



Ministry of Petroleum & Natural Gas



Petroleum Conservation Research Association

Energy Audit Report

Dayanand Science College, Latur -413531



Energy Audit Conducted by

Petroleum Conservation Research Association
(Ministry of Petroleum & Natural Gas, Govt. of India)

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Acknowledgements

We thank the Management & Principal Sri Jaiprakash Dargad Dayanand College of Science, Latur for giving PCRA an opportunity to identify the electrical energy consumption pattern, electrical energy utilizing equipment used and to identify scope of energy saving opportunities if any. **Our special thanks to Principal and his team who helped in taking measurements and completing the audit.**

We are thankful all the students, faculty and non-teaching staff who took pain along with us to gather data through survey. We also thank the office staff who helped us during the document verification.

The Energy Audit of the Institute involved measurement by Power Quality Analyser & Visual inspection of various electrical equipment and installations recording their ratings duration of operation etc. and thus identifying existence of any possible energy saving opportunity.

Certain energy saving measures were identified informed to the Electrical department for necessary corrective action.

C.Jayasurya

Additional Director PCRA, WR

Petroleum Conservation Research Association

(Ministry of Petroleum & Natural Gas, Govt. of India)

C-5, Keshava, BKC Complex, Bandra(E)

Mumbai-400 051

1.Executive Summary

DAYANAND SCIENCE COLLEGE LATUR

ECP No	Area	Description	Energy savings pa		Investment	Payback
			KWH	INR lacs	INR lacs	Months
1	HVAC	Installing * rated AC units	34020	3.40	6.60	23.28
2	MOTORS	Installing IE 4 Motors	3326	0.33	0.30	10.82
3	Offic Area	Installing bldc fans	50294	4.33	10.14	28.13
4	Power Quality	Improving effectiveness	31200	3.12	5.00	19.23
5	Solar PV	Improving PV effectiveness	5475	0.55	0.75	16.44
6	Lighting	LED lamps for TLs/ CFL	78694	6.77	3.00	5.32
Total			203008.72	18.50	25.79	16.73
kloe saved per annum			28.91			
mtoe saved per annum			27.18			

2.Introduction and Objective

A detail Energy Audit was conducted Dayanand College of Science in Aug 2019. An energy audit is a study of Institute to determine how and where energy is used and to identify methods for energy savings. 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. The opportunities lie in the greater efforts at energy efficiency and the use of these technologies and options. Therefore an energy audit is a preliminary activity towards instituting energy efficiency programs in an establishment. It consists of activities that seek to identify conservation opportunities preliminary to the development of an energy savings program. Identifying where energy is used is useful because it identifies which areas the audit should focus on and raises awareness of energy use and cost. The results of the analysis can be used in the review of management structures and procedures for controlling energy use.

Important Points to Consider When Collecting Site Load Data

a. **Operating hours** - This can be gathered from Electrical Dept. It is important to ensure the accuracy of this data because much of the potential for energy savings lies on correct estimation of the equipment's operating hours.

b. **Power Quality Analysis** - For electric power users this is based on either 3-phase current/voltage readings or power analyzer measurements. Under Building energy audit exact power consumption has been measured.

The objective of conducting this audit is to identify the electrical energy utilizing equipment their ratings period of use and energy saving potential that exist in this particular institute.

3. Methodology

The Energy analysis was carried out based on walkthrough type Energy audit as well as giving special focus on identifying several areas that have the potential to implement energy savings measures. The following is a list of general procedure followed during the walkthrough energy audit during the Dayanand Science Campus visit:

1. General information gathered regarding the Institute.
2. Identify the electrical equipment utilized for various processes/activities and their ratings.
3. Approximate usage of each equipment per day.
4. Recommendation of energy conservation measures.

General information regarding the Institute its working hours and annual days was enquired with the employees present in the Campus at the time of this energy audit. This included the work pattern followed by the Institute.

The rating operation pattern operation duration of each electrical equipment was recorded and actual operation and condition of equipment was analyzed by simple visual inspection.

Wherever possible the energy saving measures were identified however keeping in mind that accurate measurements are not possible in a walkthrough audit.

Based on the observations energy saving opportunities were analyzed and a simple savings calculation was carried out for justification.

4. General Information about the Institute

Dayanand Science College, Latur, is unique, first oldest and the finest single faculty college in the region of Marathwada, pursuing 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.

5. Electrical Equipment in the Institute

Dayanand Senior Science College:

Sr. No.	Name of Appliance	Wattage	Qty	WATTAGE
1	AC	2200	15	33000
2	Tube light	40	232	9280
3	Fan	60	184	11040
4	Water Cooler	1500	4	6000
5	Computer	200	160	32000
6	LED Panel	22	21	462
7	Exhaust Fan	150	14	2100
8	Oven	2000	12	24000
9	RO Machine	3000	1	3000
10	Smart Board	250	10	2500
10	LIFT		1	4000

Dayanand Junior Science College :

Sr. No.	Name of Appliance	Wattage	Qty	WATTAGE
1	AC	2200	7	15400
2	Tubelight	40	273	10920
3	Fan	60	323	19380
4	Water Cooler	1500	3	4600
5	Computer	200	70	1400
6	LED Pannel	22	120	2640
7	LED Pannel	12	83	996
8	Exhaust Fan	120	8	960
9	LED	50	18	900

6. Alternate Energy Initiatives

The Institute has been installed Solar Power Plant.



Annual Power requirement met by renewable energy Source

30 KW Total Power generated KWH = **54750** units /year

7. Annual Power Requirement

Energy Scenario : Billing

Details

Summary Energy Bill for Twelve Months:

Month & Year	Units	Bill Amount
18-Sep	2,534	25,840.00
18-Oct	5,263	83,330.00
18-Nov	2,309	81,110.00
18-Dec	426	1,110.00
19-Jan	1,988	22,060.00
19-Feb	1,876	41,660.00
19-Mar	2,751	60,880.00
19-Apr	2,241	53,480.00
19-May	3,353	86,620.00
19-Jun	1,439	102,710.00
19-Jul	3,163	33,170.00
Total	27,343	591,970
Solar Power Generation	KWH	54000
Total Power Consumption	KWH	645,970

Percentage of Annual Power requirements met Renewable Energy Sources
(Current year data)

% of annual power requirement of the institution met by renewable energy sources =	$\frac{\text{Annual power requirement met by renewable sources}}{\text{Annual Power requirement}} \times 100$	
--	---	--

= 8.36 %

Percentage of Annual Lighting Power requirements met through LED bulb (Current year data)

LED Panel	22 Watt	21 Nos.
LED Panel	22 Watt	120 Nos.
LED Panel	12 Watt	83 Nos.
LED	50 Watt	18 Nos.
		Total LED KW

Total Lighting Power requirement

Tube Light CFL(KW)	20.2
LED Bulb (KW)	4.998
TOTAL LIGHTING LOAD (KW)	25.198

Percentage of Annual Lighting power requirement met through LED Bulbs (Current Year Data) = 24.62 %

Average Percentage Expenditure on Green Initiatives & Waste Management Last Five Years (Excluding Salary)

Year	2015	2016	2018	2019	Total	
INR in Lakhs	6	7	5	7	25	
% per year	24.00	28.00	20.00	28.00	100	
% per year	<u>Total expenditure on Green initiatives& waste management</u>					

Annual expenditure on Green initiatives and waste management

9. POWER QUALITY ANALYSIS:



POWER QUALITY ANALYSIS

Name of Unit :



Dayanand Education Society's

Dayanand Science College, Latur

Affiliated to Swami Ramanand Teerth Marathwada University, Nanded

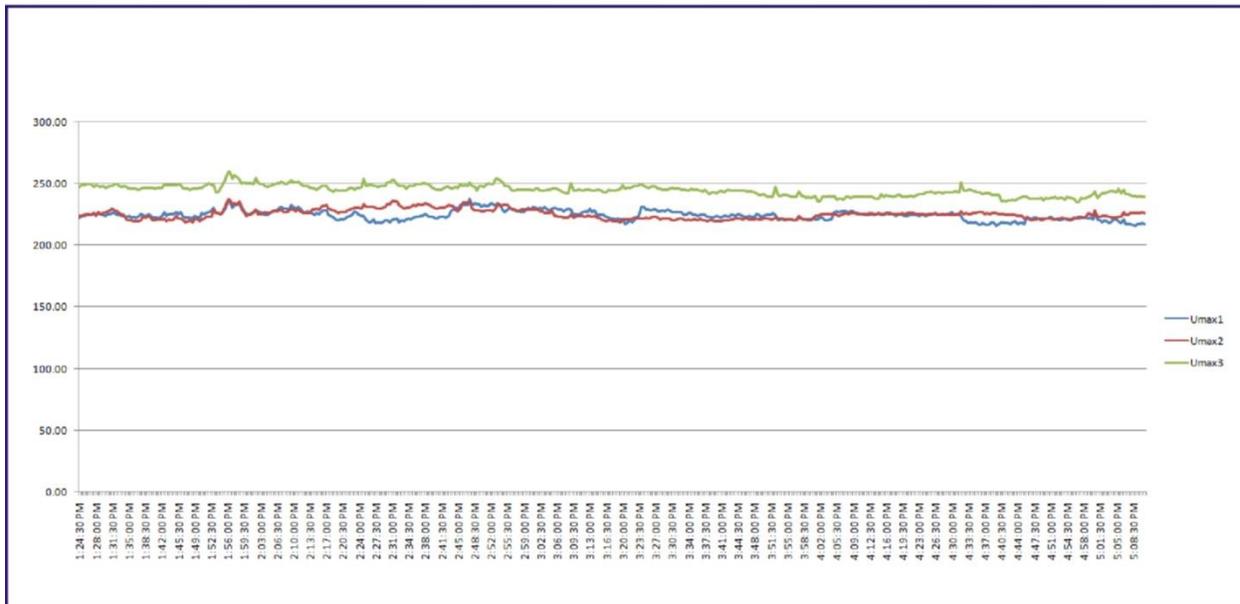
"॥ श्री गणेशाय नमः ॥"

Address : Barshi Road, Latur

Electrical System Network :

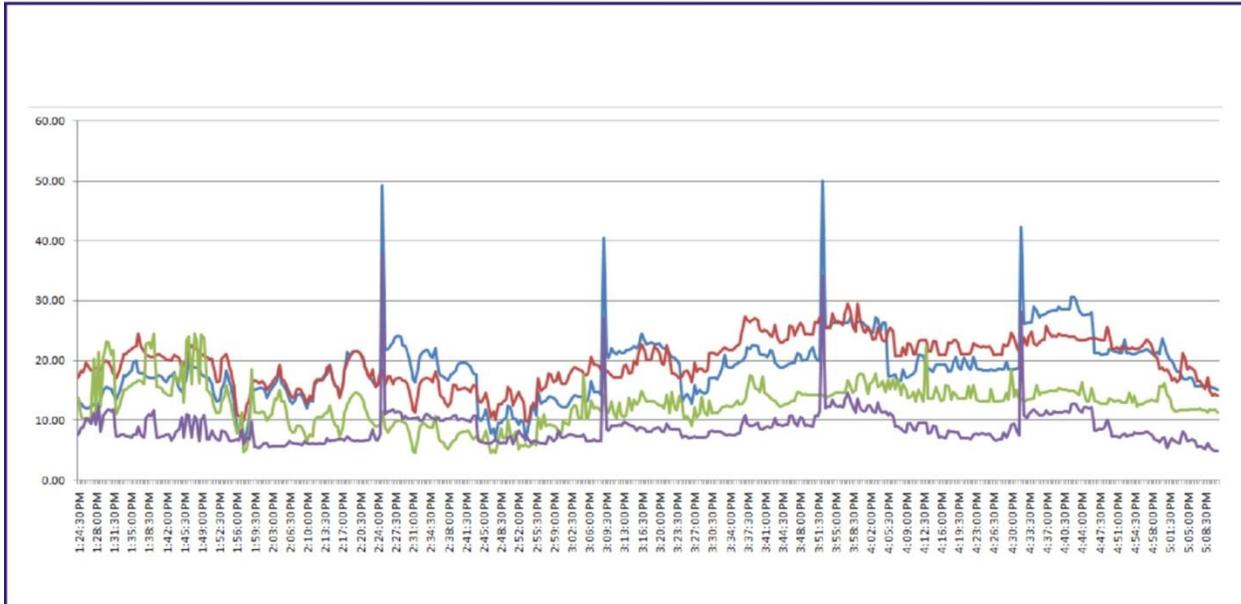
Include detailed study of all the Transformer operations of various Ratings / Capacities, their operational pattern, Loading, No Load Losses, Power Factor Measurement on the Main Power Distribution Boards and scope for improvement if any. The study would also cover possible improvements in energy metering systems for better control and monitoring.

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



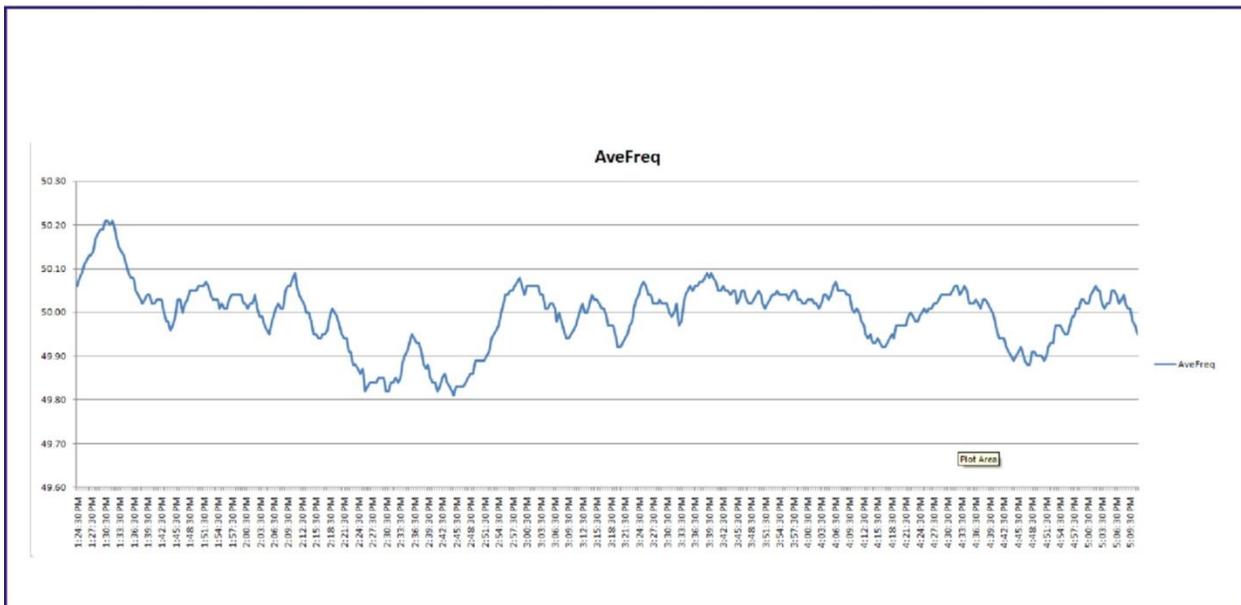
Voltage	MAX - U1-----	255.8	MAX - U2-----	253.4	MAX - U3-----	255.4
	MIN - U1----	238.7	MIN - U2----	239.6	MIN - U3----	235.8

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



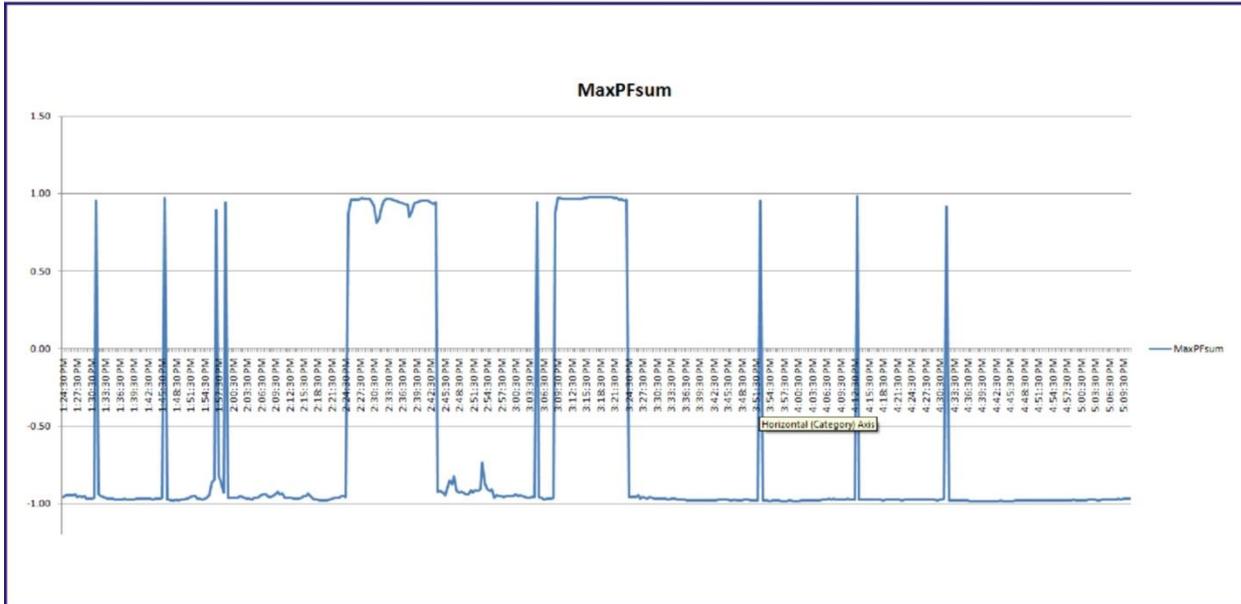
Current (I) : MAX - I-1----- 49.97 MAX - I-2----- 29.55 MAX - I-3----- 24.49 MAX - I-4----- 37.91
 MIN - I-1----- 6.59 MIN - I-2----- 9.67 MIN - I-3----- 4.52 MIN - I-4----- 5.47

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



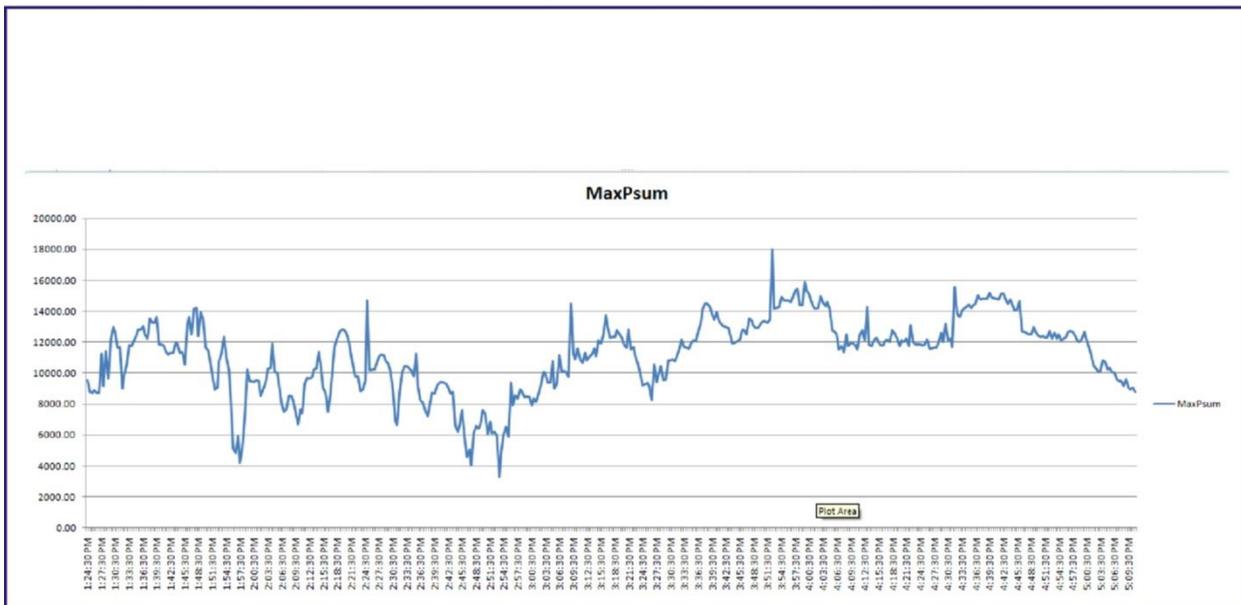
Frequency (Hz) : Max : 50
 Min. 49.81

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



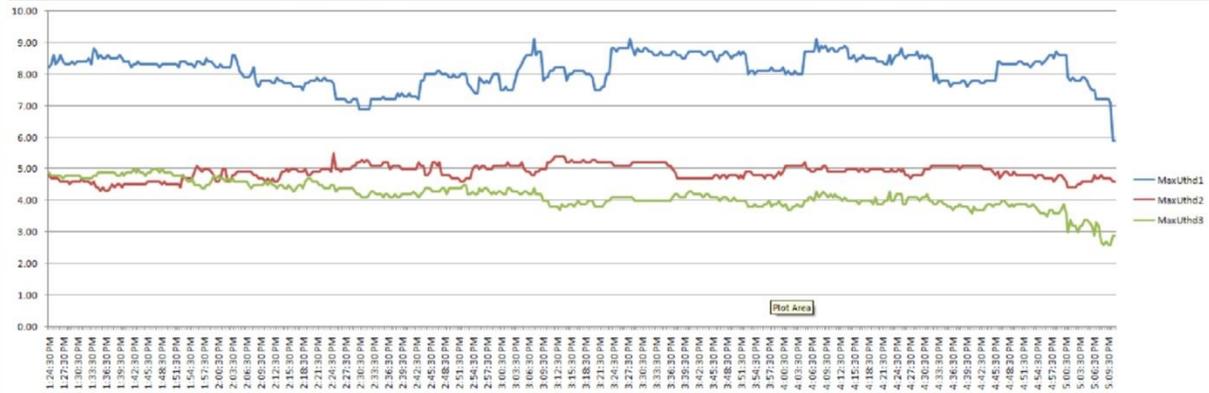
Power Factor Max : 0.98

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



KW Max : 18.010
 Min : 3.300

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



THD Voltage

U1 Max : 9.10
 U1 Min : 5.90

U2 Max : 5.50
 U2 Min : 4.30

U2 Max : 5.0
 U2 Min : 2.60

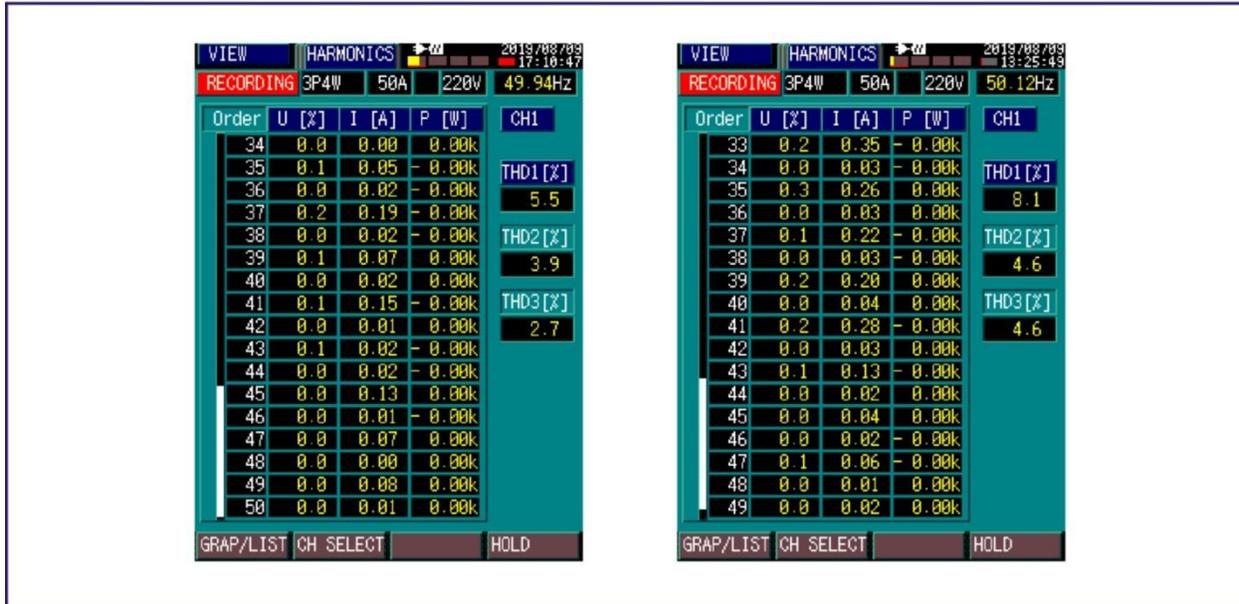
Name of Unit : Dayanand Science College, Latur
 Address: Barshi Road, Latur



Order	U [%]	I [A]	P [W]	CH1
1	100.0	11.34	2.40k	
2	0.3	0.10	0.00k	THD1 [%]
3	4.9	2.02	0.01k	8.1
4	0.1	0.06	0.00k	THD2 [%]
5	4.1	1.30	0.01k	4.6
6	0.2	0.03	0.00k	THD3 [%]
7	3.7	1.47	0.00k	4.7
8	0.2	0.09	0.00k	
9	0.8	0.44	0.00k	
10	0.1	0.04	0.00k	
11	1.8	0.33	0.00k	
12	0.1	0.03	- 0.00k	
13	1.5	0.84	- 0.00k	
14	0.1	0.10	0.00k	
15	1.5	0.57	0.00k	
16	0.1	0.08	- 0.00k	
17	1.0	0.65	0.00k	

Order	U [%]	I [A]	P [W]	CH1
17	0.9	0.63	0.00k	THD1 [%]
18	0.1	0.07	0.00k	8.2
19	0.5	0.60	0.00k	THD2 [%]
20	0.1	0.06	0.00k	4.6
21	1.0	0.54	0.00k	THD3 [%]
22	0.1	0.05	- 0.00k	4.7
23	0.5	0.39	- 0.00k	
24	0.0	0.04	0.00k	
25	0.2	0.21	0.00k	
26	0.0	0.04	0.00k	
27	0.1	0.08	0.00k	
28	0.0	0.03	0.00k	
29	0.1	0.16	- 0.00k	
30	0.0	0.02	- 0.00k	
31	0.3	0.17	0.00k	
32	0.0	0.03	- 0.00k	
33	0.2	0.39	0.00k	

THD Current 8.2%



THD Current 8.1%

‘Total Harmonics Distortion’ – THD - % was measured for both Voltage & Current. Summary of all the measurement data is tabulated in TABLE

Along with THD - % measurement data, % loading on the Transformer is also mentioned.

10. Environmental Consciousness and Sustainability

Power Required met by renewable energy sources	Total Power requirement	Renewable Energy Source	Renewable Energy generated & Used	Energy Supplied to Grid
54000 KWH	645,970 KWH	30 KW	54000 KWH	-NA-

11. Energy Conservation Measures:

11.1 Installing 5* AC s

BEE has introduced * rating for AC units. This leads to a higher EER. Replacing the AC units in the station complex and offices would lead to a saving of Rs 3.40 lacs and with an investment of Rs6.60 lacs, the ROI on straight line basis would be 23.28 months.

11.2 Installing IE 4 Motors

Presently IE 4 Motors are available with an efficiency of about 98%. It is proposed that the existing old Motors are replaced with the new high efficiency Motors. Rewinding of Motors leads to loss of efficiency by about 8% every time.

A saving of Rs0.33 lacs and with an investment of Rs .30 lacs, the ROI on straight line basis would be 10.82 months.

11.3 Installing bldc Fans

Today brushless DC (bldc) fans are available, for replacement of all types of fans. The fans in use today are to be replaced with bldc fans.

With an investment of Rs 4.33 lacs, the savings are Rs10.14 lacs per annum and the ROI on st line basis is 28.13 months.

11.4 Improving Power Quality

The THD of Power is high. It is suggested that appropriate filters are installed to improve power quality.

With an investment of Rs3.12 lacs, the savings are Rs 5 lacs per annum and the ROI on st line basis is 19.23 months.

11.5 Solar PV improving effectiveness

Solar PV panels are in place at Dayanand College Latur. The average generation per day is about 150 kWh, which is good. However, for better effectiveness, a sprinkler system with surfactant dosing is proposed. This would lead to a generation of about 10 kWh per day.

The proposal would lead to a saving of Rs.055lacs and with an investment of Rs0.75 lacs, the ROI on straight line basis would be 16.44 months.

11.6 Installing LED lamps

Today LED lamps are available, for replacement of all types of TLs/ CFLs, of all Wattages. The TLs/ CFLs lamps in use today are to be replaced with suitable lamps. The no of lamps with LED is about 60% of the original nos. This is possible due to higher CRI – colour rendering index and reorientation of lamps, thereby ensuring lux levels.

With an investment of Rs 3.0 lacs the savings are Rs 6.77 lacs per annum and the ROI on st line basis is 5.32 months.

12. Energy Conservation Opportunities – Work Sheets

Energy Conservation Opportunity 1: Installation 5 * AC s

Installing 5* rated ACs			
AC Units			2 TR
Total Nos.			22
TR rating			2
The Star rating of AC s as per BEE			2*
Star Rating	EER (W/W)		
	Min	Max	
nil	1.70	2.10	
1*	2.70	2.89	
2**	2.90	3.09	
3***	3.10	3.29	
4****	3.30	3.49	
5*****	3.50		
With no star/ 2 * rating today power consumed			53.35 kw/Hr
Same with 5 * rating units would be			44.20 kw/Hr
Savings possible/ Hr			9.15 kw/Hr
No of Hrs per day			12
No of days per year			310
Cost per unit			10.00
Savngs in kWh			34019.64 KWH/ANNUM
Savings possible per annum			3.40 lac Rs
Investment			6.6 lac Rs
ROI			23.28 months

Energy Conservation Opportunity 2: Installation of IE 4 Motors

Pumps of 5 - 10 HP	3.00	nos
No of hrs running/ day	4.00	hours
Savings/ day with IE 4 Motors	12.00%	
Presnt Power Consumption/ day	89.40	kWh
Saving possible / day	10.73	kWh
Savings/ year	3325.68	kWh
Savings in Rs/ year	0.33	lac Rs
Investment for 3 IE 4 Motors	0.3	lac Rs
ROI on st line basis	10.8	months

Energy Conservation Opportunity 3: Installation of BLDC Fans

Ordinary Energy Fan Power Consumption	60	W
Energy Efficient Fan Power Consumption	28	W
No.of Working Hrs per Day	10	
No.of Working days per Annum	310	
No. of Fans	507	
KWH Saving per annum	50294.4	
Savings in Re terms	4.33	lac Rs
Cost of fans	10.14	lac Rs
ROI on st line	28	months

Energy Conservation Opportunity 4: Improving Power Quality

Present power consumption/ month						
	Senior Collge				24000	kWh
	Junior College				2000	kWh
Total					26000	kWh
Saving possible with power quality improvement					10.00%	
Saving possible per annum					31200	kWh
Savings Rs lacs/ annum					3.1	
Investment Rs lacs					5	
ROI on st line basis					19.23	months

Energy Conservation Opportunity 5: Improving PV Panel effectiveness

Present generation	150	kWh/day
Additional generation possible @ 10%	15.00	
	5475.00	kWh/annum
Savings/annum in lac Rs	0.55	
Investment for sprinkler	0.6	lac Rs
Investment for Softener	0.15	lac Rs
Total investment	0.75	lac Rs
ROI on st line basis	16.4	months

Energy Conservation Opportunity 6 :Installing LED lamps

	T5/ CFL	LED
	22 W	11 W
Power Con in Watts	22	11
No of Lights installed*	1000	600
Power in KW	22000	6600
Per day in hrs	14	14
365 days per year KWH	112420	33726.00
Difference with LED		78694.00
Unit cost @ Rs 8.60	966812.00	290043.60
Savings per annum		676768.40
Cost of lamp & Ballast		300000
Pay Back in months		5.32
Saving in 1st Year Rslacs		3.77
Net saving in 5 years Rslacs		30.84
* considering CRI of 70 + for LED as against 40 for TL CFL and reorientation		

Conclusion:

Energy Audit of Dayanand College of Science has been conducted and analysis were made based on the observations.

Energy conservation measures were identified and the particular suggestions and their feasibility have been informed to the concerned person in the Institute.

Certificate



PCRA team has been Conducted Detailed Energy Audit of **M/s Dayanand Science College** Building Located at Latur-District Maharashtra during Aug 2019

During Energy Audit We have found Environmental Consciousness and Sustainability initiatives in their Campus.

1. Percentage of Annual Power requirements met Renewable Energy Sources
Current year data is 8.36%
2. Percentage of Annual Lighting power requirement met through LED Bulbs
(Current Year Data) is 24.62 %
3. Average Percentage Expenditure on Green Initiatives & Waste Management
Last Five Years Excluding Salary is 39 %



C. Jayasurya

Additional Director PCRA, WR

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