0.00	8495

(D) Rental Charges

Meter Rent for PSPCL Meter	MCB, CT/PT Unit Rental	Rent for any other equipment	Total Rent
157.33	8		165.33

GST

HSN Code	SGST	CGST	Total GST	D. Total Rent with Tax
	14.88	14.88	29.76	195.09

(E) Surcharges

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

(F) Rebates

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

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

Units	Fixed Charges	Energy Charges	FCA	Rentals	Surcharges(+)	Rebates(-)	Taxes	Subsidy	Total	G. Net Previous Adjustment (Rs.)
		/		/			/0		0/-100	0/-100

(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	/ 0	/	/ 0	/ 0

(I) Subsidy

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

ii)

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: NR RATE CATEGORY FOR NRS>50 KW FOR DPC

Sub Division	Division	Cycle	Bill Cycle	Bill Date	Bill No
DERA BASSI SUB DIVISION	LALRU DIVISION	MOHALI	01-2022	19-APR-2022	5001693181

A/C No.: 3017607598
Old A/C No.:
Consumer Name: M/S PRINCIPAL GOVT COLLEGE ,
Address: DERABASSI DERABASSI DERABASSI-140507-INDIA
GST No.:
Connection Date: 31-07-2019
Mobile No.: 80XXXXX346

Load	Contract Demand	Tariff Type	Bill Status	Due Date	Cash/Online	DD/Cheque	Bill Amount
68.35	75.54	NR RATE CATEGORY FOR NRS>50 KW FOR DPC	O	04-May-2022		29-Apr-2022	Rs.186120/-

Voltage Supply	Details of Meter				Meter Status	CT Make	CT No
	Meter Number	Make	Capacity	Digit			
0.415	18152417	L&T		6	O	18152417	

Feeder Code	Date of New Reading	Date of Old Reading	Bill Period	Meter Security	Securit Cons	Security cons/Meter Security Interest
	08-APR-2022	08-MAR-2022	31	0	0	

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				1.00	100/5	5/5	20.00			
KVAH				1.00	100/5	5/5	20.00			
MDI				1.00	100/5	5/5	20.00			

(A) Fixed Charges

Contract Load / Contract Demand (L) KW/HKVA	Actual Load/Demand KW/HKVA (A)	80% of (L) KW/HKVA (B)	A or B whichever greater KW/HKVA (C)	Rate per KW/KVA per month (R)	Billing Days (D)	A: Fixed Charges Amount =CxRxD/12/365
		60.75	60.75	100.00	31	6192.00

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

KWH/KVAH	Tariff Rate	B: Amount	KWH/KVAH Consumption	Rate of FCS/KWH-KVAH	C: Amount	Units	Tariff Rate	Amount	Total Energy Charges(Rs.) + FCA + Addl. Surcharge
	6.35	7493			0.00			0.00	7493

(D) Rental Charges | **GST**

Meter Rent for PSPCL Meter	MCB, CT/PT Unit Rental	Rent for any other equipment	Total Rent	HSN Code	SGST	CGST	Total GST	D: Total Rent with Tax
122	32		154		13.86	13.86	27.72	181.72

(E) Surcharges

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

(F) Rebates

Voltage Rebates			ToD Rebates			
Units	HT/EHT Rebate	Amount	Non-Peak Hours KWH/KVAH	Rate	Amount	F: Total Rebates (Rs.)
	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.)
		/497		/1074			/20700.32		/169518	/169518

(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

(I) Subsidy

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

(J) Taxation

Electricity Duty	Municipal Tax	IDF	Cow Cess	Total Tax (J)	Net Energy Charges	TCS/TDS	Curr/Prev Rounding Amount	NET BILL AMOUNT
2053.00	0.00	684.00	0.00	2737		0.00		Rs.186120/-

One Lakh Eighty Six Thousand One Hundred Twenty Rupees Only

(K) Total Billed Amount