

**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
(2019-20)**



Prepared by



SOLASTA

Energy Solutions, Services & Maintenance

Website : www.solasta.in

Contact: +91 8007552123

Email: solastasustain@gmail.com

Address: 7, Dattakunj Appt., Anand Nagar, Gangapur Road, Nashik-422013

Date: 15/06/2020

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Preface

Data collection for an energy audit of the **MVP'S S.V.K.T. Arts, Science & Commerce College, Deolali Camp, Nashik** was approved by a team for the period of July 2019 to June 2020.

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 the 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, **we have referred the energy audit report of the previous year (2018-19)**. New load/changes in load if any and its participation in total electricity consumption was taken into consideration.

We 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 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 appreciate for various efforts taken by the college.

Acknowledgement

We are very much thankful to **Principal Dr.V. J. Medhane and IQAC NAAC Coordinator Prof. Mr A.S. Kale** for motivating us and giving us the opportunity for an energy audit. We would like to express our sincere thanks to faculty members of Physics **Prof. Mr Kiran Mojad.** also, all respected staff, faculty members and students who have taken part in this audit survey etc. of MVP'S Arts, Science & Commerce College, Deolali Camp, Nashik. We tried our best to present this energy audit report as per the 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 the 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, Deolali 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, CCTV, UPS, LCD Projector, Router system, Floodlight, Pumping motor etc.

1. The average cost of energy is around **Rs. 6.80 / Month.**
2. After the measurement and analysis, we propose herewith following aspect regarding the efficient use of energy:

Abbreviations

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
HSDG	High-speed diesel Generator
PF	Power Factor
SEC	Specific Energy Consumption
TR	Tons of Refrigeration
UOM	Unit of Measurement
MSEDCL	Maharashtra State Electricity Distribution Company Ltd.
MD	Maximum Demand

Chapter: 1

Introduction to Energy Audit

General:

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 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, subsystems and types of equipment.

• 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 Methodology: Energy Audit Study is divided into the following steps:

1. Historical Data Analysis:

The historical data analysis involves the establishment of an energy consumption pattern to the established baseline 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 the potential of energy-saving and investment required to implement the proposed modifications with the payback period.

Chapter: 2

About the 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 Accreditation:	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 the 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) :

HSDG is used as a Diesel Generator which is run whenever power supply from MSEDCL is not available. A 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 the college.

C. Solar On-Grid Rooftop System:



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

Computers

Xerox machines

CCTV

UPS

LCD Projector

Router system

Flood light

Printers

Lighting

Air-Conditioning systems

Fans

Flood light

Laboratory Equipment

Pumping Motor



Administration Office



Computer Lab



Principal Office



Passage



Chemistry Lab



Library

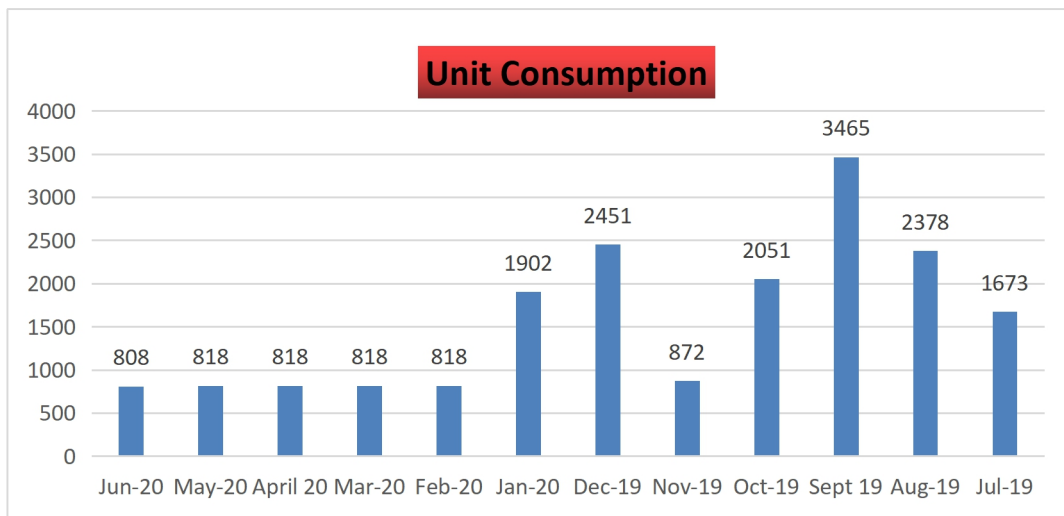
Chapter: 4

Data Analysis

4.1. Study of Variation of Monthly Units consumption:

In this chapter, we study the details of the 12-month Electricity Bills.

Sr. No.	Month	No. Units kWh
1.	June 20	808
2.	May 20	818
3.	April 20	818
4.	Mar 20	818
5.	Feb 20	818
6.	Jan 20	1902
7.	Dec 19	2451
8.	Nov 19	872
9.	Oct 19	2051
10.	Sept 19	3465
11.	Aug 19	2378
12.	July 19	1673
	Total Units	18872



MONTH WISE UNIT CONSUMPTION

Conclusion: Variation of PF

Whenever the average power factor over a billing cycle or a month, whichever is lower, of a High Tension consumer, is below 90%, Penal charges shall be levied to the consumer at the rate of 2% (2 per cent) of the amount of monthly energy bill (excluding of Demand Charges, FOCA, Electricity Duty and Regulatory Liability Charge etc.)

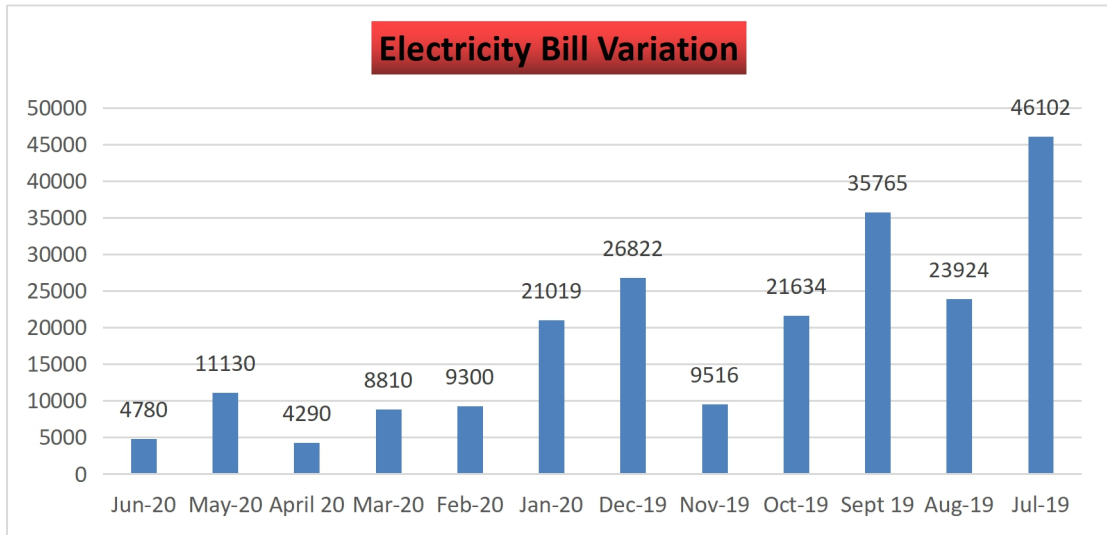
For power factor of 0.99, the effective incentive will amount to 5% (five per cent) reduction in the energy bill and for unity power factor; the effective incentive will amount to 7% (seven per cent) reduction in the energy bill.

4.2 Study of Month-wise Electricity Bill Variation:

TABLE: 2 Month wise Electricity Bill Variation:

SR.No.	Month	Electricity Bill Amount (Rs.)
1	June 20	4780
2	May 20	11130
3	April 20	4290
4	Mar 20	8810
5	Feb 20	9300
6	Jan 20	21019
7	Dec 19	26822
8	Nov 19	9516
9	Oct 19	21634
10	Sept 19	35765
11	Aug 19	23924
12	July 19	46102
	Total Annual Bill=	223092
	Average Monthly Bill=	18591

Conclusion: Monthly Electricity Bill Variation has been identified.



Month wise Electricity Bill Variation

4.5 General Observations based on Electricity Bill:

1. The average electricity cost is **Rs. 6.80** considering the last twelve months. (Excluding TOD charges, MD and PF charges)
2. Average Monthly bill is Rs. **18591** /-

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:300- 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 PERUSE
20	Solar ON-Grid Power Plant	15.36kW	1	15.36kW	12	15.36kW

Department wise total load consumption:

Sr. No.	Premises	Existing Load During (2018-19) in Watt	Additional Load during (2019-20) in Watt	Remark (Name Of Appliances)
1	Principal Office:	23910	NIL	NIL
2	Administration Office:	15858	20	CCTV
3	IQAC Office:	2460	10	CCTV
4	Meter, Battery & Store Room:	40160	NIL	NIL
5	Staff Room:	1920	NIL	NIL
6	Department & Labs IT, Computer, Physics, Electronics:	53928	60	CCTV
7	Chemistry Lab:	18944	100	CCTV, FAN
8	Department Of Botany / Zoology, Microbiology & Labs:	5604	190	CCTV, FAN
9	Dept. Of Commerce:	1896	20	CCTV
10	Library, Porch, Staircases, Passage, Open Premises:	40252	676	Flood Lights, CCTV, LED TUBE
11	Dept. Of Marathi, Hindi, Maths, English, Geography, NCC, Poly. Science, Total Classrooms:	38552	120	CCTV, FAN

Additional Load During (2019 - 20):

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	CCTV	10	24	240	8	1920
2	FAN	80	4	320	6	1920
3	LED Tube	18	2	36	6	216
4	Flood Light	300	2	600	12	7200

*** This is total load consumption considered approximately. Actual load consumption might be different according to the actual use of power for a particular period.**

Chapter: 6

Study of Electrical Systems

6.1 Electrical Supply Details:

The electrical supply to MVP'S S.V.K.T. Arts, Science And Commerce College, Deolali Camp, Nashik Received from MSEDCL supply at 11 kV Transmission line, which is stepped down to 415 V by a transformer.

6.2 Study of Electrical Demand:

There is a single meter installed on the premises. The details of meters are as under:

Energy Meter Details:

Sr. No.	Details of Electricity Demand	Tariff	73 LT-X B I
	Meter No:	055-XD490753	
1	Sanctioned Load	20.00	kW
2	Contract Demand	00.00	kVA
3	Recorded Maximum Demand	00.00	kVA

6.3 Electrical Energy Cost Analysis

The electrical bills from MSEDCL for 12 months from July 2019 to June 2020 have been studied.

6.4 TOD Charges

For all LT consumers, the Time of Day (TOD) tariff is applicable in Maharashtra for above 20HP. For this purpose, the day has been divided into 4 different time Zones as given in the table.

Zone	Consumption during the following hours of the day	Rate of Consumption
A	2200 – 0600 Hrs	(-01.50 rate in addition to actual rate)
B	0600 – 0900Hrs & 1200 – 1800Hrs	(0 i.e same rate)
C	0900 – 1200 Hrs	(0.80 rate in addition to actual rate))
D	1800 – 2200 Hrs	(0.1.10 rate in addition to actual rate)

In addition to the base tariff of Rs. 6.80 per unit consumed, TOD tariff as indicated is levied

6.5 Lighting System:

Observations and suggestions:

- It is found that FTL, Bulbs, 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 unnecessary pollution.
- **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 15000 a more a year off our electricity bill and nearly $\frac{3}{4}$ of a tone of CO₂ pollution. A 20% reduction on average consumption will save over Approximately 30,000 and 1.5 tones of CO₂.

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

- Lights
- Heaters and fans (or air-conditioning)
- Printers and scanners
- Battery and phone chargers
- Computers

Chapter: 7

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.

7.1 Load of ACs was as follows:

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

7.2 Observations and suggestions:

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

Chapter: 8

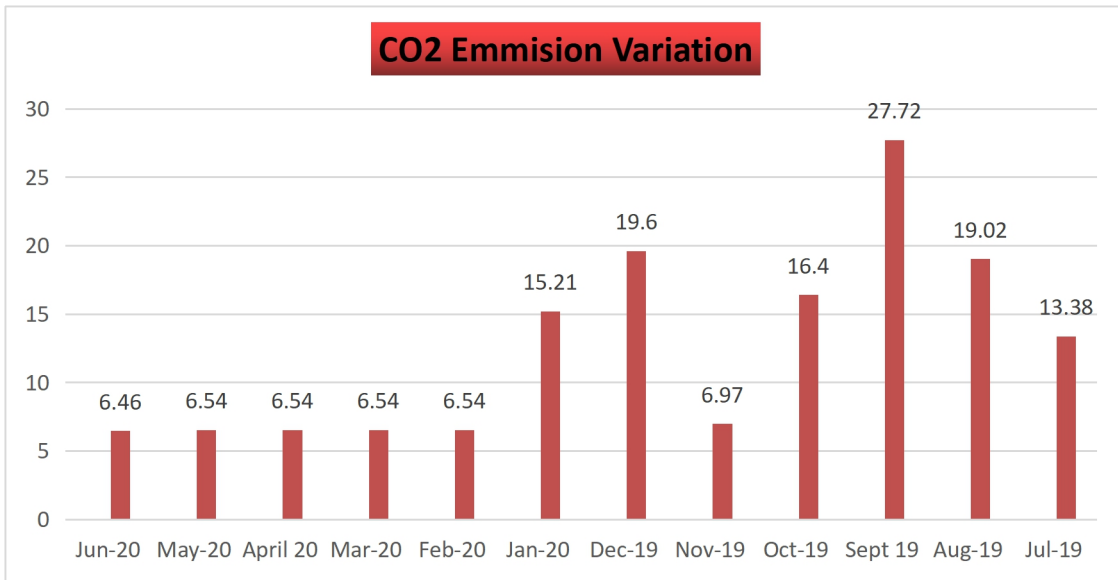
Carbon Di-Oxide Emission

In this Chapter, we compute 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 Approximately:

8.1 CO₂ Emission Variation:

TABLE 6: Month-wise CO₂ Emission Chart

Sr. No.	Month	kWh	CO ₂ Emitted in Kg
1	June 20	808	6.46
2	May 20	818	6.54
3	April 20	818	6.54
4	Mar 20	818	6.54
5	Feb 20	818	6.54
6	Jan 20	1902	15.21
7	Dec 19	2451	19.60
8	Nov 19	872	6.97
9	Oct 19	2051	16.40
10	Sept 19	3465	27.72
11	Aug 19	2378	19.02
12	July 19	1673	13.38
	Total		Avg. Emission = 12.57



Carbon Di-Oxide Emission

8.2 Merits/Existing Features for Energy Saving

1. Staff vigilance.
2. Computers are connected in LAN.
3. Printers are shared in LAN.
4. Screen savers facility implemented for every computer.
5. ACs used are of three STARS.
6. Refrigerators are of three STARS.
7. Incandescent Bulbs are nowhere used.
8. They are replaced by CFL tubes with the electronic choke.
9. Maximum use of natural light.
10. Cross Ventilation is provided in laboratory & classrooms.
11. Walls are painted with off white colour to have sufficient brightness
12. Solar powered street lamp is used.
13. LED flashlight is used in Seminar hall.

Chapter: 9

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 human comfort. This can save around 15% to 30% of the electricity depending on the weather conditions and temperature settings.

There is a total of 4 split type air conditioners. It is recommended that the old air conditioners are being replaced with a new energy-efficient BEE STAR labelled (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

Yearly Saving = $6.80 \times 315 = \text{Rs.}2142/\text{Year}/\text{Air Condition}$

*Cost of electricity = Rs. 6.80 / kWh

- Total number of Air Conditioner =4

Summary For Energy Saver Circuit:

Total Cost of each energy saver circuit = $\text{Rs.} 4500 \times 4 = \text{Rs.} 18000 /-$

Total Yearly Saving = $4 \times 315/\text{Year} = \text{Rs.} 1260/\text{Year}$

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

The 164Nos. 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, a 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 = 36 kWh/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 a 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: 10

Energy Saving Recommendations

General Recommendations:

- All Class Rooms and labs to have **Display Messages** regarding optimum use of electrical appliances in the room like lights, fans, computers and projectors. Save electricity. **Display the stickers of saving electricity**, save nature everywhere in the campus. So that all stakeholders encouraged to save the electricity
- Care should be taken to keep lights in a classroom off and keep ON whenever necessary.
- Try to get the benefit of TOD time slot(Refer Pt.6.4) i.e. -01.50 rate at night in addition to actual rate for per unit consumption for **electric motor pumping purpose during 2200 – 0600 Hrs.**
- All projectors must be kept OFF when not in use or 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 use power saver circuits for AC.
- 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, classrooms, halls, areas, meters, etc
2. Energy auditing inside the campus has to be done regularly and report should be made public to generate awareness.
3. Need to Create energy efficiency/ renewable energy awareness among the college. Solar Energy, wind Energy, Biogas energy. College should take initiative to arrange lectures, paper presentation competition among students and staff for general awareness.

Executive Initiatives:

Alternate Energy Initiatives:

Percentage Of Energy requirements met by renewable energy (Solar On-Grid System):

Avg. Annually Unit Generation from the solar system	Avg. Electricity Unit Consumption	Percentage
1211	1572	77.03%

Lighting Energy From LED:

Percentage Of Energy Requirements met by LED Bulbs OR Tube lights

Total Percentage Of LED to total power requirement is up to 10% only.

11. 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 MGottschal



Energy Solutions, Services & Maintenance

Website : www.solasta.in

Contact: +918007552123

Email: solastasustain@gmail.com

Address: 7, Dattakunj Appt., Anand Nagar, Gangapur Road, Nashik-422013

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 : 2019-20
- Work Period : From 03/06/2020 To 13/06/2020

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 13/06/2020 for year 2019-20.

Thanking you and assuring you for our best service always.

Audit Report By,

Er. Anil S. Dube

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



FOR SOLASTA,

Mr. Pushendra P. Pagar
Proprietor

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 fulfilment 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