

**Maratha Vidya Prasarak Samaj's
S.V.K.T. Arts, Science & Commerce
College, Deolali Camp- 01**

(MAHARASHTRA)

Internal Quality Assurance Cell(IQAC)

**Energy Audit Report
(2018-19)**



Prepared by



SOLASTA

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Date: 15/06/2019

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Preface

Data collection for energy audit of the **MVP'S S.V.K.T. Arts, Science & Commerce College, Deolali Camp** was approved by team for the period of July 2018 to June 2019.

This audit was over sighted to inquire about convenience to progress the energy competence of the campus. Energy audit survey was completed by the firm **SOLASTA Energy Solutions , Services & Maintenance** with the help of faculty members of Physics Department. Data was collected for each classroom, laboratory, office, library and of the campus. The work is completed by considering how many tubes, fan, A.C.'s, electronic instruments, etc. installed in every room. While preparing the energy audit report. New load/changes in load if any, and its participation in total electricity consumption was taken in consideration.

We really appreciate the effort put by MVP'S management for creating awareness of Energy Audit, Use of renewable energy such as solar energy and its roll in energy saving amongst all of us. We really appreciate Hon. Management of the college for encouraging us by providing this opportunity to do the energy audit and participate in the energy saving program. Through this, we have been cleared the vision of Institution towards the Green campus and save our nature. We really appreciate for various efforts taken by the college.

Acknowledgement

We are very much thankful to **Principal Dr. V.J. Medhane Sir** and **IQAC coordinator, NAAC Pf. Mr. A.S. Kale** for motivating us and giving us the opportunity for energy audit. our sincere thanks to faculty members of Physics Department for **Pf. Kiran Mojad** and all respected staff, faculty members and students who have taken part in this audit survey etc. of MVP'S S.V.K.T. Arts, Science and commerce College, Deolali Camp ,Nashik. We tried our best to present this energy report as per requirements of college and our expertise work.



Main Building

Summary

The objective of the audit was to study the energy consumption pattern of the college, 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:

MVP'S S.V.K.T. Arts, Science & Commerce College, Deoali Camp, Nashik uses energy in the following forms:

- a. **From MSEDCL**
- b. **High Speed Diesel Generator (HSDG)**
- c. **Solar On grid System 15kWp**

Electrical energy is used for various applications, like: Computers, Lighting, Air-Conditioning, Fans, Laboratory Equipment, Printers, Xerox machines, UPS, LCD Projector, Router system, Flood light, Street Lights, Pumping motor etc.

After the measurement and analysis, we propose herewith following Chapter regarding the efficient use of energy:

Abbreviations

AHU	Air handling unit
APFC	Automatic Power Factor Controller
ECP	Energy Conservation Proposal
MD	Maximum Demand
HSDG	High speed diesel Generator
MSEDCL	Maharashtra State Electricity Distribution Co.Ltd.
Co2	Carbon Di-Oxide
FTL	Fluorescent Tube Light/ Faster Than Light
LT/HT	Low Tension/ High Tension
BU	Billing Unit
kW	Kilo watt
kVA	Kilo Volt Ampere

Chapter: 1

Introduction to Energy Audit

- **General:**

The MVP'S S.V.K.T. Arts, Science & Commerce College, Deolali Camp, Nashik entrusted the work of conducting a detailed Energy Audit of campus with the main objectives as given below:

- ✓ 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 equipments. The key to such performance evaluation lies in the sound knowledge of performance of equipments 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.

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. 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.

Chapter: 2

About Institute

Sr. No.	Particulars	Details
1	Name of the Institute:	Maratha Vidya Prasarak Samaj's Shrimati Vimlaben Khimji Tejookaya (S.V.K.T.) Arts , Commerce and Science College, Deolali Camp, Nashik
2	Address:	Naka No.6 , Lam road ,Deolali Camp , Nashik -422401 Maharashtra State, India.
3	Affiliation:	Affiliated to Savitribai Phule, Pune University,Pune-07 Affiliation ID No. PU/NS/A SC/029/(1984)
4	Year of Establishment:	1984
5	NAAC Accrediation:	NAAC REACCREDITED "A" GRADE with CGPA 3.10 AISHE: C-41392
6	Contact:	Phone : 0253-2473132 Email :svktcollege@yahoo.co.in Website :www.mvpsvktcollege.ac.in
7	Courses Offered:	Graduate / Post Graduate B. A./B.Com./B.Sc. (3 Years) M. A. Economics (2 Years) M.COM.(2 Years)

Chapter: 3

Energy Consumption Profile

3.1 Source of Energy:

MVP'S S.V.K.T. Arts, Science And Commerce College, Deolali Camp, Nashik uses Energy in following forms:

A. Electricity from MSEDCL :

MVP'S S.V.K.T. Arts, Science And Commerce College , Deolali Camp, Nashik receives Electricity from 4671/ Deolali S/DN. NASIK URBN DIV. II :

B. High Speed Diesel Generator 15 kVA :

HSDG is used as a Diesel Generator which is run whenever power supply from MSEDCL is not available. Generator is of Kirloskar make, 3 phase, AC and rated output Voltage is 15kVA OF 50Hz frequency, 20.5 bhp of 1500RPM, But It Rarely in use by college.



Diesel Generator (15kVA)

C. Solar On-grid Rooftop System:



Solar On Grid (15kWp)

3.2 Following are the major consumers of electricity in the facility:

- Computers
- Lighting
- Air-Conditioning systems
- Fans
- Laboratory Equipment
- Printers
- Xerox machines
- UPS
- LCD Projector
- Flood light
- Pumping motor



Administrative Office



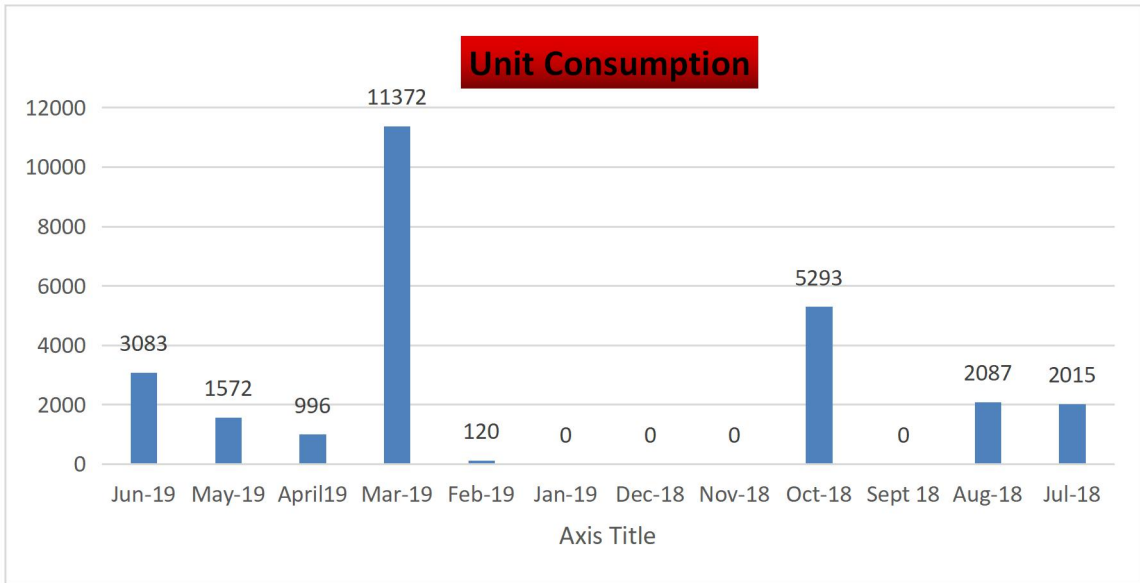
Computer Lab

Chapter: 4

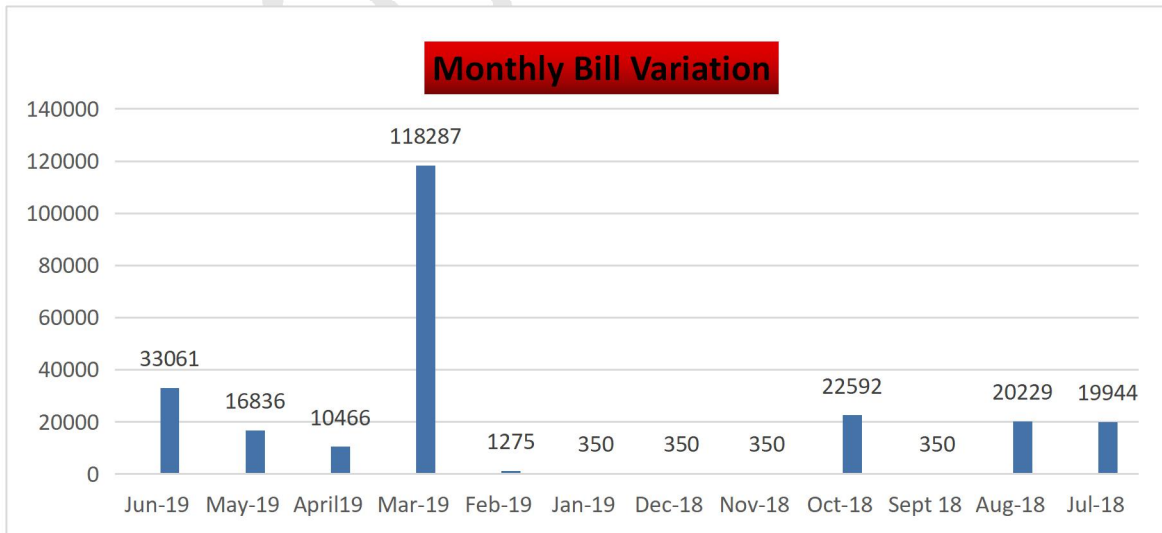
Data Analysis

Sr. No.	Month	No. Units kWh	Electricity Bill Amount (Rs.)
1.	June 19	3083	33061
2.	May 19	1572	16836
3.	April19	996	10466
4.	Mar 19	11372	118287
5.	Feb 19	120	1275
6.	Jan 19	0	350
7.	Dec 18	0	350
8.	Nov 18	0	350
9.	Oct 18	5293	22592
10.	Sept 18	0	350
11.	Aug 18	2087	20229
12.	July 18	2015	19944
	Total Units & Bill Amount	26538	₹ 244090
	Avg. Of Unit & Bill Amount	2211	₹ 20340

Conclusion : Monthly Unit Consumption & Electricity Bill Variation has been identified.



Month wise unit consumption



Month Wise Electricity Bill Variation

Chapter: 5
Actual Measurements and its Analysis

Summary:-

Sr. No.	Name of Appliance	Power Rating (Watt)	Quantity	Power Consumption (Watt)	Usage per Day Hr.	Power Consumption/day (Watt)
A	B	C	D	E = C X D	F	G = E X F
1	FTL	40	164	6560	6	39360
2	Fan	80	70	5600	6	33600
3	PC	60	42	2520	6	15120
4	Printer: Standby mode:30-50w	printing mode:300-500w	15	4500	2	9000
5	LED 18 W	18	8	144	2	288
6	Xerox machine	650	1	650	2	1300
7	Fax machine	30	1	30	2	60
8	Air Condition	3500	4	14000	2	28000
9	Online UPS 10kVA &8kVA	Total 28 Batteries of 80Amp-hr	2	18000	4	72000
10	Water Cooler	2-8kwh/Day	1	2800	1	2800
11	RO system	3-7kwh/m3	1	3000	1	3000
12	Flood Lights	300	8	2400	12	28800
13	LCD Projector	282	7	1974	2	3948
14	Charging socket	23	34	782	2	1564
15	Exhaust fan	60	15	900	6	5400
16	Electric bell	5	1	5	1	5
17	Refrigerator	2kwhr/day	1	2000	6	12000
18	Pumping motor	1.0 HP	1	746	2	1492
19	DG Gen set	15KVA	1	AS PER USE		AS PER USE
20	Solar ON-Grid Power Plant	15.36kW	1	15.36kW	12	15.36kW

Department wise Load Analysis:

1) Principal Office/Cabin:

Sr. No.	Name of Appliance	Power Rating (Watt)	Quantity	Power Consumption (Watt)	Usage per Day Hr.	Power Consumption/day (Watt)
A	B	C	D	E = C X D	F	G = E X F
1	FTL	40	6	240	6	1440
2	Fan	80	2	160	6	960
3	PC	60	1	60	2	120
4	Printer Standby mode: 30- 50w/	Printing mode: 300- 500w	1	30	2	60
5	AC	3500	3	10500	2	21000
6	Bell	5	1	5	6	30
7	LED TV	50	1	50	6	300

2) Administration Office:

Sr. No.	Name of Appliance	Power Rating (Watt)	Quantity	Power Consumption (Watt)	Usage per Day Hr.	Power Consumption/day (Watt)
A	B	C	D	E = C X D	F	G = E X F
1	FTL	40	11	440	6	2640
2	Fan	80	9	720	6	4320
3	PC	60	9	540	6	3240
4	Printer Standby mode: 30- 50w	printing mode:300- 500w	6	180	6	1080
5	Xerox machine	650	1	650	1	650
6	Fax Machine	30	1	30	2	60
7	Charging socket	23	8	184	2	368
8	Air Condition	3500	1	3500	1	3500

3) IQAC Office:

Sr. No.	Name of Appliance	Power Rating (Watt)	Quantity	Power Consumption (Watt)	Usage per Day Hr.	Power Consumption/day (Watt)
A	B	C	D	E = C X D	F	G = E X F
1	Fan	80	2	160	6	960
2	PC	60	1	60	6	360
3	Printer: Standby mode: 30- 50w	printing mode:300- 500w	1	30	6	180
4	FTL	40	4	160	6	960

4) Meter ,Battery Room/Store Room:

Sr. No.	Name of Appliance	Power Rating (Watt)	Quantity	Power Consumption (Watt)	Usage per Day Hr.	Power Consumption/day (Watt)
A	B	C	D	E = C X D	F	G = E X F
1	FTL	40	2	80	1	80
2	Fan	80	1	80	1	80
3	Online UPS	10kVA	1	10000	4	40000

5) Staff Room:

Sr. No.	Name of Appliance	Power Rating (Watt)	Quantity	Power Consumption (Watt)	Usage per Day Hr.	Power Consumption/day (Watt)
A	B	C	D	E = C X D	F	G = E X F
1	FTL	40	4	160	6	960
2	Fan	80	2	160	6	960

6) Department & Labs of I.T.(Computer), Physics, Electronics etc.:

Sr. No.	Name of Appliance	Power Rating (Watt)	Quantity	Power Consumption (Watt)	Usage per Day Hr.	Power Consumption/day (Watt)
A	B	C	D	E = C X D	F	G = E X F
1	FTL	40	16	640	6	3840
2	Fan	80	14	1120	4	4480
3	PC	60	23	1380	6	8280
4	Printer Standby mode: 30- 50w/	printing mode:300-500w	2	60	2	120
5	UPS	8 KVA,	1	8000	4	32000
6	Charging socket	23	6	138	2	276
7	Exhaust Fan	60	9	540	6	3240
8	Projector	282	3	846	2	1692

7) Chemistry Lab:

Sr. No.	Name of Appliance	Power Rating (Watt)	Quantity	Power Consumption (Watt)	Usage per Day Hr.	Power Consumption/day (Watt)
A	B	C	D	E = C X D	F	G = E X F
1	FTL	40	9	360	6	2160
2	Fan	80	4	320	6	1920
3	Exhaust Fan	60	6	360	6	2160
4	Refrigerator	2kwhr/day	1	2000	6	12000
5	PC	60	1	60	2	120
6	LED 18 W	18	2	36	6	216
7	Charging Socket	23	4	92	6	368

8) Department of Botany/Zoology, Microbiology and Labs:

Sr. No.	Name of Appliance	Power Rating (Watt)	Quantity	Power Consumption (Watt)	Usage per Day Hr.	Power Consumption/day (Watt)
A	B	C	D	E = C X D	F	G = E X F
1	FTL	40	13	520	6	3120
2	Fan	80	4	320	6	1920
3	Projector	282	2	282	2	564

9) Dept. of Commerce:

Sr. No.	Name of Appliance	Power Rating (Watt)	Quantity	Power Consumption (Watt)	Usage per Day Hr.	Power Consumption/day (Watt)
A	B	C	D	E = C X D	F	G = E X F
1	FTL	40	3	120	6	720
2	Fan	80	2	160	6	960
3	LED 18w	18	2	36	6	216

10) Library, and Porch, Passage, College Premises, Staircase:

Sr. No.	Name of Appliance	Power Rating (Watt)	Quantity	Power Consumption (Watt)	Usage per Day Hr.	Power Consumption/day (Watt)
A	B	C	D	E = C X D	F	G = E X F
1	FTL	40	16	640	6	3840
2	Fan	80	2	160	6	960
3	PC	60	1	60	6	360
4	Printer: Standby mode: 30-50w	printing mode: 300- 500w	1	30	2	60
5	Flood Lights	300	8	2400	12	28800
6	Water Cooler	2.8kwh/day	1	2800	1	2800
7	RO System	3-7 kWhr /m3	1	3000	1	3000
8	LED 18W	18 W	4	72	6	432

11) Dept. Of Marathi, Maths, English, Geography ,NCC,Poly. Science & Total Classrooms:

Sr. No.	Name of Appliance	Power Rating (Watt)	Quantity	Power Consumption (Watt)	Usage per Day Hr.	Power Consumption/day (Watt)
A	B	C	D	E = C X D	F	G = E X F
1	FTL	40	80	3200	6	19200
2	Fan	80	28	2240	6	13440
3	PC	60	6	360	6	2160
4	Printer	30	4	120	1	120
5	Charging socket	23	22	506	2	1012
6	Projector	282	2	564	2	1128
7	Pumping motor	1.0 HP	1	746	2	1492
8	DG Gen set	15KVA	1	AS PER USE		AS PER USE

Lighting System Analysis:

Observations and suggestions:

- It is found that FTL, Bulbs, CFLs are installed in the facility.
- It is recommended that some tube lights in this area need to be switched off when sufficient daylight is available.
- Presently there are no reflectors installed for tube lights.
- Every light or electric gadget left ON when not needed which is wasting energy and money and is causing pollution that is totally unnecessary.
- **Stand-by power can use up to 8% of a household's total electricity.**

For most homes a 10% reduction in electricity consumption can save Rs.15000 a more a year off our electricity bill and nearly $\frac{3}{4}$ of a ton of CO₂ pollution. A 20% reduction on average consumption will save over Approximately Rs.30,000 and over 1.5 tones of CO₂.

Don't forget to power down these things when not in use:

- Lights,Bulbs
- Heaters and fans (or air-conditioning)
- Printers and scanners
- Battery and phone chargers
- Computers
- LED, Projector
- PA System

Chapter: 6

Study of Air Conditioners

In the facility for air conditioning there is no centralized system with AHU (air handling unit), but mostly split air conditioners are installed.

Load of Air Conditions was as follows:

Item	Rated Power (kW)	Qty	Voltage	Current Amp	Actual Power (kW)
ACs	4	4	406	8.4	3.5

Observations and suggestions:

1. Normal air conditioning temperature should be kept as high as possible (i.e. 24 Deg. cel.) By thumb rule, increase in 3 degrees in indoor air temperatures can save 1% of electricity.
2. The ventilation in area can be provided with installation of natural ventilation. Natural ventilation will also minimize the requirement of exhaust fans.

Chapter: 7

Carbon Di-Oxide Emission

In this Chapter we compute the CO₂ emissions. For consumption of 1 Unit (1 kWh) of Electricity, the CO₂ emitted is 0.8 Kg. OR the Emission is 0.8 Kg/kWh. In the following

Table we present the total units consumed and CO₂ emitted as under:

CO₂ Emission Variation:

Month wise CO₂ Emission Chart:

Sr. No.	Month	kWh	CO₂ Emitted in Kg
1	June 19	3083	24.66
2	May 19	1572	12.57
3	April 19	996	7.96
4	Mar 19	11372	90.97
5	Feb 19	120	0.96
6	Jan 19	0	0
7	Dec 18	0	0
8	Nov 18	0	0
9	Oct 18	5293	42.34
10	Sept 18	0	0
11	Aug 18	2087	16.69
12	July 18	2015	16.12
	Total	26538	Avg. Emission = 17.68

Merits/Existing Features for Energy Saving in College Campus:

1. Computers are connected in LAN.
2. Printers are shared in LAN.
3. Screen savers facility implemented for every computer.
4. ACs used are of three STARS.
5. Refrigerators are of three STARS.
6. They are replacing by CFL tubes from electronic choke.
7. Maximum use of natural light is considered.
8. Cross Ventilation is provided in laboratory & class rooms.
9. Walls are painted with off white colour to have sufficient brightness
10. Solar powered street lamp is used.
11. LED light/Flood lights are used in Seminar hall.
12. Energy Saving Displays are observed in labs, class rooms.

Chapter: 8

Energy Conservation Proposals

Providing Energy Saver Circuit to the Air Conditioners:

The **energy saver circuits for the air conditioners, intelligently reduces the operating hours** of the compressors either by timing or temperature difference logic without affecting the human comfort. This can save around 15% to 30% of the electricity depending on the weather conditions and temperature settings.

There are total 4 split type air conditioners. It is Recommended that the old air conditioners are being replaced with new energy efficient BEE STAR labeled (3 Star and above) air conditioners in a phased manner.

- Considering the average compressor ON Time = 2h/day
- Power consumption by 2 TN compressor = 3.5kW
- Average daily consumption = $3.5 \times 2 = 7$ hr
- kWh/day/ air conditioner Yearly operating days = 300 days/year/ air conditioner
- Yearly electricity consumption = 2100 kWh/year/ air conditioner
- Considering a saving of 15%, total annual savings
= $15\% \times 2100 = 315$ kWh/year/ air conditioner
- *Cost of electricity = Rs. 6.80 / kWh
- Yearly Saving = $6.80 \times 315 =$ Rs.2142/Year/Air Condition
- Total number of Air Conditioner =4

Summary For Energy Saver Circuit:

Total Cost of each energy saver circuit = Rs. 4500 x 4 = Rs. 18000/-

Total Yearly Saving = 4×315 /Year= Rs. 1260/ Year

Replacing Fluorescent Tube Lights (FTL) with LED Tube Lights:

The 164 Watt FTLs can be replaced with the LED tube lights 20 W. These changes can be made at the places where the life is higher. Usually minimum of 3 years warranty is given and approximate burning hours is 40000.

(15 years considering 8 hours per day running)

Following calculations are done for 8 hours working:

- Power consumption by 36 W FTL with conventional choke = 40 W/ Tube Light
- Equivalent LED tube light = 20 W/ Tube Light
- Savings in power = 20 W/ Tube Light
- Operating hours = 6 h/day x 300 = 1800 h/year
- Tube Light Yearly savings = 1800 x 20 W = 36kWh/year/Tube Light
- Average Cost of electricity = Rs.6.80/ kWh
- Saving = 36 kWh x 6.80 = Rs.244.8/ year/ Tube light
- Approximate investment on single LED Tube lights = Rs. 200
- Number of Tube Lights to be replaced = 164

Summary For FTLs:

Total Yearly Saving = 164 x 244 = Rs. 40016/year

Total Investment = 164 x Rs. 200 = Rs. 32800/ONLY

CHAPTER: 9

Energy Saving Recommendations

General Recommendations:

- All Class Rooms and labs to have More **Display Messages** regarding optimum use of electrical appliances in the room like, lights, fans, computers and projectors. Save electricity. **Display the stickers of save electricity, save nature** everywhere in the campus. So that all stakeholders encouraged to save the electricity
- Care should be taken to keep lights in classroom off and keep ON whenever necessary.
- All projectors must be keep OFF when not in use or in stand by mode if there is No any presentation work is scheduled
- All computers to have power saving settings to turn off monitors and hard discs, say after 10 minutes/30 minutes.
- The Default air conditioning temperature must be set between 24°C to 26°C.
- Need to replace existing ordinary CRT monitor by LED where ever still in use.

Executive Recommendations:

1. 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

2. Energy auditing inside the campus has to be done on a regular basis and report should be made public to generate awareness.

3. Need to Create energy efficiency/ renewable energy awareness among the college campus i.e. solar, wind, Biogas energy. College should take initiative to arrange seminars, lectures, among students and staff for general awareness.

References:

References:

- 1) "Energy Management, Audit and Conservation" by Barun Kumar De
- 2) "Guide to Energy Management" by Barney L
- 3) "Energy Audits: A Workbook for Energy Management in Buildings" by Tarik Al-Shemmeri
- 4) "Fundamentals of Energy Conservation and Audit" by Agarkar Santosh Vyankatro and Mateti Naresh Kumar
- 5) "Industrial Energy Conservation (UNESCO Energy Engineering)" by Charles MGottschalk



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WORK COMPLETION REPORT

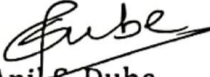
- Name of Work Project : Energy Audit of MVP'S S.V.K.T.
Arts, Science and Commerce College,
Deolali Camp-01
- Work Order Number : 2018-19
- Work Period : From 01/06/2019 To 13/06/2019


This is to Certify that SOLASTA Energy Solutions, Services & Maintenance has successfully completed Energy audit at S.V.K.T. Arts, Science & Commerce College, Deolali Camp-01. The work of energy audit is completed on 15/06/2019 for year 2018-19.

Thanking you and assuring you for our best service always.

Audit Report By,

FOR SOLASTA,


Er. Anil S. Dube
Er. Anil S. Dube
BEE Certified Energy
Auditor
Regn.No.EA-4973


Energy Solutions, Services & Maintenance
Mr. Pushpendra P. Pagar
Proprietor



Page 1

Regn. No. EA-4973

No. 2487



National Productivity Council
(National Certifying Agency)
PROVISIONAL CERTIFICATE

This is to certify that Mr. / Ms. **Anil Siddhanarayan Dube**
son / daughter of Mr. **Siddhanarayan Dube**

has passed the National Certification Examination for Energy Auditors in 2006, conducted on behalf of the Bureau of Energy Efficiency, Ministry of Power, Government of India.

He / She is qualified as Certified Energy Manager as well as Certified Energy Auditor.

He / She shall be entitled to practice as Energy Auditor under the Energy Conservation Act 2001, subject to the fulfillment of qualifications for the Accredited Energy Auditor and issue of certificate of Accreditation by the Bureau of Energy Efficiency under the said Act.

This certificate is valid till the issuance of an official certificate by the Bureau of Energy Efficiency.

Place : Chennai, India

Date : 30th April 2007


Controller of Examination