ENERGY AUDIT REPORT

Project Details:

SWAMI VIVEKANAND SUBHARTI UNIVERSITY

Submitted to:

SWAMI VIVEKANAND SUBHARTI UNIVERSITY

Conducted by:

EHS Guru Sustainable Solutions Pvt Ltd

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ACRONYMS AND ABBREVIATIONS

Acronym/Abbreviation	Expansion
AHU	AIR HANDLING UNIT
APFC	AUTOMATIC POWER FACTOR CONTROLLER
DG	DIESEL GENERATOR
ECP	ENERGY CONSERVATION PROPOSAL
GCV	GROSS CALORIFIC VALUE
HVAC	HEATING, VENTILATION AND AIR CONDITIONING
HSD	HIGH SPEED DIESEL
kCal	KILO-CALORIES FO FURNACE OIL
PF	POWER FACTOR
SEC	SPECIFIC ENERGY CONSUMPTION
TR	TONS OF REFRIGERATION
UOM	UNIT OF MEASUREMENT

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ACKNOWLEDGEMENT

EHS Guru Sustainable Solutions Pvt Ltd expresses sincere thanks to the Management of **"Swami Vivekananda subharti university"** for their kind assistance and co-operation for carrying out the Energy Audit of them**.**

The site visits for the Energy Audit have been conducted at **October 13th 2021**.

The Audit team of **EHS Guru Sustainable Solutions Pvt Ltd** conveys their gratitude and thanks to the management **of Swami Vivekananda subharti university** for their positive attitude in safety, reliability and energy conservation program through energy efficiency improvement and better utilization of available energy system infrastructures followed by their proactive role in conducting the energy audit study.

The Audit team would like to register their hearty thanks to Swami Vivekananda subharti university officials for their guidance, coordination, active support, participation during the audit and motivating the audit team.

Official from Swami Vivekananda subharti university

- Mr. Syed Zafar Hussain
- Dr. Mukesh Ruhela

Energy Audit Team Members

- Mr. Ankit Srivastava
- Mr. Atul Gupta

1. OBSERVATION

1.1. INTRODUCTION

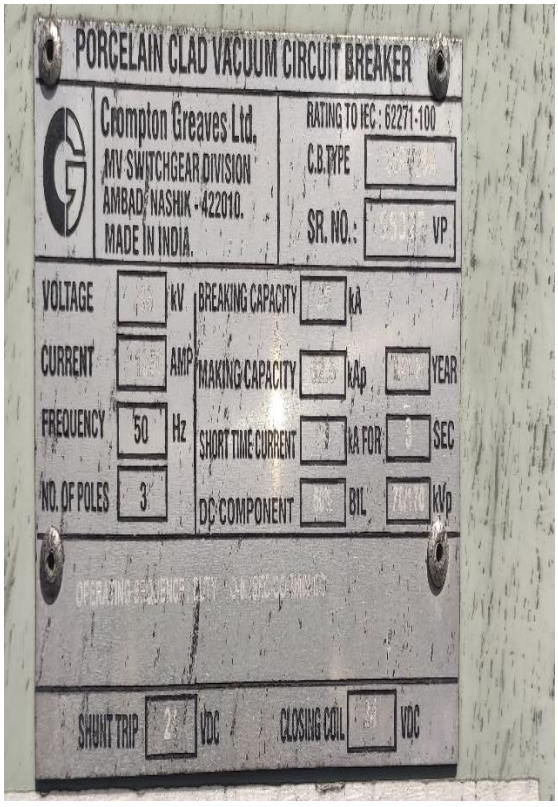
The HIGH-TENSION SERVICE CONNECTION (HT-1) has 33000 V supply fed from the PASHCHIMANCHAL VIDYUT VITRAN NIGAM LIMITED. The sanctioned contracted demand is 4000 KW.

The HIGH-TENSION SERVICE CONNECTION (LMV-1) has 11000 V supply fed from the PASHCHIMANCHAL VIDYUT VITRAN NIGAM LIMITED. The sanctioned contracted demand is 311 KVA.

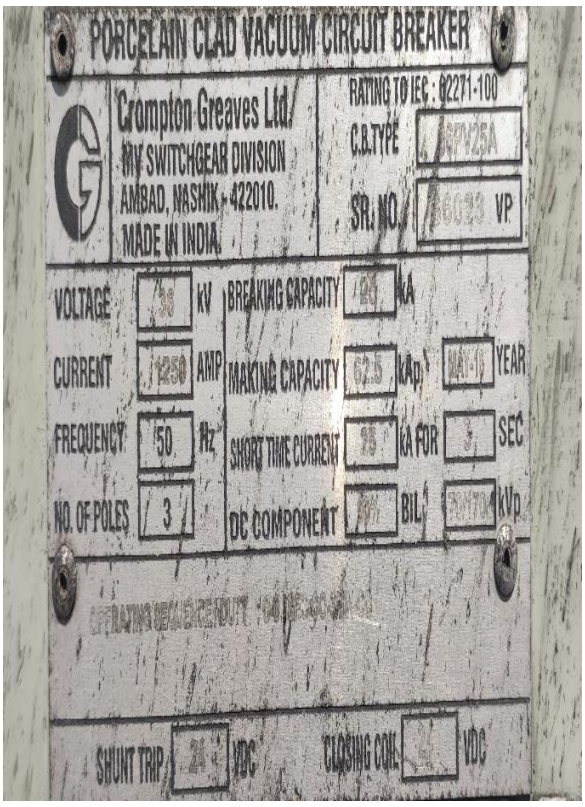
1.2. SF6

The HT supply fed from PASHCHIMANCHAL VIDYUT VITRAN NIGAM LIMITED was controlled by using 2 Nos 33 KV SF6 at substations.

I/C – 1 SF6 Breaker



I/C – 2 SF6 Breaker



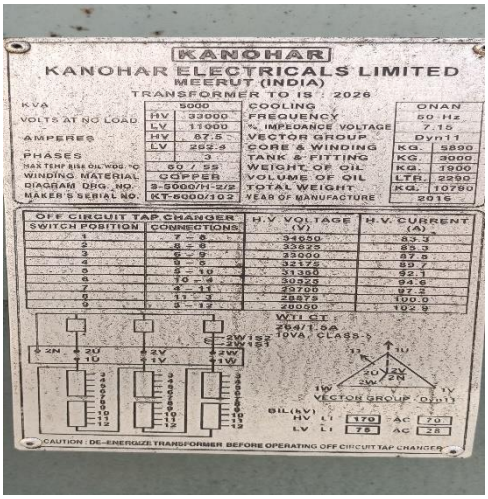
1.3. OCB

The HT supply fed from University Substation was controlled by 4 Nos OCB's of 11 KV at 1: - Auditorium, 2: - Hospital, 3: - Hotel Management, 4: - Sub- Station feeder.

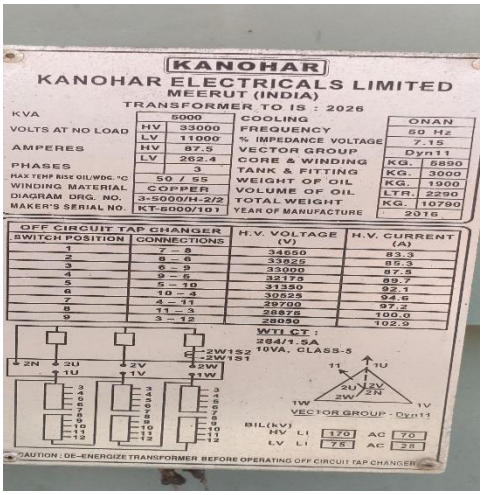
1.4. TRANSFORMERS

SWAMI VIVEKANAND SUBHARTI UNIVERSITY loads are fed from 2 Nos of 5000 KVA 33/11 KV transformers at 33/11 KV substation. The maximum demand reached is 2440 KVA out of 4000 KVA of sanctioned maximum demand. Hence the transformer capacities are adequate.

I/C – 1 Transformer 5 MVA



I/C – 2 Transformer 5 MVA



HOTEL MANAGEMENT SUB STATION: -

1.5. CABLES

Generally underground cables with sizes of 150 Sq.mm, 300 Sq.mm and 400 Sq.mm with additional runs (wherever required) are used for transmitting power to the load area from the substation. The capacity of the cables is adequate to supply the power to the connected load.

2. ENERGY CONSUMPTION STUDY

The detailed study was conducted for all the loads by measuring the required parameters for the assessment of energy consumption at the panels and rising main units erected in the substation, concerned buildings and street light poles. The major load areas connected to university 33/11 KV substation were detailed below.

2.1. HT CONSUMPTION

The consumption of 33 KV HT supply at SWAMI VIVEKANAND SUBHARTI UNIVERSITY Substation was calculated as maximum reached per day KWH in previous 12 months is 32720 KWH.

2.2. LIGHTING LOAD

The total lightning load including lights (tube light, LED's, PL Lamps etc.). Area wise lighting load details were given below in table.

3. ONSITE AUDIT ACTIVITIES

The onsite audit includes

1. The opening meeting is the first step between the energy audit team and estate department. In this meeting the purpose of audit, the procedure and the time schedule were discussed.
2. Site inspection is the second step for onsite activity. In this step the audit team discovered matters which are important to the audit, but which were not identified at the planning stage.
3. Onsite phase of the audit developed a working understanding of how the facility manages the activities that influences the working environment.
4. If there is one works assessed strengths and weaknesses of the auditee's management controls and risks associated with their failure were established.
5. Gathering audit evidence i.e., collecting data and information.
6. Communicated with the staff of the auditee to obtain most information.
7. Evaluate the audit evidence against the objectives established for the audit.

4. PROCEDURE FOLLOWED

Team was formed consisting of three members under the guidance of Dr. Mukesh Ruhela, to analysis of energy consumption and costs.

Based on our assessment, the different sources of carbon- dioxide emitted from our campus are: -

1. 14 DG sets
2. Electric Motors
3. Refrigerators
4. Air conditioners

1. There are 1209 Nos of air conditioners in the university campus. The students, teaching and non- teaching staff and the visitors also contribute to carbon dioxide emission.
   It is suggested use five-star rating Air- Condition, this will help to increase to the efficiency of equipment and save energy.
   Similarly, it is also suggested to use energy efficient motor instead of conventional motor which can increase the efficiency by 4 to 6 %.

2. Analysis of energy consumption and costs the university campus is well equipped with electricity supply, each department along with hospital possess computers, printers, fans, plug points, tube lights, bulbs etc., As part of "Green Campus "initiation, University campus has shifted from conventional energy to solar energy, to reduce electricity bill and increase the usage of solar energy, installed as roof top Solar plant with capacity of 500 KW has been installed in university.

5. Recommendations to the University for Energy Conservation

The following measures are undertaken by the Construction & Maintenance Department for the conservation of energy.

- Copper chokes in tube lights are converted to electronic chokes which consumes less energy.
- All the rooms of the campus are equipped with CFL/LED.
- All Incandescent light bulbs and high consumption tube lights are replaced with LED's and CFL's.
- About 8020 no. out of total lights 13369 no, LED tube lights and CFL bulbs are used in place of ordinary bulb in all buildings in the campus. Use of Compact florescent light (CFL) and LED generate less heat and reduce carbon emission (Maximum of 25-35% Power).
- Tripping system is used in case of short circuiting, overloading and circuit break.
- Sensors for switching on/off motor pumps are installed.
- Replacement of resistance regulator with electronic regulator.
- Replacement of CRT monitors with LCD/TFT monitors fitted with Computers.
- Replacement of DOT matrix printers with desk jet/Laser printers.
- Electrical vehicles are used for internal transportation within the campus.
- Common switch for all electronic equipment is installed in each classroom to cut the power of the class when not in use.
- Central heating and cooling system are installed in the campus.
- Implementation of energy saving techniques is ensured i.e. Lights and fans are switched off by floor peons and staff after completion of working that area.
- All rooms are provided with large windows to ensure appropriate natural light and ventilation so that the use electricity can be minimized.

Table 1 - List of Power transformer use in university

S.No	Transformer capacity in KVA	Area name	Voltage ratio	Remark
1	5 MVA	33/11 KV Sub-station subharti	33/11 KV	Power Transformer
2	5 MVA	33/11 KV Sub-station subharti	33/11 KV	Power Transformer
3	400 KVA	33/11 KV Sub-station subharti	11/.433 KV	Distribution Transformer
4	1000 KVA	Hotel Management	11/.433 KV	Distribution Transformer
5	630 KVA	Hotel Management	11/.433 KV	Distribution Transformer
6	1000 kVA	Hospital Generator room	11/.433 KV	Distribution Transformer
7	1000 KVA	Hospital Generator room	11/.433 KV	Distribution Transformer
8	1000 kVA	Hospital Generator room	11/.433 KV	Distribution Transformer
9	630 KVA	Main Generator room	11/.433 KV	Distribution Transformer
10	630 KVA	Main Generator room	11/.433 KV	Distribution Transformer
11	630 kVA	Domestic Power distribution	11/.433	Distribution Transformer
12	630 KVA	Spice Canteen	11/.433	Distribution Transformer
13	400 KVA	Media Generator room	11/.433	Distribution Transformer
14	630 KVA	Mangalam Generator room	11/.433	Distribution Transformer

Table 2 - List of servo transformer installed in university.

S.No	Item Description	Make	KVA rating	Installed In Department.	Annual net amount
1	Servo transformer	Creast Engg	15	Gohaen Hostel	**3080.98**
2	Servo transformer	Creast Engg	15	Ultrasound	**3080.98**
3	Servo transformer	Creast Engg	15	Ultrasound	**3080.98**
4	Servo transformer	Creast Engg	15	Dental College	**3080.98**
5	Servo transformer	Creast Engg	15	Emergency Hospital	**3080.98**
6	Servo transformer	Powerware	15	Mahavira Bhawan	**3080.98**
7	Servo transformer	Powerware	15	Mahavira Bhawan	**3080.98**
8	Servo transformer	Powerware	15	Shyam Krishna Hostel	**3080.98**
9	Servo transformer	Powerware	15	Durga Bhagwati	**3080.98**
10	Servo transformer	Powerware	15	Shyam Krishna Hostel	**3080.98**
11	Servo transformer	Servokon System	75	Maanglaya	**5237.666**
12	Servo transformer	Creast Engg	75	Faculity of Science	**5237.666**
13	Servo transformer	Powerware	150	Gate No. 7	**7702.45**
14	Servo transformer	Powerware	150	Water Tank (MLDI)	**7702.45**
15	Servo transformer	Powerware	300	Engg. College	**12323.92**
16	Servo transformer	Powerware	300	Generator Room	**12323.92**
17	Servo transformer	Powerware	300	Lachit Hostel	**12323.92**
18	Servo transformer	Malhotra	300	Law College	**12323.92**
19	Servo transformer	Malhotra	300	Polytechnic	**12323.92**
20	Servo transformer	Powerware	500	Generator Room	**16021.096**
21	Servo transformer	Powerware	500	Generator Room	**16021.096**
22	Servo transformer	Powerware	500	Medical College	**16021.096**
23	Servo transformer	Powerware	500	Dental College	**16021.096**
24	Servo transformer	NA	15	Shyam Krishna Hostel	**3080.98**
25	Servo transformer	NA	300	Media	**12323.92**

Table 3 - List of DG's Installed in University.

Sr. No	Generator capacity in KVA	Area name	Make
1	500 KVA	DENTAL	Cummins
2	600 KVA	DENTAL	Kirloskar
3	1265 KVA	DENTAL	B & W
4	1470 KVA	DENTAL	MAK-I
5	1470 KVA	DENTAL	MAK-II
6	1250 KVA	HOTEL MANAGEMENT	Cummins
7	1250 KVA	HOTEL MANAGEMENT	Cummins
8	1250 KVA	HOTEL MANAGEMENT	Cummins
9	1500 KVA	BEHIND HOSPITAL	Cummins
10	800 KVA	BEHIND HOSPITAL	Cummins
11	1010 KVA	MANGALAM	Cummins
12	320 KVA	MANGALAM	Cummins
13	250 KVA	MEDIA	Cummins
14	125 KVA	MEDIA	Kirloskar

Table 4 - List of Appliances

Sr. No	Equipment Name	Quantity
1	Lights	13369
2	Fan	8671
3	Air condition	1209
4	Computers	941
5	UPS	280
6	Printer	197
7	Photo copy	28
8	Cooler	271
9	Fridge	135
10	Water Cooler	59
11	Television	78
12	Camera	300
13	Instruments	6674
14	Projectors	165

6. USE OF RENEWABLE ENERGY

Adoption of solar energy under renewable energy is the best course of action in the existing circumstances, Solar technologies are broadly characterized as passive or active solar technologies depending on the way these equipment's capture, convert and distribute solar energy.

- Solar Panels having photo voltaic cells are installed on roof tops of buildings in the campus for generation of 500 KW and also management look forward to increases the capacity up to 1 MW.
- Solar water heating system are installed for use of hot water in the campus.
- This initiative helped to reduce the carbon emission.

Reducing the use of electricity: -

- Reducing the use of electrical energy by solar water heater are widely used in hostels for supplying hot water.
- Photo voltaic cells/ solar panel are used for electricity generation.

Reducing the Use of Stationery: -

- Communication to the faculty through conventional paper circulars has been almost replaced with the use of e-mail services or text messages.
- Whole campus has the Wi-Fi accessibility.
- Admission to the campus through on-line portal is initiated.

It can be seen that electricity consumption in the last 12 months is 8843300 KWH

7. Detail & Pics of Solar water heater and Solar Energy: -

1. 04 Solar Water Heater of capacity 2,500 LPD each installed in Rani Chenamma Girls Hostel.

2. 04 Solar Water Heater of capacity 2,500 LPD each installed in Bhagini Nivedita Girls Hostel.

3. 04 Solar Water Heater of capacity 2,500 LPD each installed in Rani Durgawati Girls Hostel.

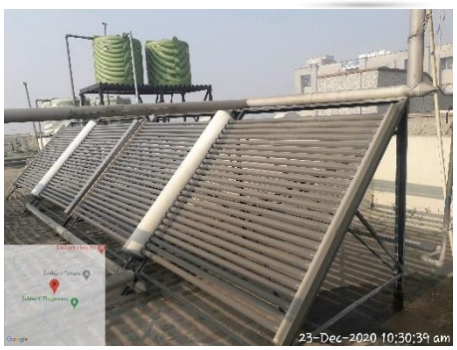
4. 02 Solar Water Heater of capacity 2,500 LPD each installed in Begam Hazrat Girls Hostel.

5. 02 Solar Water Heater of capacity 2,500 LPD each installed in Ahilya Bai Girls Hostel.

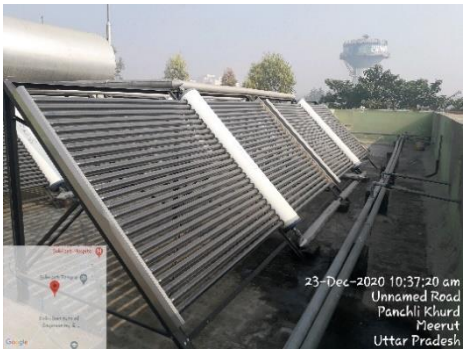
6. 02 Solar Water Heater of capacity 2,500 LPD each installed in Savitri Bai Phulle Girls Hostel.

7. 02 Solar Water Heater of capacity 2,500 LPD each installed in Laxmi Shegal Girls Hostel.

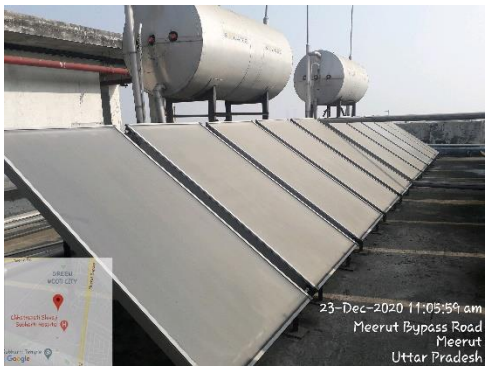
8. 02 Solar Water Heater of capacity 2,500 LPD each installed in Veer Haqikat Rai Boys Hostel.

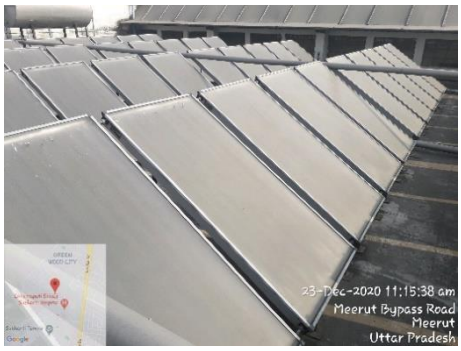


9. 02 Solar Water Heater of capacity 2,500 LPD each installed in Madan Lal Dhingra Boys Hostel



10. 09 Solar Water Heater of capacity 2,500 LPD each installed in Gohin, Shyam Krishna & Kotnish Boys Hostels.





11. 02 Solar Water Heater of capacity 2,500 LPD each installed in Lachit Boys Hostel

12. 02 Solar Water Heater of capacity 2,500 LPD each installed in Udham Singh Boys Hostel.

13. 02 Solar Water Heater of capacity 2,500 LPD each installed in Hardyal Singh (Couple Accommodation)

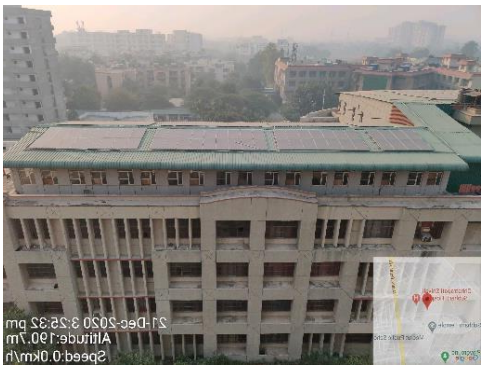
These give an approximate saving of electricity up to 1,28,110 kWh per year.

Integrated Alternative Energy Solution for the University, a Power Purchase Agreement has made between M.T.V. Buddhist Religious and Charitable Trust and M/s. Freyr Energy Services Pvt. Ltd in March, 2018. To install 1,000 kWh., solar panels at the rooftop of the following buildings with the capacity mentioned as under:

1. Subharti Dental College – 50 kWp.
2. Panna Dhai Maa Subharti Nursing College - 250 kWp.

3. Subharti Fine Arts College – 125 kWp.
4. Subharti Institute of Technology & Engineering – 300 kWp.

5. Bhagwati Hostel – 25 kWp.
6. Subharti Medical College – 150 kWp.



7. Lachit Hostel – 50 kWp.
8. Madan Lal Dhingra Hostel – 50 kWp.

M/s Freyr Energy Services Pvt. Ltd. has commissioned 500kWh. solar generation in Nov. 2020 as under:

Details of Solar Penal installation and its commissioned

1. CS Subharti Hospital no. - 1 - 58 kWp.
2. CS Subharti Hospital no. -2 - 58 kWp
3. Subharti Nursing College - 50 kWp
4. Subharti Institute of Technology & Engineering - 34 kWp
5. Subharti Institute of Technology & Engineering - 50 kWp
6. Subharti Medical College No. 1 - 50 kWp

7. Subharti Medical College No. 2 - 50 kWp
8. Subharti Medical College No. 3 - 50 kWp
9. Labour Room-CSSH - 50 kWp
10. Medical OPD-CSSH - 50 kWp

Table 5 - Demand figures according to electricity bill

Month	Contracted Demand IN KVA	Billable Demand IN KVA	Recorded Demand IN KVA
Sep-20	4000	3333.33	2157
Oct-20	4000	3333.33	1506
Nov-20	4000	3333.33	811
Dec-20	4000	3333.33	1199
Jan-21	4000	3333.33	1419
Feb-21	4000	3333.33	1131
Mar-21	4000	3333.33	1249
Apr-21	4000	3333.33	1582
May-21	4000	3333.33	1000
Jun-21	4000	3333.33	2109
Jul-21	4000	3333.33	2440
Aug-21	4000	3333.33	2312
Average	4000	3333	1576
Maximum	4000	3333.33	2440
Minimum	4000	3333.33	811

Maximum demand recorded in last 12 months was 2440 KVA

Billable demand = 3333.33 KVA

Suggested Contrated demand = 3500 KVA from 4000 KVA

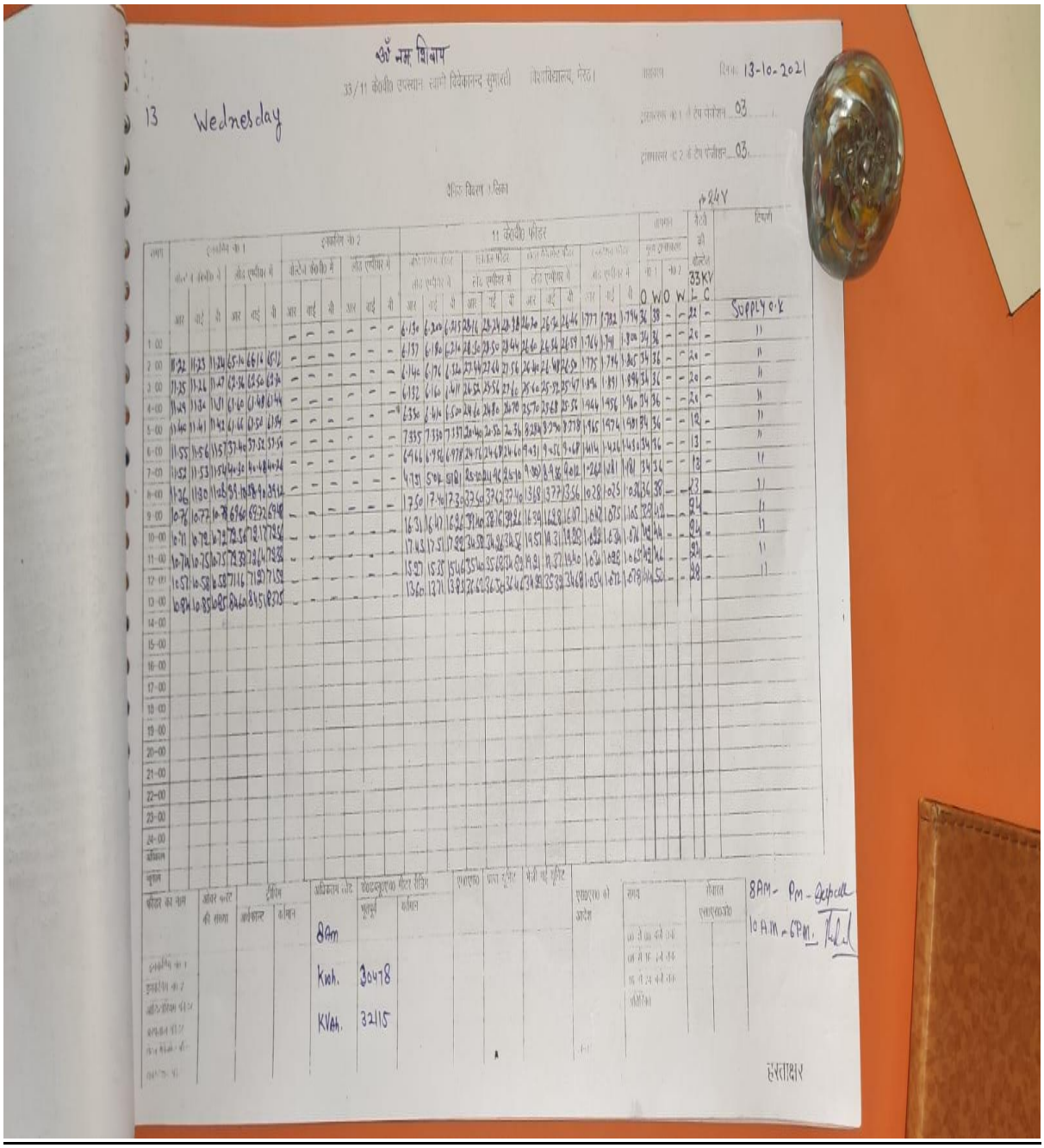
Suggested Billable demand = 3500 * 83.3% = 2917 KVA

(We suggested that Demand because in future Load increase up to 600 KW.)

Saving by new contracted demand = 3333.33 – 2917 = 416 KVA

Saving in Rs = 416 * 400 = Rs 166532 per month.

Log book of 33 KV substation: -



Full Load capacity of Transformer in LV side = 267 Amp

Running amp =85 Amp

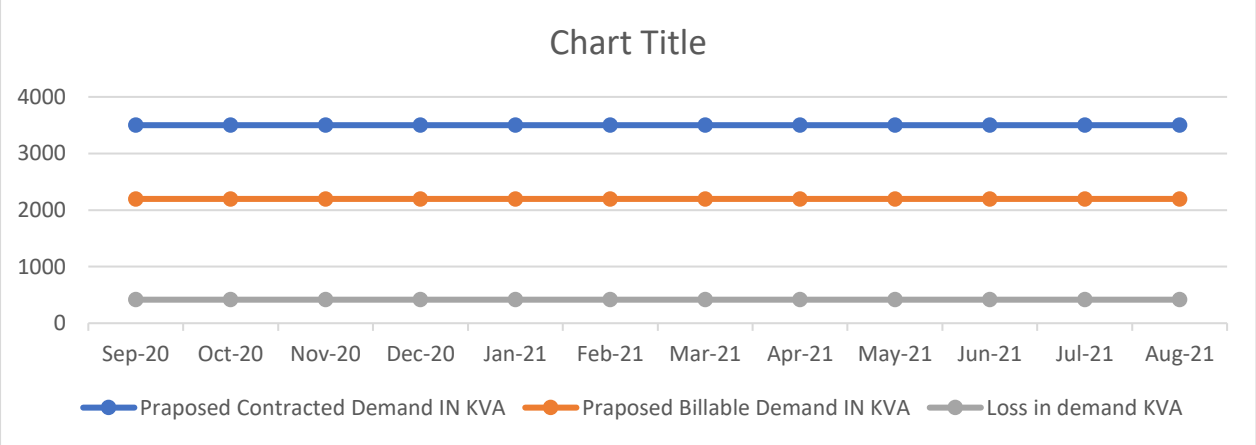
Loading Percentage = 32 %

Table 6 - Study of last 12 months electricity bills

Month	Contracted Demand IN KVA	Billable Demand IN KVA	Recorded Demand IN KVA	KWH Consumption	KVAH Consumption	PF	Per Unit Teriff rate upto 2500 KWH	Per Unit Tariff Rate after 2500 KWH	Amount upto 2500 KWH in Rs	Amount after 2500 KWH in Rs	Total	Demand rate per KVA in RS	Demand Charges in Rs	Tax on Energy Chages @7.5%	FC/Installment credit	Amount Payable
Sep-20	4000	3333.3	2157	830300	908500	0.91	8.12	8.48	20300	7682880	7703180	400	1333332	677738	90713	9624090
Oct-20	4000	3333.3	1506	547500	587000	0.93	8.12	8.48	20300	4956560	4976860	400	1333332	473264	90365	6693091
Nov-20	4000	3333.3	811	375400	388100	0.97	8.12	8.48	20300	3269888	3290188	400	1333332	346764	63102	4907182
Dec-20	4000	3333.3	1199	509900	527500	0.97	8.12	8.48	20300	4452000	4472300	400	1333332	435422	46235	6194819
Jan-21	4000	3333.3	1419	607200	625000	0.97	8.12	8.48	20300	5278800	5299100	400	1333332	497432	58056	7071808
Feb-21	4000	3333.3	1131	447900	461300	0.97	8.12	8.48	20300	3890624	3910924	400	1333332	393319	66324	5571251
Mar-21	4000	3333.3	1249	460300	474800	0.97	8.12	8.48	20300	4005104	4025404	400	1333332	401905	52443	5768248
Apr-21	4000	3333.3	1582	570300	591800	0.96	8.12	8.48	20300	4997264	5017564	400	1333332	476317	53587	6895776
May-21	4000	3333.3	1000	599700	634100	0.95	8.12	8.48	20300	5355968	5376268	400	1333332	503220	63509	7285219
Jun-21	4000	3333.3	2109	745600	792200	0.94	8.12	8.48	20300	6696656	6716956	400	1333332	603772	67096	8320330
Jul-21	4000	3333.3	2440	953600	1014300	0.94	8.12	8.48	20300	8580064	8600364	400	1333332	745027	80503	10689403
Aug-21	4000	3333.3	2312	925900	982100	0.94	8.12	8.48	20300	8307008	8327308	400	1333332	724548	99337	10291721
Average	4000	3333	1576		665558	1	8	8	20300	5622735			1333332	523228	69273	7442745
Maximum	4000	3333.3	2440		1014300	0.97152	8.12	8.48	20300	8580064			1333332	745027.2	99336.96	10689403
Minimum	4000	3333.3	811		388100	0.91392405	8.12	8.48	20300	3269888			1333332	346764	46235.2	4907182

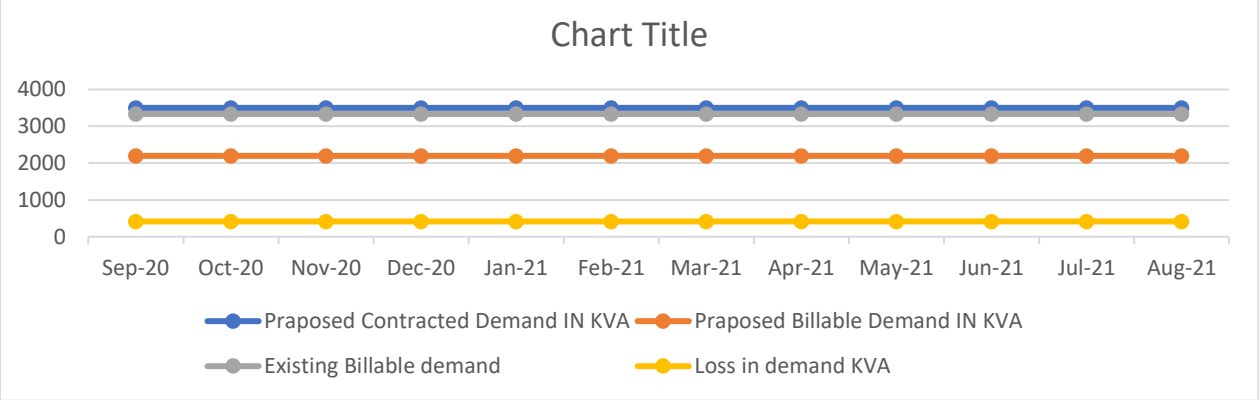
8. Existing Demand Study

Month	Sep-20	Oct-20	Nov-20	Dec-20	Jan-21	Feb-21	Mar-21	Apr-21	May-21	Jun-21	Jul-21	Aug-21
Contracted Demand IN KVA	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000
Billable Demand IN KVA	3333	3333	3333.2	3333	3333	3333	3333	3333.2	3333.2	3333.2	3333	3333
Recorded Demand IN KVA	2157	1506	811	1199	1419	1131	1249	1582	1000	2109	2440	2312

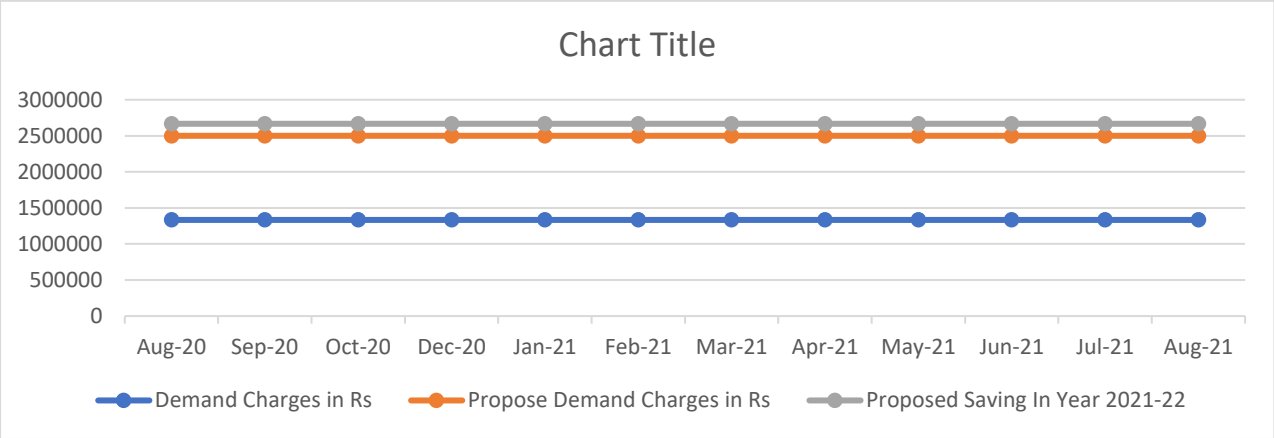


9. Proposed demand study

Month	Sep-20	Oct-20	Nov-20	Dec-20	Jan-21	Feb-21	Mar-21	Apr-21	May-21	Jun-21	Jul-21	Aug-21
Proposed Contracted Demand IN KVA	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500
Proposed Billable Demand IN KVA	2197	2197	2197	2197	2197	2197	2197	2197	2197	2197	2197	2197
Existing Billable demand	3333	3333	3333	3333	3333	3333	3333	3333	3333	3333	3333	3333
Loss in demand KVA	416	416	416	416	416	416	416	416	416	416	416	416

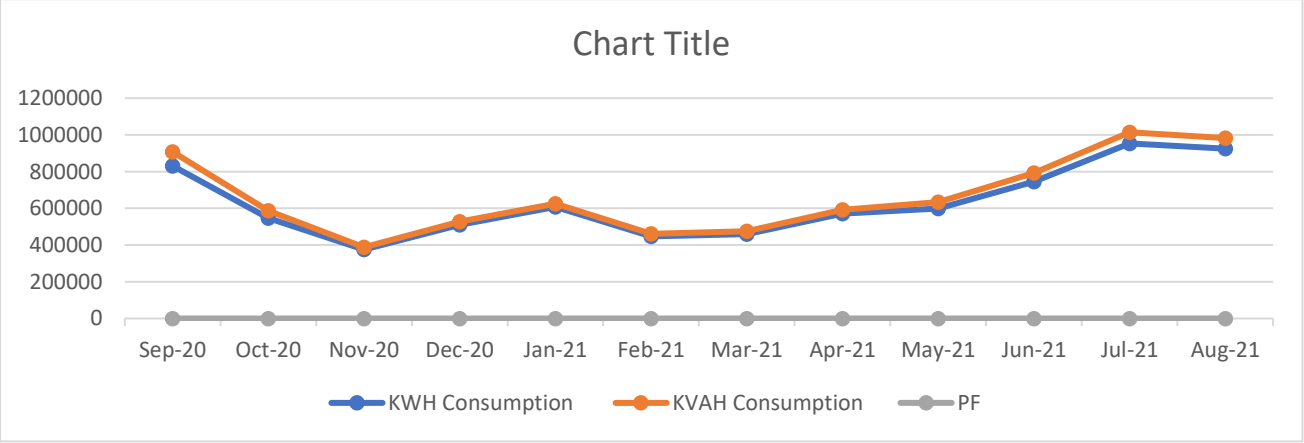


CALCULATION OF SAVING ON PROPOSE DEMAND												
Month	Aug-20	Sep-20	Oct-20	Dec-20	Jan-21	Feb-21	Mar-21	Apr-21	May-21	Jun-21	Jul-21	Aug-21
Demand Charges in Rs	1333320	1333320	1333320	1333320	1333320	1333320	1333320	1333320	1333320	1333320	1333320	1333320
Propose Demand Charges in Rs	1166800	1166800	1166800	1166800	1166800	1166800	1166800	1166800	1166800	1166800	1166800	1166800
Proposed Saving In Year 2021-22	166520	166520	166520	166520	166520	166520	166520	166520	166520	166520	166520	166520



Month	Sep-20	Oct-20	Nov-20	Dec-20	Jan-21	Feb-21	Mar-21	Apr-21	May-21	Jun-21	Jul-21	Aug-21
KWH Consumption	830300	547500	375400	509900	607200	447900	460300	570300	599700	745600	953600	925900
KVAH Consumption	908500	587000	388100	527500	625000	461300	474800	591800	634100	792200	1014300	982100
PF	0.91	0.93	0.97	0.97	0.97	0.97	0.97	0.96	0.95	0.94	0.94	0.94

Average	Maximum	Minimum
665558	1014300	388100
0.95	0.97	0.91



- **Minimum PF recorded according to HV-2 connection was found = 0.91**
- **Average PF recorded according to HV-2 connection for last 12 month's electricity bills were found = 0.95**
- **Due to low PF system drawn more current from grid and its tends to increase consumption on Electricity bill.**
- **Recommended to improve PF at load side to reduce consumption.**

10. Suggested action plan for saving

- Replace the conventional lamp with LED lights.
- Replace Air conditioning with high star rating or use centralised AC.
- Improve PF on load end by Capacitor bank.
- Recommend reduce the contractual demand to proposed demand to take saving in billable amount.
- Increase the capacity of solar energy.
- Replace the old convention technology DG with new technology to efficient operation of DG.
- Convert street light to solar.
- Install sensor in pumps to auto operation.
- Install lighting timer for parking and street lights.

11.WTI & OTI Images: -

Site & Old conventional DG images of 1470 KVA: -