

# **ENERGY AUDIT AT S.N.D.T ARTS & COMMERCE COLLEGE- Pune**

**Energy Audit Report**

*By*

**VIDYUT VIKAS POONA**

**ENERGY AUDITORS ENGINEERS AND CONTRACTOR**

**1372 SADASHIV PETH PUNE**

**(M): 9579299545 | 9371016488 | 9028556834**

**[www.vidyutvikas.com](http://www.vidyutvikas.com)**

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# Energy Audit Report

## Introduction



Energy Audit of **S.N.D.T ARTS & COMMERCE COLLEGE- Pune** was carried out. For this purpose the premises was visited on 18-2-2020, 19-2-2020, 20-2-2020, 29-2-2020, 5-3-2020, 9-3-2020, 10-3-2020 and 11-3-2020 for collection, detailed analysis of data and measurements.





### Energy Executive Summary

- From the timings it is noted that there is no continuous load.

However the activities in C and D zone are required to be shifted in A zone where there is rebate and if not possible then shift to B Zone, to avoid consumption in penalty zone. e.g charging of batteries , operation of pump can be operated during 10 pm to 6 am to avail the rebate.

At the most work can be scheduled in such a way that maximum work is carried out between 12=00 Hrs to 18=00 Hrs where normal rate is applicable .Minimum activities to be carried out between 09=00 Hrs to 12=00 Hrs and between 18=00 Hrs to 22=00 Hrs to avoid the penal charges

- If the power factor is maintained as 1 or from **0.995 - 1**, there is incentive from MSEDCL.

Also tariff calculation for power factor penalty/ incentive is changed from Sept 2018

Obviously this could not be availed in this case as there is no power factor correction measures are taken. No any incentive received from MSEB

Electricity billing is not as per TOD meter billing, TOD EC not received ,you may contact MSEDCL for billing as per TOD meter

- It is proposed to install 25 kVAR Automatic Power Factor Controller Panel
- Electricity duty paid = Rs **3,71,737.01/-** yearly you may get exemption from this duty please contact MSEDCL





- It is recommended to replace conventional lighting by LED lights

Total Annual savings will be **75735 kWh**

Saving amount in Rs. will be 9,08,820/-

Total cost of replacement will be Rs 4,97,250/-

Simple payback period is less than 6 months

- Set Air Conditioner temperature between 22 °C to 25 °C
- It is suggested that replace conventional 60 w Fan with new 28 W energy efficient fans

It is suggested that replace conventional 60 w Fan with new 28 W energy efficient fans

Total Annual savings will be 48363 kWh

Saving amount in Rs. will be 5,80,356/-

Total cost of replacement will be Rs 13,54,850/-

Simple payback period is 3 yrs

**TOTAL ANNUAL SAVING WILL BE = 1,24,098 kWh**

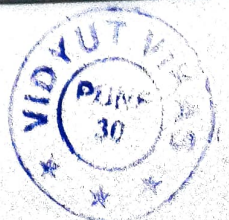


### Electrical Executive Summary

Critical Observations	Recommended Action for rectification
Earth Leakage Circuit Breaker ELCB is not installed	Earth Leakage Circuit Breaker ELCB is to be installed for shock protection and safety
Wiring to be done	If the electrical installation (wiring ) is more than 20 years old it is suggested to rewire the same as per Govt. Norms
Earthing to be done	If Earthing is 15 years old then Separate Earthing is to be provided  Water to be poured in earthing pit periodically
No Rubber Mats available at Main Distribution board/Panel	Rubber Mats to be provided at Main distribution panel



Energy Audit





## 1 Energy Audit:

An **energy audit** is an inspection, survey and analysis of energy flows for energy conservation in a building, process or system to reduce the amount of energy input into the system without negatively affecting the output(s). In commercial and industrial real estate, an energy audit is the first step in identifying opportunities to reduce energy expense and carbon footprints.

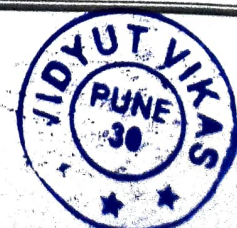
### **Walk-through or preliminary audit:**

The preliminary audit (alternatively called a simple audit, screening audit or walk-through audit) is the simplest and quickest type of audit. It involves minimal interviews with site-operating personnel, a brief review of facility utility bills and other operating data, and a walk-through of the facility to become familiar with the building operation and to identify any glaring areas of energy waste or inefficiency.

Typically, only major problem areas will be covered during this type of audit. Corrective measures are briefly described, and quick estimates of implementation cost, potential operating cost savings, and simple payback periods are provided. A list of energy conservation measures (ECMs, or energy conservation opportunities, ECOs) requiring further consideration is also provided. This level of detail, while not sufficient for reaching a final decision on implementing proposed measure, is adequate to prioritize energy-efficiency projects and to determine the need for a more detailed audit.

### **General audit :**

The general audit (alternatively called a mini-audit, site energy audit or detailed energy audit or complete site energy audit) expands on the preliminary audit described above by collecting more detailed information about facility operation and by performing a more detailed evaluation of energy conservation measures. Utility bills are collected for a 12 to 36 month period to allow the auditor to evaluate the facility's energy demand rate structures and energy usage profiles. This type of audit will be able to identify all energy-conservation measures appropriate for the facility, given its operating parameters. A detailed financial analysis is performed for each measure based on detailed implementation cost estimates, site-specific operating cost savings, and the customer's investment criteria. Sufficient detail is provided to justify project implementation.



An initial walk-through of the facility – is essentially an inspection tour. Attention should be given to,

- 1) Where energy is obviously being wasted
- 2) Where repair or maintenance work is needed
- 3) Where capital investment may be needed in order to improve energy efficiency



## **Electricity bill: Terms and Terminologies**

### **The Electricity Bill**

The information in an electricity bill includes the following:

#### **Kilowatt-hours (kWh) used**

Energy consumed since the previous meter reading (also referred to as "consumption").

#### **Metered demand (kW and/or kVA)**

Actual metered values of maximum demand recorded during the billing period. If both are provided, the power factor at the time of maximum demand can be calculated and may also be provided.

#### **Billing demand (kW and/or kVA)**

Demand value used to calculate the bill. It is the metered demand or some value calculated from the metered demand, depending on the utility rates.

#### **Tariff**

Billing rate as applied to the energy and demand readings.

#### **Days**

Number of days covered by the current bill. This is important to note because the time between readings can vary within  $\pm 5$  days, making some monthly billed costs artificially higher or lower than others.

#### **Reading date**

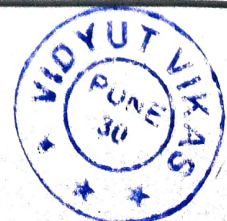
The "days used" and "reading date" can be used to correlate consumption or demand increases to production or weather-related factors.

#### **Load factor**

Percent of energy consumed relative to the maximum energy that could have been consumed if the maximum demand had been constantly maintained throughout the billing period.

#### **Power factor**

Ratio of recorded maximum kW to kVA (usually expressed as a decimal or percentage)





## 1. Analysis of Electricity bill

Date of connection:01-01-1979

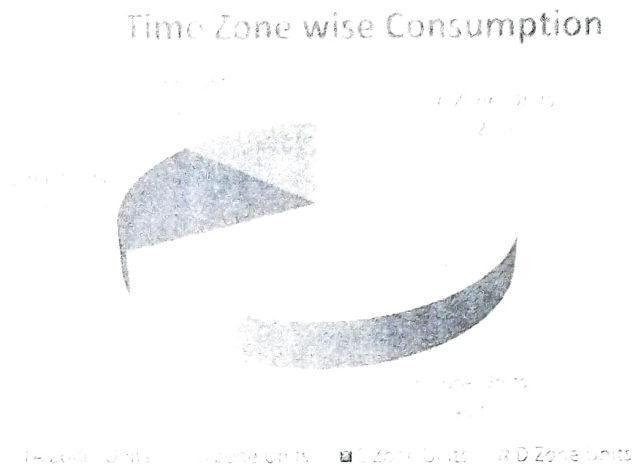
ELECTRICITY BILL DETAILS		
A)Consumer name/Address		THE PRINCIPAL Address : S N D T COLLEGE KARVE ROAD 170011016904
B) Tariff Category		89 I.T X B III
C)Energy charges (Rs/KWH)		7.2
D)Total Energy consumed(KWH) Yr 2019-20		188146
	Connected Load(KW)	51
	Contract demand (KVA)	64
	Average recorded demand Yr 2019	58.22 kVA
	Average Power Factor Yr 2019	0.904
	Any Penalty Against Power factor	No
	Any penalty against Excess Demand	No
	Is Actual connected Load of Facility is More than Sanctioned Load/Connected Load	YES (S.CONNECTED 51KW A.CONNECTED 58KW)
	Any PF Incentive	No
	Any TOD Incentive	YES
G)	Total Bill amount	Rs 2248665.98/-
	Yr 2019	

Please refer annexure for detailed Electricity Bill Analysis



1.1 Time Zone wise Consumption

It is observed that, Consumption in C and D zone is 36030 and 25613 units respectively which are 19% and 14% of total consumption. Thus 33% consumption is in penalty zone. Incentive obtained is for 21% of the units consumed.



Pl note that the consumption in C and D Zones is penalized and there is an incentive for consumption in A zone

Table1.1 Zones and Time of Day Tariff by MSEDCL for Rebate/Penal Charges

ZONE	ZONE A	ZONE B	ZONE C	ZONE D
Time Period	2200 to 0600 Hrs	0600 to 0900 Hrs& 1200 to 1800 Hrs	0900 to 1200 Hrs	1800 to 2200Hrs
Units Consumed	39266	87235	36030	25613
TOD Tariff Rs/kWh			0.80	1.10
	Incentive on Normal Rate	Rate	Penal Charges on Normal rate	More penal Charges on Normal rate



## Recommendations:

From the timings , it is noted that there is no continuous load.

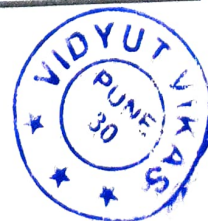
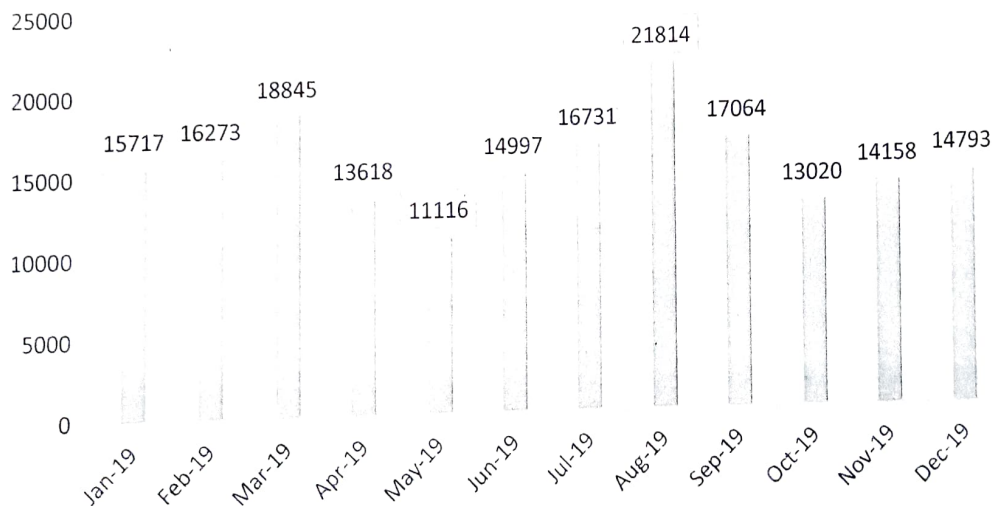
However the activities in C and D zone are required to be shifted in A zone where there is rebate and if not possible then shift to B Zone, to avoid consumption in penalty zone. e.g.operation of pump can be operated during **10 pm to 6 am** to avail the rebate.

At the most work can be scheduled in such a way that maximum work is carried out between 12=00 Hrs to 18=00 Hrs where normal rate is applicable .Minimum activities to be carried out between 09=00 Hrs to 12=00 Hrs and between 18=00 Hrs to 22=00 Hrs to avoid the penal charges.

## 1.2 Energy Consumption Pattern

Below is the chart indicating monthly unit consumption from JAN 2019 To DEC 2019 (data from electricity bills) It is noted that lowest consumption is 11116 units in the month of May 2019 and peak demand are 21814 units in the month of Aug 2019.

### kWh Consumption





### 1.3 Power factor

#### Observations:

From electricity bill analysis for 12 months avg PF value is 0.904

And yearly incentive received of Rs : **33874.18/-**

The power factor measured by power analyzer is 0.951 If the power factor is maintained as 1 or from **0.995- 1**, there is incentive from MSEDCL.

Also tariff calculation for power factor penalty/ incentive is changed from Sept 2018

Obviously this could not be availed in this case as there is no power factor correction measures are taken.

#### Recommendations

- It is proposed to install 25 kVAr Automatic Power Factor Controller Panel

#### Electricity Duty:

As per section (ia), clause 2 of Electricity Duty Act 1958, Electricity duty is levied on the units consumed by Educational Institutes .

Observation:

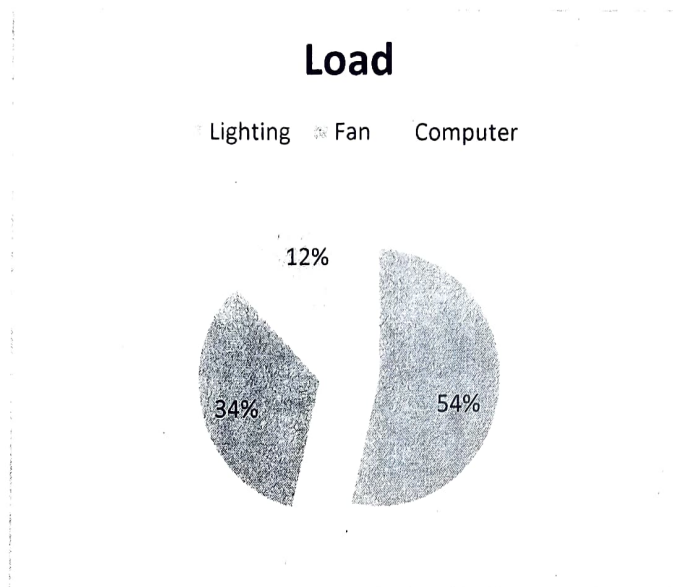
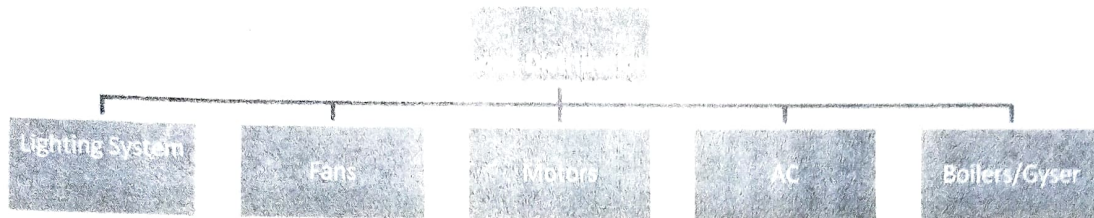
It is observed that, electricity duty is has been paid amounting to Rs **3,71,737.01/-** yearly

#### Recommendation:

Matter may please be taken to MSEDCL for levying of electricity duty with immediate effect and application be made for refund of duty amount paid for electricity duty

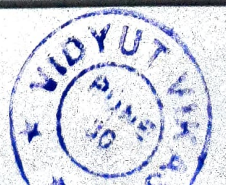


## 2. Load Distribution



From the above chart it is seen that load is divided in

1. Lighting System
2. Fans
3. Computer



## 2.1 Lighting System

It is noted that the light s/lamps used are of conventional type such as tube lights,

T5,CFL etc.

### Advantages of LED Lamps

- a) Lesser power consumption
- b) Withstands high voltage fluctuations
- c) Much longer life of the lamps up to 15000 hours.
- d) Zero run up time i.e. Instantaneous light
- e) Eco- friendly

The life of LED lamps is 50000 hours and that of Tubes and CFLs is 2000 and 5000 hours respectively. Considering the life cycle costing, there will be replacement of Tubes and CFLs 7 and 3 times respectively in future.. This will reduce the payback period considerably. The expenditure for replacement of old luminaries in future cannot be ascertained at this instant , however considering the short life cycle of existing luminaries,as compared to LEDs, replacement by LED lamps will be **definitely beneficial.**

### Calculations :

Total Number of 1x 40 W Tubes = 704 Nos

Working Hours = 10 Hours / Day

Days = 300/year

Annual Consumption = total kW\*Hrs\*Days

= 75735 kWh

### Recommendations :

It is recommended to replace conventional lighting by LED lights

Total Annual savings will be **75735 kWh**

Saving amount in Rs. will be 9,08,820/-

Total cost of replacement will be Rs 4,97,250/-

Simple payback period is less than 6 months.





## 2.2 Fans

### Observations

It is observed that 343 Nos of Ceiling fans are installed

### Calculations

Total Number of 60 W Fans = 343 Nos

Working Hours = 10 Hours / Day

Days = 300/year

Annual Consumption = total kW\*Hrs\*Days

= 48363 kWh

### Recommendations

It is suggested that replace conventional 60 w Fan with new 28 W energy efficient fans

Total Annual savings will be 48363 kWh

Saving amount in Rs. will be 5,80,356/-

Total cost of replacement will be Rs 13,54,850/-

Simple payback period is 3 yrs.

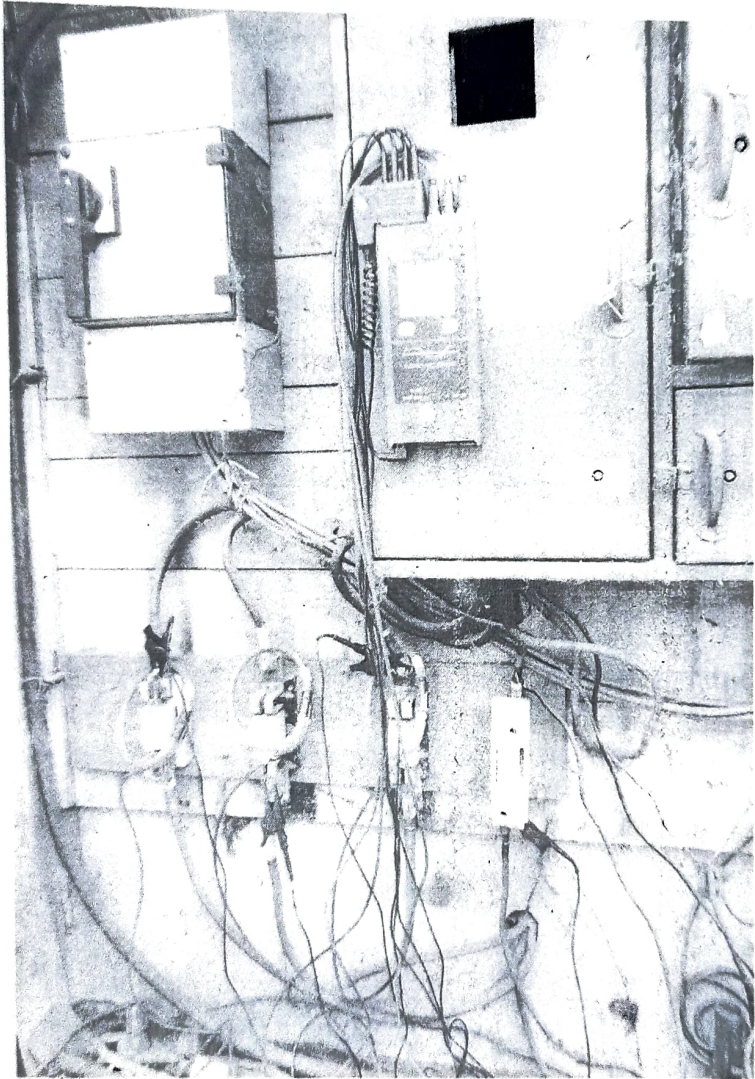


2.3 Measurements

	R	Y	B
I Max in Amp	89	72	72

Measured current on each phase is given at full load

It is seen that Load is slightly unbalanced on R phase than Y and B





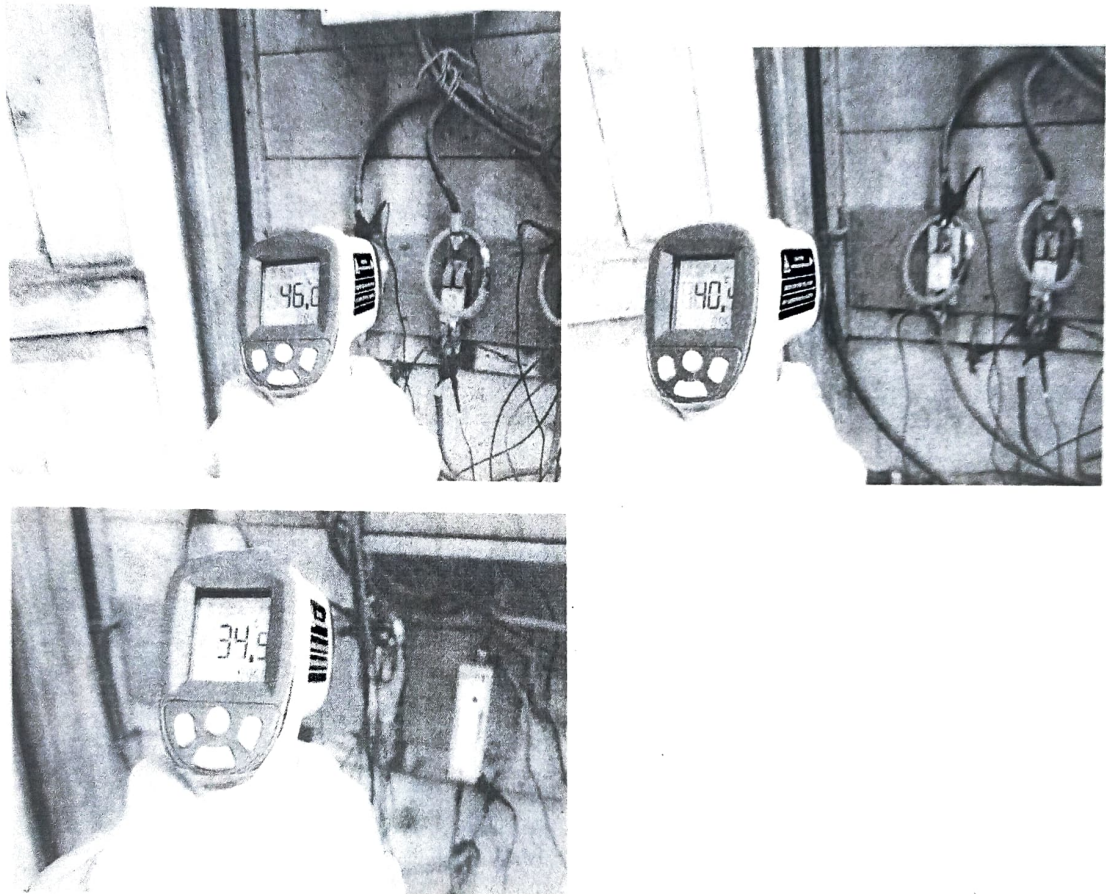
Electrical System details

3.1 Power Source

Source of power is three phase L.T electricity supply by MSEDCL.

3.2 Thermography

1. Measurement at Bus Bar



Phase	Temperature
R	40.6°C
Y	46.0°C
B	34.9°C

Recommendations

Temperature at Busbar is within limit





### 3.3 Harmonics

The presence of harmonics in electrical systems means that current and voltage are distorted and deviate from sinusoidal waveforms. Harmonic currents are caused by non-linear loads connected to the distribution system.

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The total harmonic distortion, or **THD**, of a signal is a measurement of the harmonic distortion present and is defined as the ratio of the sum of the powers of all harmonic components to the power of the fundamental frequency.

#### Causes

Harmonics are caused by non-linear loads, that is loads that draw a non- sinusoidal current from a sinusoidal voltage source. Some examples of harmonic producing loads are Computers,static VAR compensators, inverters, DC converters, switch-mode power supplies, and AC or DC motor drives

#### Observations:

%Current THD	R	Y	B
Value % THD	8.2	9.63	12.03

Please refer the Total Harmonic Distortions graph

#### Recommendations:

According to MERC rule allowable % harmonic is 5 H%

Harmonics are slightly more than permissible limit

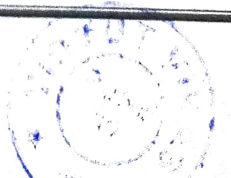
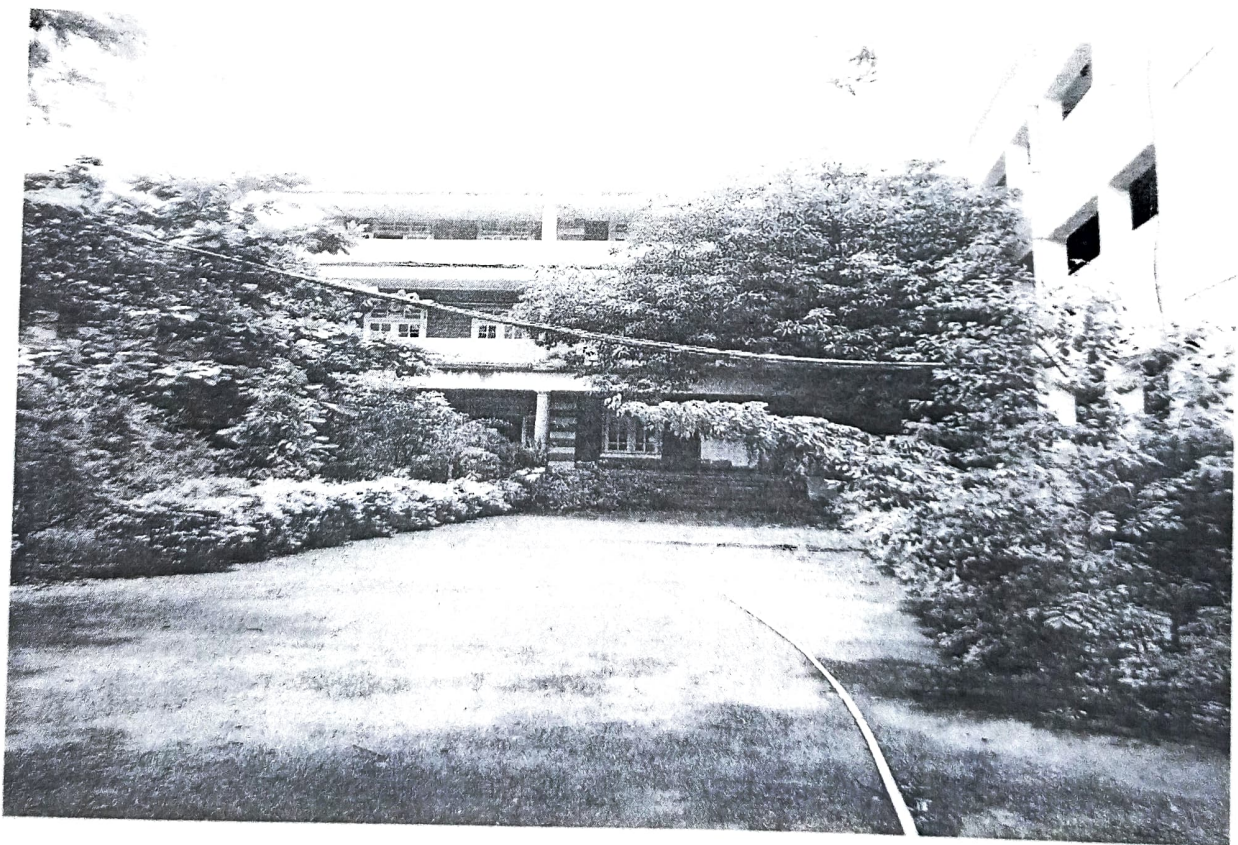
### **Solar Power Generation:-**

In our country solar energy is abundantly available. The most positive point in the use of solar energy is that there is no energy cost and it is a clean energy. It is a gift of nature. Only initial capital cost is required to be incurred and the solar panels are practically free from maintenance and the expected life is 25 -30 years. The batteries required are also lasting for 4-5 years.

Considering the above facts, the load survey and shadow analysis was carried out for the possibility of installing roof top solar panels on terrace

The exact nature of load to be catered by Solar will be known only after carrying out energy audit of entire premises as the system cannot run in a piecemeal manner.

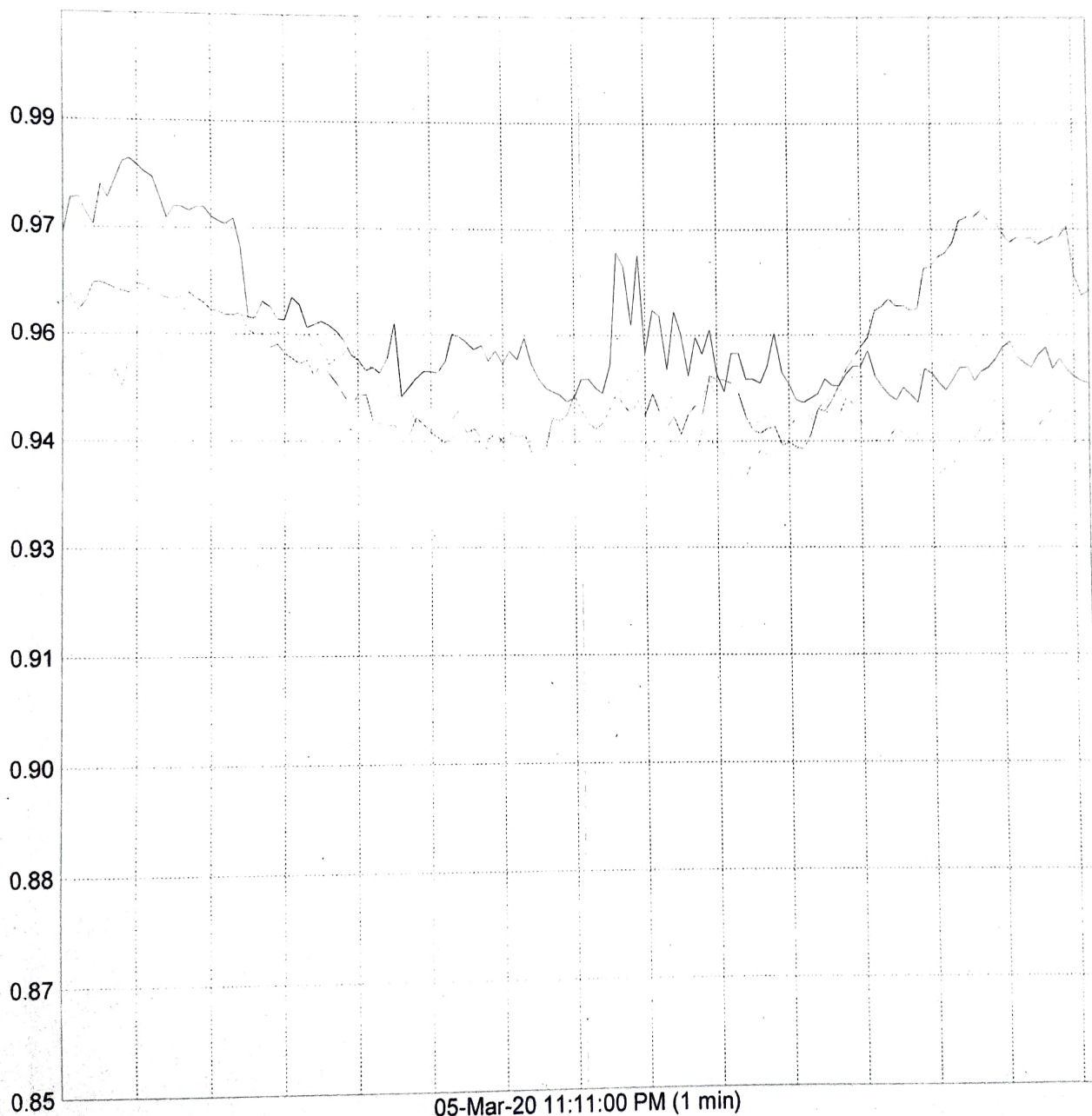
If this is approved in principle, details will be worked out in consultation with the manufacturer of the solar plant





## 1 min Summary

Channel	Color	Cursor	Window MIN	Window A/G	Window MAX
PF1-	■	###	---	---	---
PF2-	■	###	---	---	---
PF3-	■	###	---	---	---
PFT-	■	###	---	---	---
PF1+	■	0.949	0.946	0.955	0.98
PF2+	■	0.938	0.933	0.944	0.958
PF3+	■	0.945	0.939	0.952	0.973
PFT+	■	0.944	0.942	0.951	0.966



10:00:00 PM  
05-Mar-20

10 min /Div

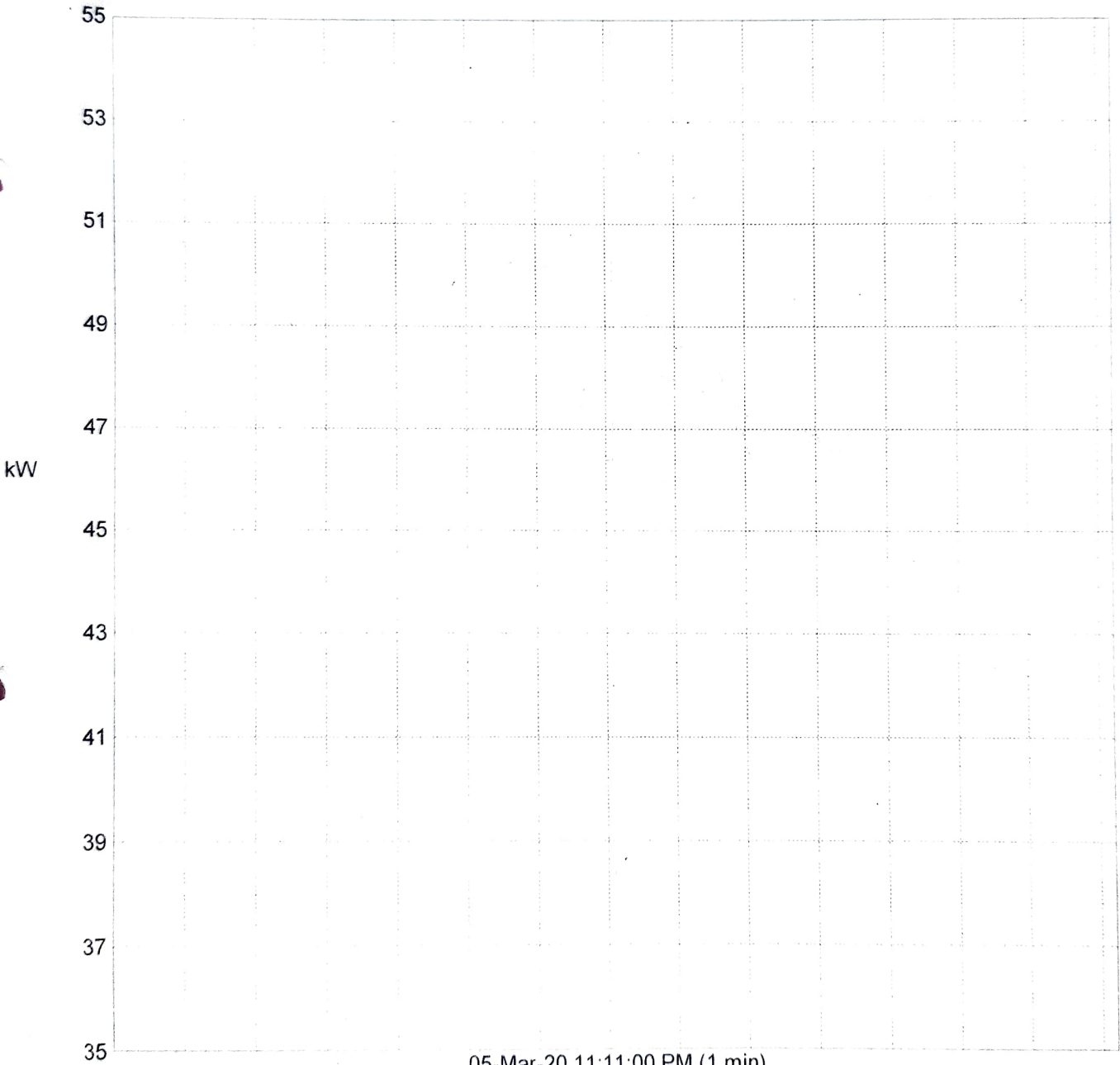
12:22:00 AM  
06-Mar-20





1 min Summary

Channel	Color	Cursor	Window MIN	Window A/G	Window MAX
P1-		---	---	---	---
P2-		---	---	---	---
P3-		---	---	---	---
PT-		---	---	---	---
P1+		16.43 kW	14.23 kW	16.45 kW	19.99 kW
P2+		14.6 kW	13.6 kW	14.88 kW	15.89 kW
P3+		15.37 kW	12.24 kW	14.85 kW	16.21 kW
PT+		46.41 kW	41.55 kW	46.17 kW	49.66 kW



10:00:00 PM  
05-Mar-20

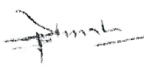
05-Mar-20 11:11:00 PM (1 min)


10 min /Div


12:22:00 AM  
06-Mar-20



The audit team would like to thank the staff for providing the necessary information/data and the cooperation extended to the audit team during visit and work.

  
Shripad B. Godbole  
Energy Auditor  
EA 6378

  
Kunal V. Joshi  
Energy Manager  
EM 8528

  
Gayatri N. Akolkar  
Energy Manager  
EM 8530

  
Neelkanth M. Akolkar  
For Vidyut Vikas Poona  
Proprietor  
MC 18165



Place : Pune

Date:

