Dayanand Shiksan Sanstha's
Dayanand Science College,
Latur

Energy Audit Report 2020-21

Dayanand Science College, Latur

(Affiliated to Swami Ramanand Teerth Marathwada University, Nanded)

Energy Audit Conducted by

KEDAR KHAMITKAR & ASSOCIATES

Empanelled Consultant Mahaurja, Govt. of Maharashtra Institution

M: 9850244701 Email. : urjabachat@gmail.com

INDEX

Dayanand Shiksan Sanstha's
Dayanand Science College,
Latur

Preface

An energy audit is an inspection survey and an analysis of energy flows for energy conservation in a building. It may include a process or system to reduce the amount of energy input into the system without negatively affecting the output.

There is now a universal recognition of the fact that new technologies and much greater use of some that already exist provide the most hopeful prospects for the future.

Data collection for energy audit of Dayanand Science College, Latur was conceded by EA Team for the period of 1st Feb 2021 to 15th Feb 2021. This audit was conducted to enquire about convenience to progress the energy competence of the campus.

All data collected from each classroom, Lab. The work is completed by considering how many Tubes, Fan, A.Cs, Electronic instruments, etc. in each room. How much was participation of each component in total electricity consumption.

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Latur

Acknowledgement

We express our sincere gratitude to
The General Manager Mahaurja, Govt. of Maharashtra Institution
Along with Shri D.V. Kulkarni, DGM Office - Latur
Special thanks to **The Principal Dayanand Science College, Latur** for entrusting and offering the opportunity of energy performance assessment assignment.

- **Honorable Dr. Jayprakash ji Dargad - Principal**

Best Wishes,
Kedar Khamitkar

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With the Support and Cooperation of Dayanand Science College

We are thankful to Staff for their positive support in undertaking the task of system mapping and energy efficiency assessment of all electrical system, utilities and other workshop equipment. The field studies would not have been completed on time without their interaction and guidance. We are grateful to their cooperation during field studies and providing necessary data for the study.

We would like to express our sincere thanks to:-

Name	Designation
Dr. Jayprakash Dargad	**Principal**
Dr. S.S. Bellale	Vice Principal
Mr. S.K. Alane	Staff Member
Mr. R.V. Solunke	Staff Member
Mr. C.S. Swami	Staff Member
Mr. A.M. Chougule	Staff Member

Scope of Work

The objective of the audit was to study the energy consumption pattern of the facility, identify the areas where potential for energy/cost saving exists and prepare proposals for energy/cost saving along with investment and payback periods. The salient observations and recommendations are given below.

Electrical energy is used for various applications like: Computers, Lighting, Air-Conditioning, Fans, Lift & Other Laboratory Equipment, Printers, LCD Projector, Router System, Flood light, Pumping System etc.

Total Yearly Electricity Bill Amount	Rs. 101864 /-
The average Monthly cost of energy is around	Rs. 8500/ Month
Total Yearly KWH Consumption (Mahavitaran)	25605 KWh/Year
Total Yearly Consumption (Solar Power Generation 30 KW Plant)	38400 KWh/Year

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Dayanand Science College,
Latur

Specific Energy Consumption (SEC)

The Specific Energy Consumption (SEC) is the ratio of energy required per square meter.

In this case the SEC is evaluated as electrical units consumed per square meter of area.

Total Built-up Area = **7412.60** Sq. Meter

Total KWH Consumption- **64005** KWH/Year

It is calculated as under for (Electricity): 8.63 kWh/Sq. Meter

After the measurement and analysis, we propose herewith following Energy Efficiency Improvement measures.

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Latur

Executive Summary

Sr.	Recommendations	Savings	Investment	Payback
1	**Install APFC panel** Automatic Power Factor Controller	@4-5%	45 Thousand	2 Yrs.
2	**Improve Power Quality:** Install Voltage Servo Stabilizer of 100 KVA	@8-10%	1.50 Lakhs	3 Yrs.
3	**Replacement of No Star Inefficient AC system** with Inverter BEE Star rated system	10-15 %	7.50 Lakhs	3.5 Yrs.
4	**Replacement of 65w Ceiling Fans with 35W BLDC fans** Qty. 244	15%-18%	4.88 Lakhs	3.5Yrs
5	**Install Solar Pumping System** Pump House - recommended	15%	3.25 Lakhs	2.5 Yrs.
6	**Install Motion Sensor** in corridors, passage and toilets	5%	1.50 Lakhs	1.5 Yrs.
7	**Establish Energy Park** -100 KW Solar Power Plant -Install EV Recharge Points	-NA-	45 Lakhs	4.5 Yrs.

Chapter: 1

Introduction about the Institute

Dayanand Science College, Latur is unique, first oldest and the finest single faculty college in the region of Marathwada, pursing excellence in science education with several branches. Dayanand Science College became independent in 1967. The institution, Dayananda Education Society is a Public Charitable Trust managed by a democratically elected body consisting of 28 members constituting the Governing Council for framing institutional policies.

Department of Science

The department is one of the oldest departments of Science in Marathwada region (8 districts of Maharashtra) established in 1961. It is the Biggest Department of Science with highest strength of teachers and students in the Shri Ramananda Tirth Marathwada University area.

The college is well known about the development of "Latur pattern of Education" in the state of Maharashtra for the meritorious pattern.

1.1 General:

Dayanand Science College, Latur entrusted the work of conducting a detailed Energy Audit of campus with the main objectives are as bellows:

- To study the present pattern of energy consumption
- To identify potential areas for energy optimization
- To recommend energy conservation proposals with cost benefit analysis.

- **Scope of Work, Methodology and Approach:**

Scope of work and methodology were as per the proposal .While undertaking data Collection, field trials and their analysis, due care was always taken to avoid abnormal situations so as to generate normal/representative pattern of energy consumption at the facility.

- **Approach to Energy Audit:**

We focused our attention on energy management and optimization of energy efficiency of the systems, sub systems and equipment's. The key to such performance evaluation lies in the Sound knowledge of performance of equipment's and system as a whole.

- **Energy Audit:**

The objective of Energy Audit is to balance the total energy inputs with its use and to identify the energy conservation opportunities in the stream. Energy Audit also gives focused Attention to energy cost and cost involved in achieving higher performance with technical and financial analysis. The best alternative is selected on financial analysis basis.

1.2 Energy Audit Methodology

Energy Audit Study is divided into following steps

1. Historical data analysis:
The historical data analysis involves establishment of energy consumption pattern to the established base line data on energy consumption and its variation with change in production volumes.

2. Actual measurement and data analysis:
This step involves actual site measurement and field trials using various portable Measurement instruments. It also involves input to output analysis to establish actual operating Equipment efficiency and finding out losses in the system.

3. Identification and evaluation of Energy Conservation Opportunities:
This step involves evaluation of energy conservation opportunities identified during the energy audit. It gives potential of energy saving and investment required to implement the Proposed modifications with payback period.

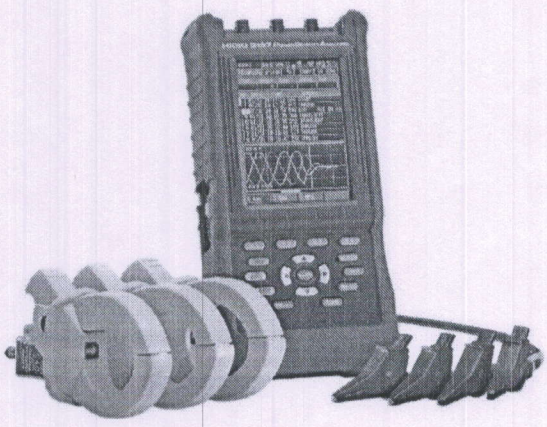
1.3 Energy Audit Instruments

Energy Meters used for measurements of actual consumption.

Measure and Record: -Power and Power Factor -Active/Reactive Energy - Demand -Load Changes (with graph display) -Voltage and Current

a) **Three Phase Power Quality Analyser** MODEL – HIOKI -3196

Measure Power and Power Quality on Single to Three-Phase Circuits Quickly and Effortlessly



b) **Lux Meter**

c) **Infrared Noncontact Thermometer**

d) **Wattmeter (MECO)**

Chapter: 2 Electrical & Distribution System

2.1 Electrical Supply Details:

The electrical supply to Dayanand Science College, Latur comes from

1. MSEDCL Maharashtra State Electricity Distribution Company Limited
2. Solar Power Plant 30 KW
3. D.G. Set 45 KVA / 30 KVA

2.2 Study of Electrical Consumption:

There are Four Meters installed in the premises.

Table A: Consumer No. 610550016462 **Details:**

Sr. No.	Details of Electricity Demand		LT VII(B) Public Service 0-20KW
1	Meter No.	07642071445	
2	Sanctioned Load	19	KW
3	Unit Cost	4.68	Rs/KWH

Table B: Consumer No. 610550293377 **Details:**

Sr. No.	Details of Electricity Demand		LT VII(B) Public Service 0-20KW
1	Meter No.	07639123348	
2	Sanctioned Load	19	KW
3	Unit Cost	4.68	Rs/KWH

Table C: Meter 610550074951 Details:

Sr. No.	Details of Electricity Demand		LT VII(B) Public Service 0-20KW
1	Meter No.	07639123342	
2	Sanctioned Load	19	KW
3	Unit Cost	4.68	Rs/KWH

Table D: Meter 610550289132 Details:

Sr. No.	Details of Electricity Demand		LT VII(B) Public Service 0-20KW
1	Meter No.	07652455252	
2	Sanctioned Load	19	KW
3	Unit Cost	4.68	Rs/KWH

COVID-19 Impact

After the lockdown occurs there is decrease in the demand.

Decrease electricity consumption by 80% in 20 months.

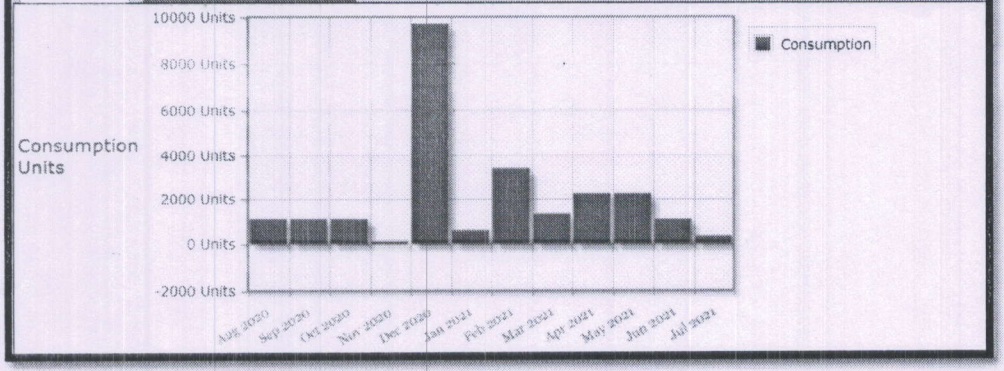
Chapter: 3. Historical Data Analysis

The electrical bills from MSEDCL for 12 months

Consumer Number: 610550016462

Consumer Number	610550016462	BU	4640 LATUR (U) S/D(SOUTH)
Name	THE PRINCIPAL DAYANAND COLLEGE	Connection Type	LT
Address	PHYSICS LAB TQ. LATUR DIST. LATUR LATUR 413512	Contact Numbers	8149516780

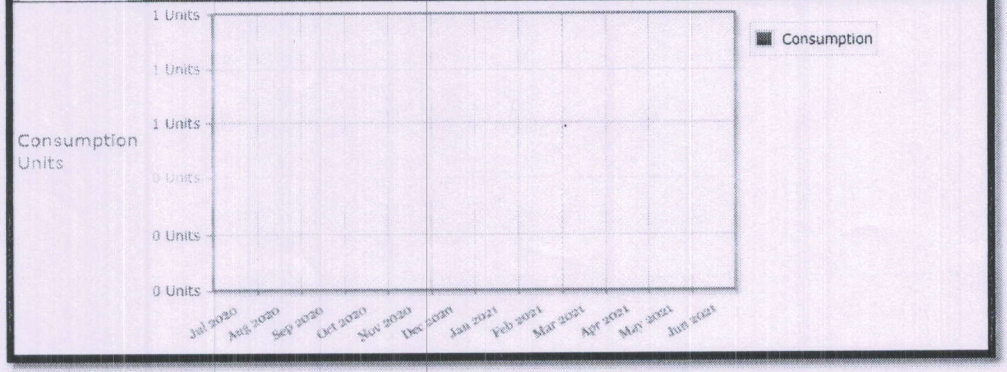
Billing | Payments History



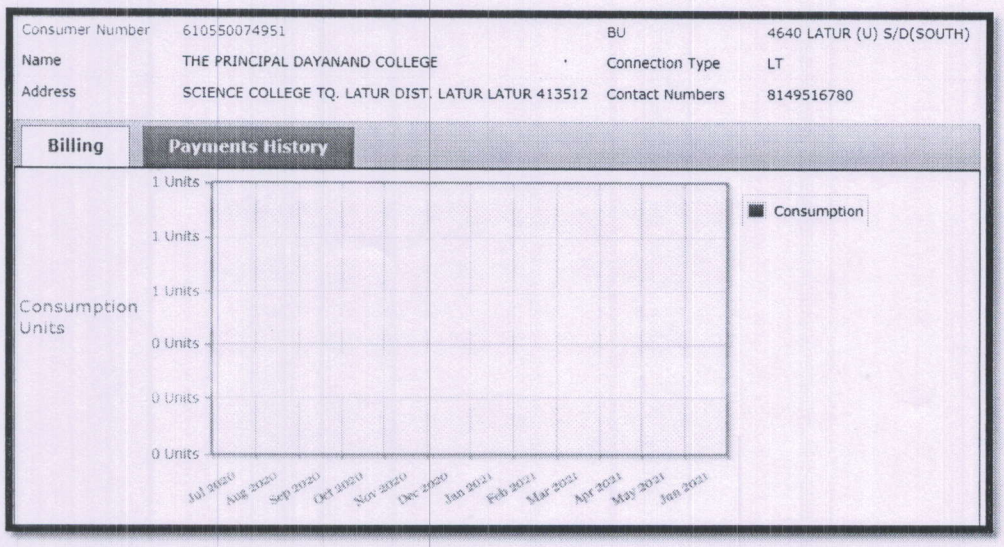
Consumer Number: 610550293377

Consumer Number	610550293377	BU	4640 LATUR (U) S/D(SOUTH)
Name	THE PRINCIPAL DYAND VIDHNYAN COLLEGE	Connection Type	LT
Address	COMPUTER SECTION TQ. LATUR DIST. LATUR LATUR 413512	Contact Numbers	9881297385

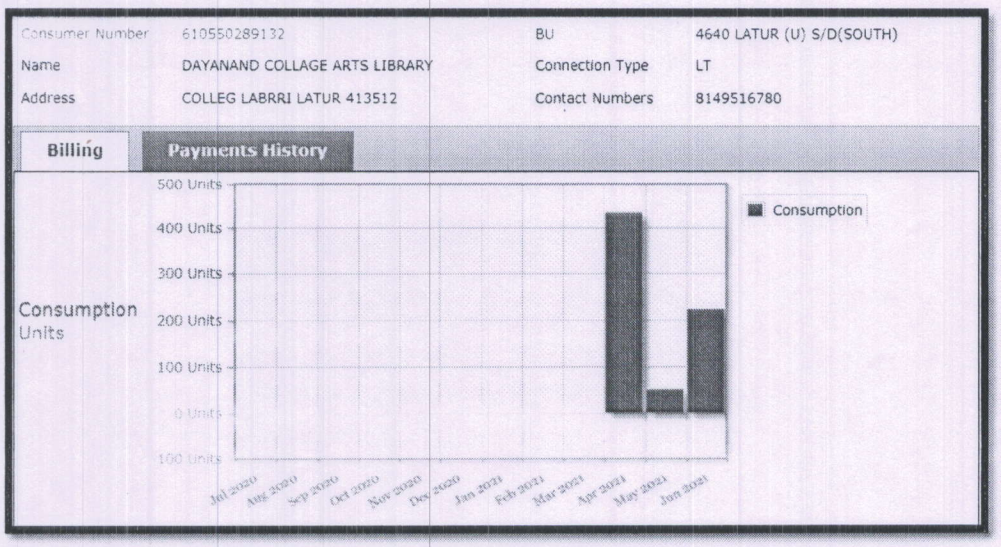
Billing | Payments History



Consumer Number: 610550074951



Consumer Number: 610550289132



Major consumers of electricity in the facility:

- Lighting
- Fans
- Air-Conditioning
- Computers
- Printers

- **Other Equipment's**
    - Lift & Other Lab Equipment's

Chapter: 4 Connected load Details

4.1 Air Conditioning System Total Load @50 KW

Sr	Location	Quantity	Area Sq. Feet	Capacity
1	Conference Hall	8	210	1.5 TR
2	Principal Cabin	5	2000	1.5 TR
3	Vice Principal	1	100	1.5 TR
4	Micro Lab	2	200	1.5 TR
5	Scientific Lab	2	200	1.5 TR
6	Physics Lab	2	400	1.5 TR
7	Micro Lab	1	100	1.5 TR
8	Math's	1	100	1.5 TR
9	Physics Lab	1	150	2 TR

4.2 **Fan System** Total Wattage 244X65 = 15.86 KW

About 244 Celling Fans installed at Dayanand Science College building. Each fan system @65 Watt

4.3 **Lighting System** Total Wattage 400X20 = 8 KW

About 400 LED Tube Lights installed

Each LED system @20 Watt

4.4 **Pumping System** Total Wattage = 5 KW

a) 3 HP Pump
b) 2 HP Pump

4.5 **LIFT System** Wattage = 4 KW

4.6 **Miscellanies** Total Wattage @ 45KW

a) Lab Equipment's
b) Computer System
c) Mineral Water System

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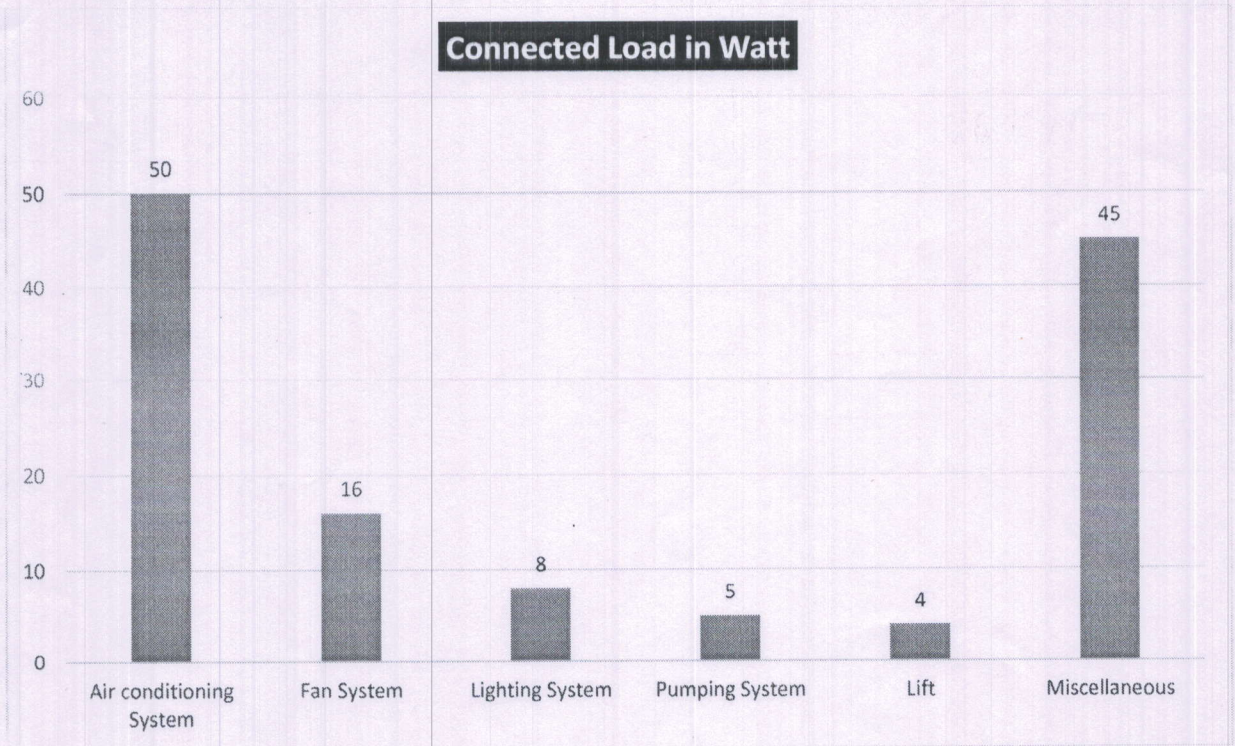
Dayanand Science College,
Latur

Sr	Appliances	Wattage
1	Air conditioning System	50 KW
2	Fan System	16 KW
3	Lighting System	8 KW
4	Pumping System	5 KW
5	Lift	4 KW
6	Miscellaneous	45 KW

Graphical View



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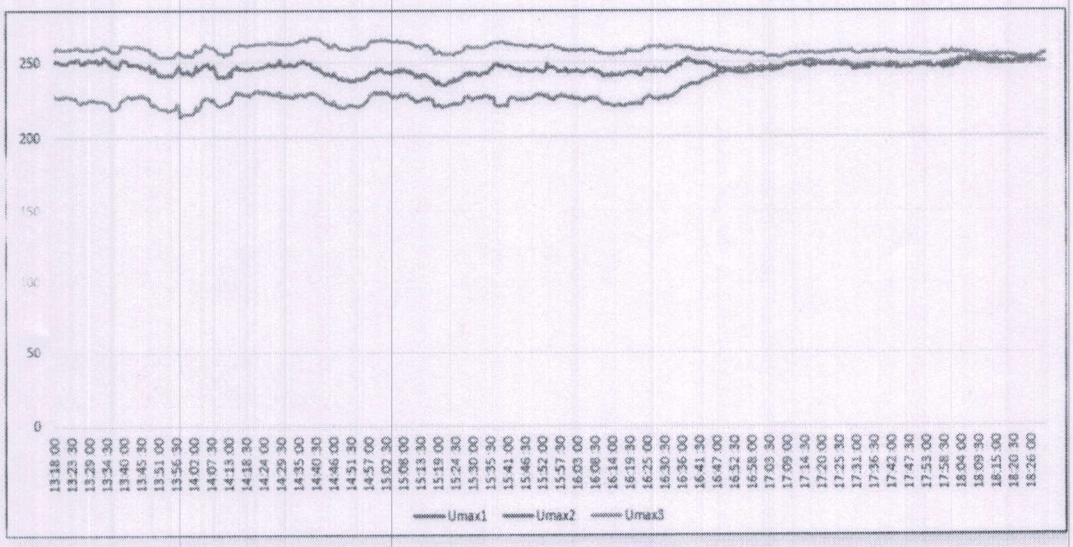
Chapter: 5 Power Quality Analysis

5.1 Voltage (V Volts)

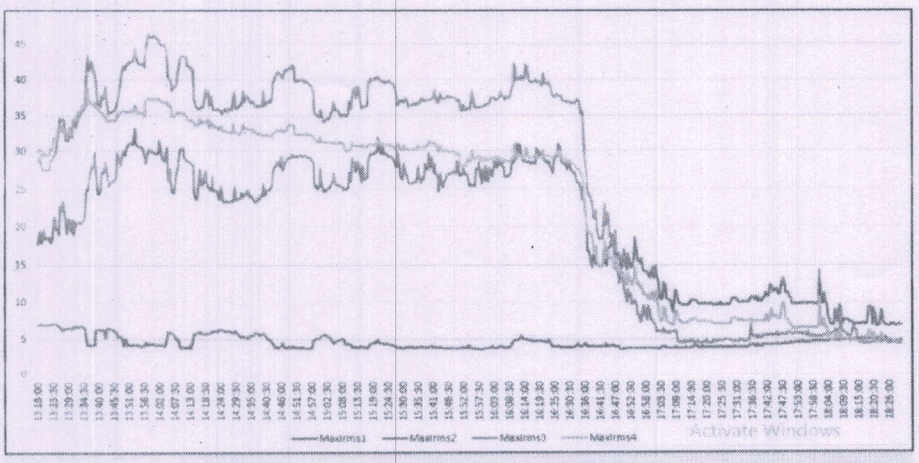
Name of Unit : Dayanand Science College, Latur
Address: Barshi Road, Latur



Voltage	MAX - U1----- 256	MAX - U2----- 253.9	MAX - U3----- 268
	MIN - U1---- 234.5	MIN - U2---- 214	MIN - U3---- 253.2

5.2 Current (I Amp)

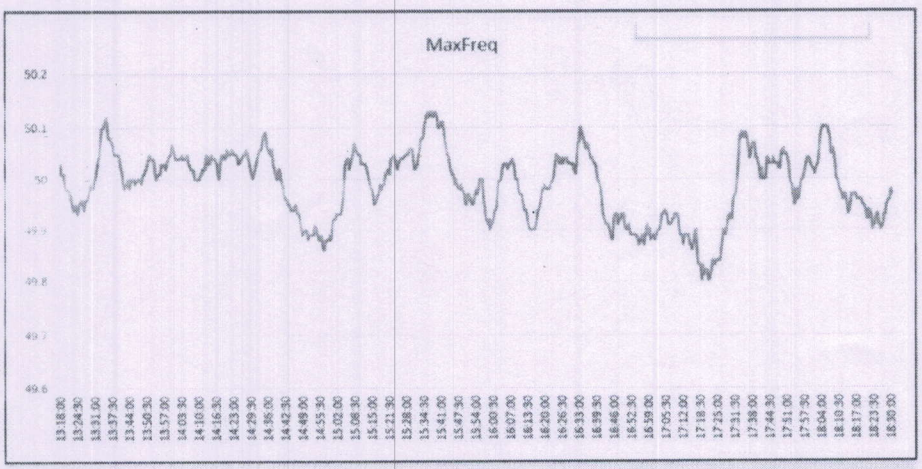
Name of Unit : Dayanand Science College, Latur
Address: Barshi Road, Latur



Current (I) : MAX - I-1----- 33.01 MAX - I-2----- 7.12 MAX - I-3----- 46.46 MAX - I-4-----38.78
MIN - I-1---- 6.72 MIN - I-2---- 3.6 MIN - I-3----- 4.3 MIN - I-4-----4.39

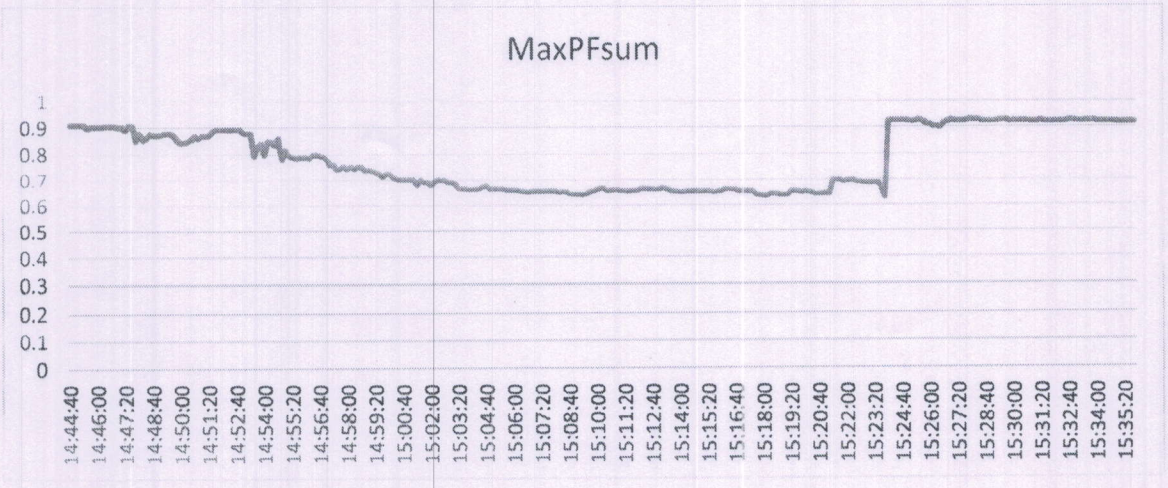
5.3 Frequency (HZ)

Name of Unit : Dayanand Science College, Latur
Address: Barshi Road, Latur

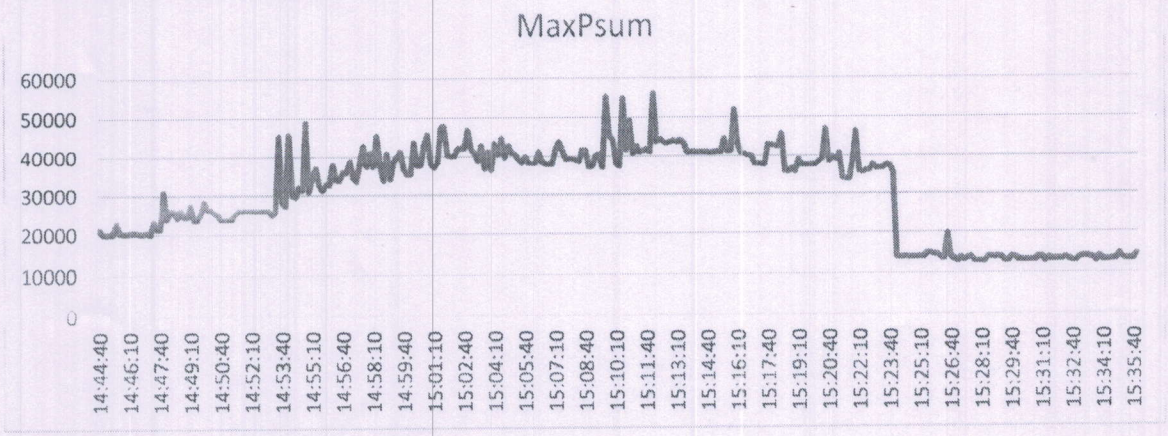


Frequency (Hz) : Max : 50.13
Min. : 49.8

5.4 Power Factor (P.F.)



5.5 Power (Watt)



5.6 Conclusion:

As per the Power Quality Analysis report it's recommended to install 100 KVA Capacity Voltage Stabilizer.

6.2 Improve Power Quality: Install Voltage Servo Stabilizer of 100 KVA

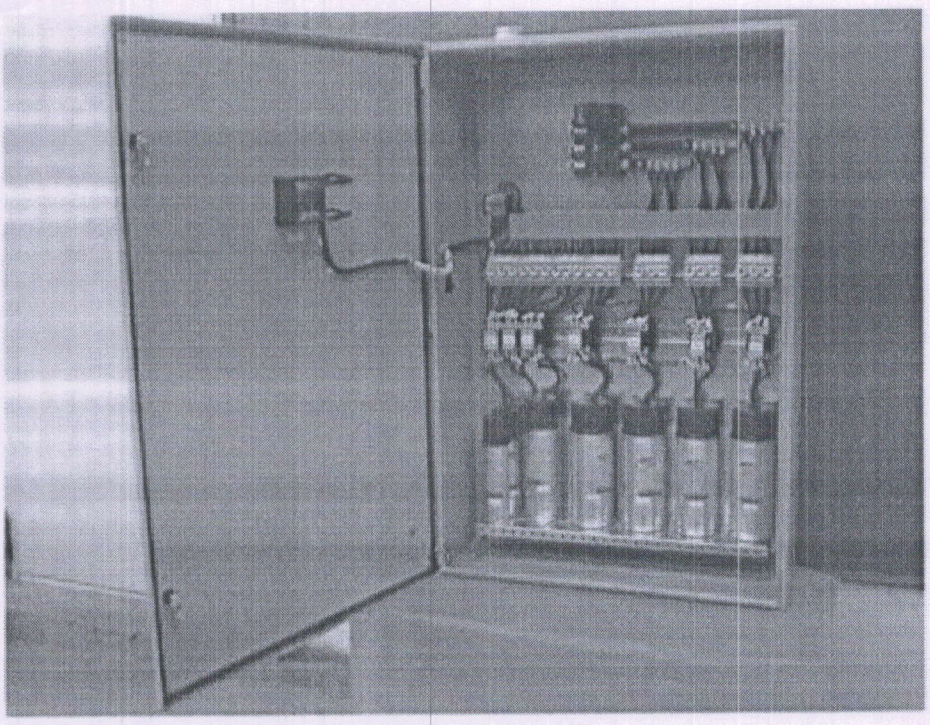
6.3 Install APFC: Automatic Power Factor Controller (APFC)

As per the MSEDCL Billing Analysis:

There is scope for improvement of power factor at particular case.

If we more focus on average power factor up to 0.99, we will get the reduction in Bill.

Hence we have to more focus on power factor correction/improvement using capacitor bank Or APFC panel.



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Latur

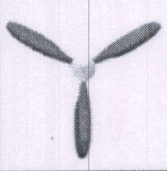
6.4 Replacing Existing Ceiling Fans with BLDC Fan

Existing Fan System: 63 Watts Proposed 35 Watts

Suggestion: Install Efficient BLDC Fan System

Speed	1	2	3	4	5
Wattage	3.8 watts	7.7 watts	13.8 watts	22.7 watts	35 watts

FEATURES	SUPERFAN SUPER X1	CROMPTON AURA 2 PRIME	HAVELLS ENTICER	ORIENT WENDY
Size (mm)	1200 mm	1200 mm	1200 mm	1200 mm
Input Power (W)	35 W	74 W	74 W	70 W
Air Delivery (CMM)	230 CMM	230 CMM	235 CMM	230 CMM
Operational Voltage Range (V)	160 V - 265 V	220 V - 240 V	220 V - 240 V	220 V - 240 V
Speed (RPM)	385 RPM	380 RPM	390 RPM	320 RPM
Warranty (Years)	5	5	2	2
Remote Control	✓	×	×	✓
MRP (Rs.)	Rs. 3690/-	Rs. 3800/-	Rs. 3830/-	Rs. 3020/-
Amount Of CO2 Emission Avoided (Kg)	1 Kg	—	—	—




6.5 GUIDELINES FOR IDENTIFYING EC OPPORTNITIES

- Use as much natural day light as possible by use of translucent roofing sheets.
- Use day lighting effectively by locating work stations requiring good IL luminance near the windows.
- Minimize IL luminance in non- task areas by reducing the wattage of lamps or number of Fittings
- Avoid use of incandescent/tungsten filament lamps. The power consumed by these lamps is 80% more than the fluorescent lamps (discharge) for same lumen output.
- Use electronic ballasts in place of conventional ballast for fluorescent lamps.
- Task lighting saves energy, utilize it whenever possible.
- All surfaces absorb light to some degree and lower their reflectance. Light colored surfaces are more efficient and need to be regularly painted or washed in order to ensure economical use of light.

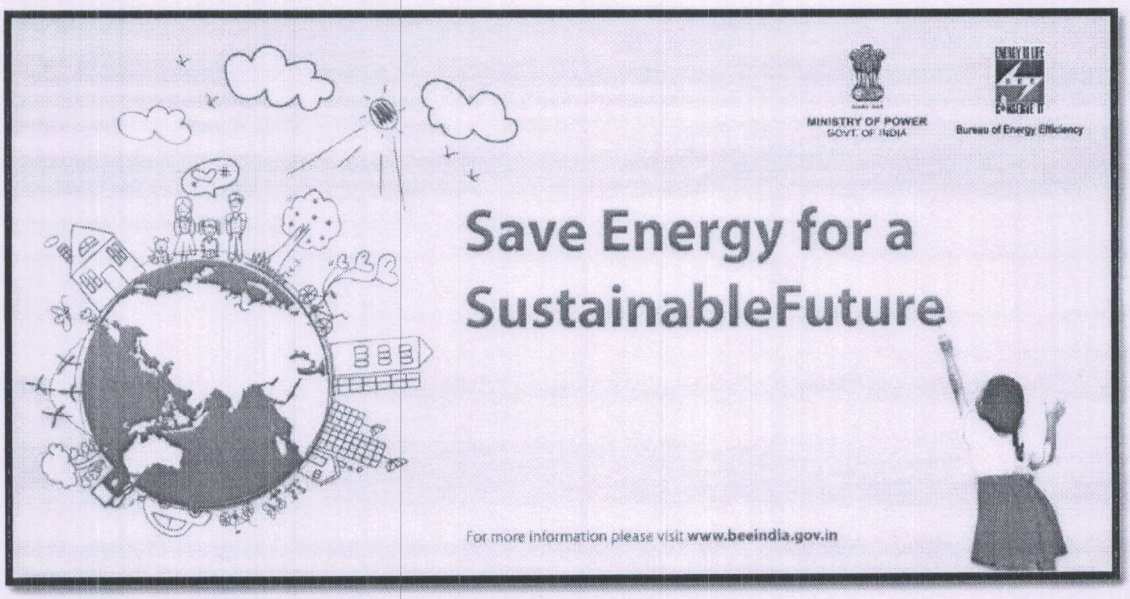
- Maintenance is very important factor. Evaluate present lighting maintenance program and revise it as necessary to provide the most efficient use of lighting system.
- Clean luminaries, ceilings, walls, lamps etc. on a regular basis.
- Controls are very effective for reducing lighting cost. Provide separate controls for large ratings.
- Install switching or dimmer controls to provide flexibility when spaces are used for multiple purpose and require different amounts of illumination for various activities.
- Switching arrangements should permit luminaries or rows of luminaires near natural light sources like windows or roof lights to be controlled separately.
- Separate lighting feeder and maintain the feeder at permissible voltages by using transformers.
- Install occupancy sensors for indoor cabin light controls

Chapter: 7 General Recommendations

Awareness: Display the stickers of Save electricity

Save Nature everywhere in the campus. So that all stakeholders encouraged to save the electricity.

- Most of the time, all the tube lights in a class room are kept ON, even though, there is sufficient light level near the window opening. In such cases, the light row near the window may be kept OFF.
- All computers to have power saving settings to turn off monitors and hard discs, say after10 minutes/30 minutes.
- The comfort/Default air conditioning temperature to be set between 24°C to26°C.
- Lights in toilet area may be kept OFF during daytime
- There has to be Institute level student community that keeps track of the energy consumption Parameters of the various departments, class rooms, halls, areas, meters, etc.
- Energy auditing inside the campus has to be done on a regular basis and report should be made public to generate awareness.
- Need to create energy efficiency/ renewable energy awareness among the college campus i.e. solar, wind, Biogas energy. Institute should take initiative to arrange seminars, lectures, paper presentation competition among students and staff for general awareness.



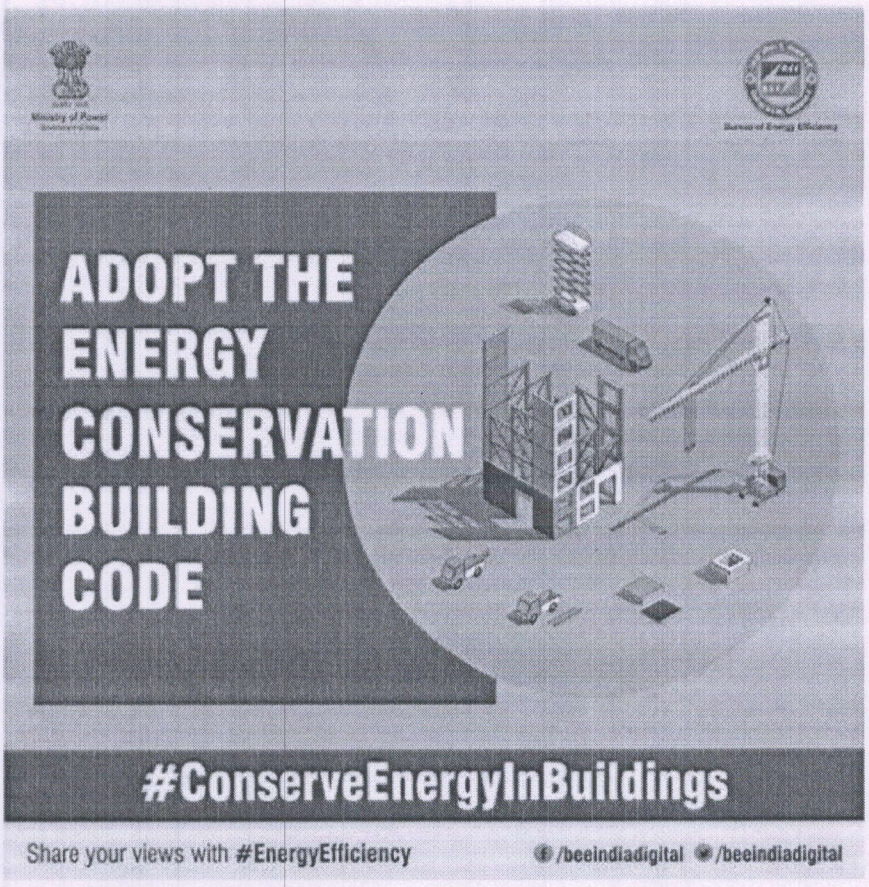
प्रतिज्ञा

हम सत्यनिष्ठा से प्रतिज्ञा करते हैं कि अपने सभी कार्यों में पेट्रोलियम उत्पादों के संरक्षण हेतु सतत् प्रयासरत रहेंगे, ताकि देश की प्रगति के लिए आवश्यक ये दुर्लभ संसाधन दीर्घकाल तक टिके रहें। आदर्श नागरिक होने के नाते हम अधिकाधिक लोगों को तेल एवं गैस संरक्षण के प्रति सजग करेंगे ताकि पेट्रोलियम पदार्थों के दुरुपयोग से बचा जा सके।

Chapter 8: Adopt ECBC

The **Energy Conservation Building Code** (ECBC) was developed by the BEE Govt. of India. ECBC sets minimum energy standards for commercial buildings having a connected load of 100kW or contract demand of 120 KVA and above.

While the Central Government has powers under the EC Act 2001, the state governments have the flexibility to modify the code to suit local or regional needs and notify them. Presently, the code is in voluntary phase of implementation. About 22 states are at various stages of mandating ECBC, wherein most of building construction activities are happening across the country.



ECBC for the Existing Building:

In existing Dayanand Science Latur building we could save up to 30 percent of electricity by applying ECBC code. For this we could do retrofitting in the existing building and can make building close to ECBC compliant building.

Energy Audit Studies have revealed a savings **potential to the extent of 40% in end use such as lighting, cooling, ventilation, refrigeration etc.** In order to address this institutional barrier, the Bureau of Energy Efficiency has taken up the task of institutionalizing energy efficiency services, and of promoting energy efficiency delivery mechanisms.

Complementing the efforts of the government of India, the ECBC has been integrated in other rating & compliance systems being followed in the country such as **EIA (Environmental Impact Assessment)** for large area development under **MoEF** (Ministry of Environment & Forest), **Green Rating for Integrated Habitat Assessment (GRIHA)** rating system of **ADARSH** and **Leadership in Energy & Environmental Design (LEED)** rating system of the **Indian Green Building Council (IGBC)**.

Chapter 9 : Establish Energy Park

District level Energy Park is a Public Park for Education + Entertainment =Edutainment.

Objectives for establishing the park are:

- To impart awareness to the public, students, visitors, and beneficiaries about the use of renewable energy, its advantages, and its relation to the environment.
- Demonstrate the technology of various renewable energy devices to educate people on the subject.
- To provide a recreational center integrated with renewable energy education.
- To provide a forum for children to experiment with renewable energy devices.
- To fulfill the partial energy requirement of the park from renewable energy sources.

Educational models of solar energy, Hydel energy and Biogas energy projects etc. which provide information about their basic concepts to these young minds

Install 100 KW Solar Power Generation Plant

- To fulfill the partial energy requirement of the park from renewable energy sources.

Electric Vehicle Solar Charging Stations, EV Chargers

Revenue Projections to the institute from a Typical Public Charging Station.