

**ENERGY AUDIT REPORT (2019-2020)**

**OF**

**S.T.U.S. Mandal's**

**SANGOLA COLLEGE, SANGOLA,**

**SOLAPUR, MAHARASHTRA, INDIA, 413307**



**Coordinator**

**Prof. Ramesh Arun Bugad**

**Assistant Professor**

**Department of Physics**

**Auditor**

**Engg. Mr. A.D. Pawar,  
Deputy Executive Engineer,  
O & M Sub Dn. Sangola**

**Engg. Mrs. Sujata .P. Pawar,  
Assistant Engineer (QC),  
O & M Sub Dn. Sangola**

**Engg. Mr. B.G. Mahankal & Son's  
Govt. Licensed Electrical Engineer's  
Contractor & Consultants,  
Sangola**



## PREFACE

Energy audit report is a study of facility to determine how and where energy is used and to recognize methods for energy savings. There is now an universal recognition of the fact that new technology and much greater use of some that already exists provide the most hopeful prospects for the future. The opportunities lie in the use of existing renewable energy technologies, greater efforts at energy efficiency and the dissemination of these technologies and options.

The energy audit of Sangola College, Sangola campus including academic area, library, hostels and ground was carried out by the faculties of the department of physics as a part of the college task. This report is just one step, a mere mile marker towards our destination of achieving energy efficiency and we would like to emphasise that and energy audit is a continuous process. We have compiled a list of possible measures to conserve and efficiently utilize our scarce resources and identified their saving potentials. The next step would be to prioritize their implementation. We look forward with optimism that the college authority, staff and the students shall ensure the maximum execution of the recommendation and the success of the work.

To all of you, we hope that the ideas and pages that follow will give as much enjoyment and the challenge as they have given us in their development, synthesis and writing. Any suggestions to further enhance the quality of this work are always welcome. Kindly email your comments and suggestions to [rameshbugad@gmail.com](mailto:rameshbugad@gmail.com), [taramane@gmail.com](mailto:taramane@gmail.com)



## DECLARATION

We, hereby, declare that the Energy Audit Report (2019-20) of Sangola College campus is prepared based on the existing electrical gadgets such as tubes, bulbs, motors, lab-equipments, fans, freezers, computers, printers etc in all the buildings in the campus and their capacities.

**Prof. Ramesh Arun Bugad**  
**Assistant Professor**  
**Department of Physics**  
**Sangola College, Sangola**

**Dr. Tanaji Ramchandra Mane**  
**Professor and Head**  
**Department of Physics**  
**Sangola College, Sangola**

**Prof. Dr. Madhusudan T. Bachute**

**Principal**  
**Sangola College, Sangola**  
**Sangola College, Sangola**  
**Tal. Sangola Dist. Solapur**

**Engg. Mrs. Sujata .P. Pawar,**  
**(Sujata P. Pawar)**  
**Assistant Engineer (QC),**  
**O & M Sub Div. Sangola**  
**M. S. E. D. Co. Ltd.**  
**O&M Sub Division Sangola**

**Engg. Mr. B.G. Mahankal & Son's**  
**Govt. Licensed Electrical Engineer's**  
**Contractor & Consultants, Sangola**



## ACKOWELDGEEMENT

We would like to express heartily gratitude towards following persons for the support and cooperation they rendered during the energy audit

- ❖ Hon. Shri. **B.R. Gaikwad**, President, S.T.U.S. Mandal, Sangola
- ❖ Hon. Shri. **M.S. Zirape**, Secretary , S.T.U.S. Mandal, Sangola
- ❖ Prof. Dr. **M.T. Bachute**, Principal, Sangola College, Sangola
- ❖ Prof. Dr. **T.R. Mane**, Coordinator, IQAC
- ❖ Dr. **R.R. Tembhurane** , Criterion- VII, Chairman
- ❖ Dr. **C.L. Jambhale**, Department of Physics
- ❖ Mr. **P.R. Babar**, Department of Physics
- ❖ Teaching Staff
- ❖ O.S. Mr. **P.S. Shinde** and Non-teaching Staff
- ❖ B.Sc. Physics Students



## CONTENTS

Content Details	Page No.
<b>1: INTRODUCTION</b>	
1.1 OBJECTIVE OF ENERGY AUDIT	5
1.2 PRESENT ENERGY SCENARIO OF CAMPUS	5
1.3 SPECIFIC ENERGY CONSUMPTION	7
1.4 SEGEMENTATION	7
<b>2: ENERGY AUDIT</b>	
2.1 ENERGY AUDIT METHODOLOGY	8
2.2 STEPS AND STRATEGY	8
<b>3: QUANTIFICATION BY END USE</b>	
3.1 ELECTRICITY USE OF CAMPUS	9
3.2 AC LOAD OF CAMPUS	9
3.3 VOLTAGE PROFILES	16
<b>4: ENERGY MANAGEMENT STRUCTURE</b>	17
<b>REFERENCES</b>	18



## **1. INTRODUCTION**

Sangola College, Sangola was established in 1978, Today, Sangola College, Sangola is renowned as one of the colleges of academic excellence in the Solapur University. Over the years, there has been significant progress at SCS in academic and administrative set up support facilities like library, ground with indoor games sankul. NSS, NCC are there to make holistic development of students. As on date, it has 14 UG departments, 03 PG departments, 03 Research Centers, 04 Certificate Courses, 11 Skill oriented programmes. The student strength of the college is 2421, with faculty strength of 92 and office and non-teaching staff of 23. The attractive college building and other are spread over the land of measuring 9.19 acres.

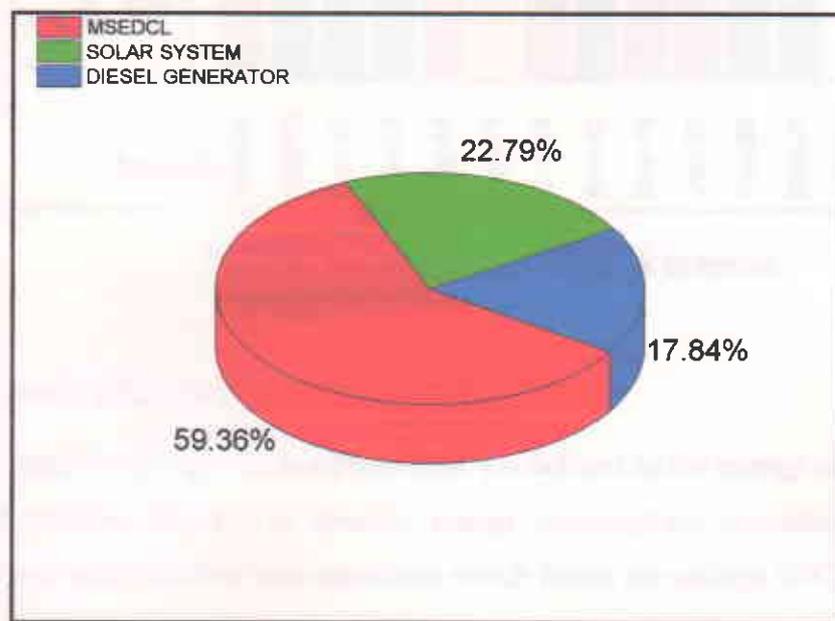
### **1.1 OBJECTIVE OF ENERGY AUDIT**

This energy audit marks the significance due to the fact that the electricity bill of campus had crossed Rs. 75000/- during 2019-20, and it was aimed at getting a detailed idea about the various end use energy consumption activities and identifying, enumerating and evaluating the possible energy saving opportunities. The target is to achieve saving in the electrical energy consumption to the extent of 15%. The audit was also aimed at giving us a feel of the practical problems and difficulties in carrying out energy audits.

### **1.2 PRESENT ENERGY SCENARIO OF CAMPUS**

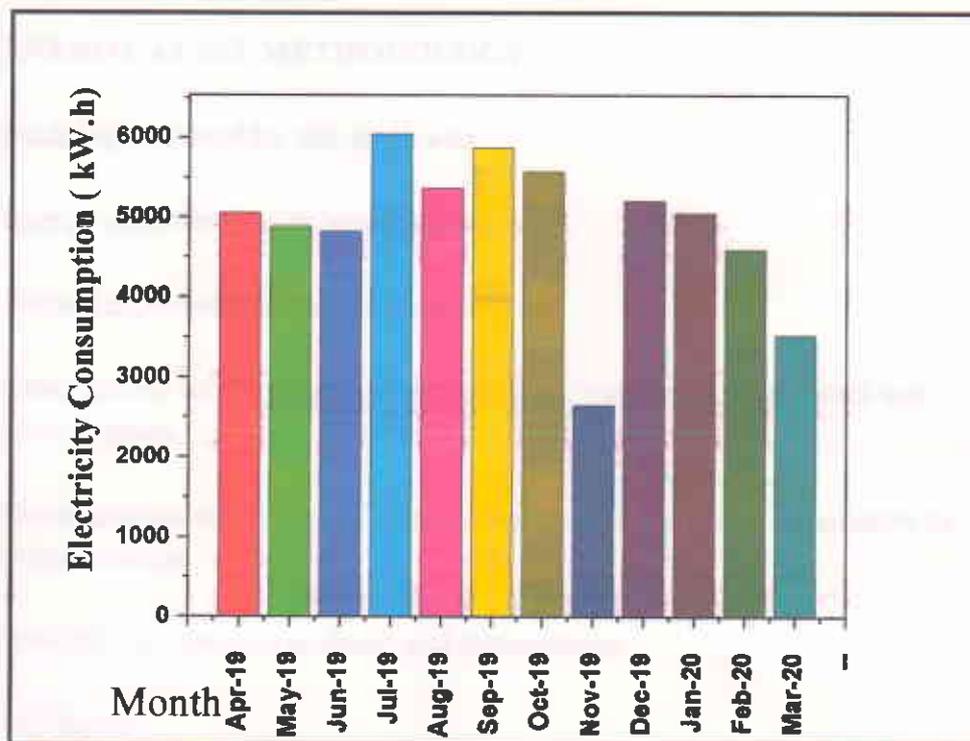
The energy consumption on campus is mainly in the form of electricity, apart from the use of LPG as cooking fuel in the hostels. As well as, Solar Water Heater

System was installed in the ladies hostel. The solar panels are installed on terrace of college building as non-conventional energy sources. The capacity of installed solar panels system to generate electrical power is 30 kWh per day. Total electricity demand in the campus is about 99.637 MWh. Out of this, maximum electricity demand (59.148MWh) is meet through MSEDCL (Maharashtra State Electricity Distribution Company Ltd.) and rest from renewable sources as Solar system (22.710MWh) and Diesel Generator (17.779MWh). The percentage of energy requirement in SCS Campus is shown in figure 1.1.



**Fig 1.1: Total Energy demand of Campus through various sources**

The monthly recorded peak demand for the year 2019- 20 is given in Fig.1.2. The SCS energy bill for the year 2019-20 was Rs. 94789/-. The electricity bill comprises two parts: one related to the energy consumed and the other is the maximum demand charge. There exist wheeling charges as well as penalty for low power factor and it is reduced by capacitor. Furthermore, the energy charge includes a component based on time of use.



**Fig. 1.2: Recorded monthly peak demand.**

### 1.3 SPECIFIC ENERGY CONSUMPTION

Specific Energy Consumption (SEC) is defined as the energy consumption per unit of product output. The specific energy consumption considering a students, faculty and staff member was calculated which forms the college SEC and was taken as reference for comparison. The SEC was calculated to be 38.32 kWh/person/annum (for 2019- 20) for the academic area and expenditure of Rs. 445 per person per annum.

### 1.4 SEGMENTATION

This energy audit report has segmented the energy consumption patterns both by Halls/departments/ hostels/ offices/laboratory equipments and by end use activities (lighting, cooling, pumping, washing etc.). The details are provided in further points.

## 2. ENERGY AUDIT

### 2.1 ENERGY AUDIT METHODOLOGY

The methodology adopted for this audit was

- Energy audit for specific areas and end use
- Visual inspection and data collection
- Observations on the general condition of the facility and equipment and quantification
- Identification/verification of energy consumption and other parameters by measurements
- Detailed calculations, analyses and assumptions
- Validation
- Potential energy saving opportunities
- Implementation

As a first step in this regard, both of us had been assigned a particular area for energy audit of the campus. The activity was organized as a task for the Energy Management during April 2019-March 2020.

### 2.2 STEPS AND STRATEGY

The following steps are formed for observation with specific target areas and end users were nominated and surveyed.

Step-1: Lighting, fans and other in all buildings

Step-2: Lighting, fans and other in Girl's and Boy's Hostel

Step-3: Lighting common area-covering passage lights

Step-5: Lighting, fans and other in Kridabhavan

### 3. QUANTIFICATION BY END USE

#### 3.1 ELECTRICITY USE OF CAMPUS

The Energy consumption was segregated based on the end use in various wings of Buildings, water pumping, departments (considering lighting and fans, air conditioning, Computer/printers, water pumping, etc.). Quantification, types and necessary measurements were carried out. The details are given below.

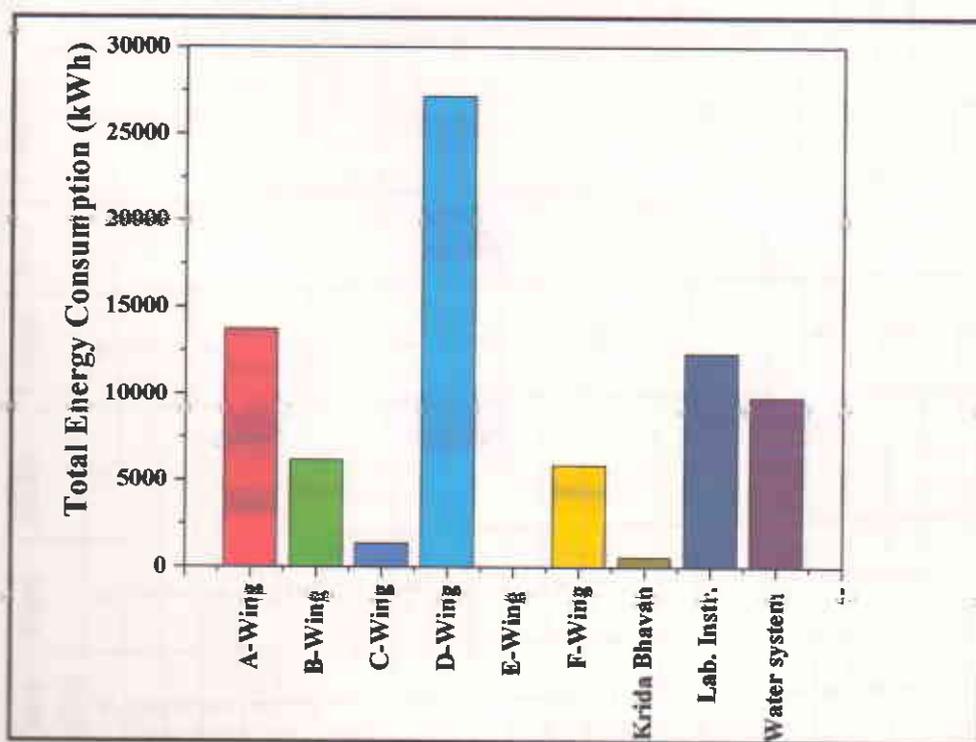


Fig. 1.3: Energy consumption at various buildings and Campus.

#### 3.2 AC LOAD OF CAMPUS

The college has about 224 Tube lights, 250 Ceiling Fans, 79 Bulb (LED), 255 Computers TV, 5ACs, 19 Printers, 8 Water Coolers, 11Speakers , 2 Xerox machines and 3 Water-pumps, 14 LCD in various buildings, departments, Libraries, Hostel, Ground and various places.

**Table No. 1.1: Connected AC load in College Building**

Sr. No.	Room No.	Details of Hall	Tube lights	Fans	Bulbs	Comp	ACs	Printers	UPS	Xerox Machine	LCD Projector	Avg. Watt./Y
1	A1	Office	6	6	3	8		4	1	1		2090
2	A2	Principal Cabin	2	2		2	2		1			3660
3	A3	Management Cabin	4	1			2					3340
4	A4	Geography	1	1		1					01	180
5	A5	Geography Lab	1	1								330
6	A6	Common Staff Room	1	2								140
7	A7	Lecture Hall	1									20
8	A8	Lecture Hall									01	450
9	A9	English	2	1		1					01	450
10	A10	Hindi				2						220
11	A11	Economics/Marathi	1			2						20
12	A12	Lecture Hall	1								01	750
13	A13	Seminar hall	5	5		1						1720
14	A14	Common computer facility	2	3		15						
15	A15	Commerce				1						100
16	A16	Office Document Store Room						6				
17	A17	Xerox	1							01		270
18	B1	Zoology	6	5		1					01	770
19	B2	Ladies Room	4	2								200
20	B3	IQAC Room	1	2		3		2				640
21	B4	Zoology	2	1								100
22	B5	Chemistry Lab-I (P.G)	3	1		2		1				420



21	B6	Chemistry Lab-2 (P.G.)	5	3	1	1				01	662
24	B7	Chemistry Lab -1 (U.G.)	2	1							100
25	B8	Chemistry Lab -2 (U.G.)	1	1	2	1					380
26	B9	Store room	1	1							80
27	B10	Chemistry Lab -3 (U.G.)	2	1							100
28	B11	Physics Lab -1	4	3	1	1					360
29	B12	Physics Lab -2	4	2	2	1			01		650
30	B13	Botany	2	2	1	1			01		360
31	B14	Botany Lab-1	4	3	1	1				01	40
32	B15	Physics Lab -3	2								380
33	B16	Botany Lab-2	1	6	1	1					180
34	B17	Mathematics	1	1							100
35	B18	Common Facility Centre	1	1							940
36	C1	Electronic Lab	6	7	4						60
37	C2	History/ political science		1							
38	C3	Lecture Hall									20
39	C4	Lecture Hall	1								
40	C5	Lecture Hall									20
41	C6	Lecture Hall	1								-
42	C7	Lecture Hall									20
43	C8	Lecture Hall	1								-
44	C9	Lecture Hall									-
45	C10	Lecture Hall									-
46	C11	Lecture Hall	1								20







Table No. 1.2: Connected AC load in Krishi Bhavan, Ladies Hostel and Boy's Hostel

Sr. No.	Details of Hall	Tube Lights	Fans	Bulbs	Bath	Printers	UPS	Xerox Machine	LCD Projector	Avg. Watt./Y
1	Physical Education	1	1							80
2	NSS	1	1							80
3	NCC	1	1							80
4	Health Centre	1	1							80
5	Gymkhana Hall	3			6					240
6	Canteen									
7	Ladies Hostel	1	58	42	17					3936
8	Boys Hostel		15	13	17					1240
9	Open Ground			3						300
10	Water Filtration Plant									3000
11	Motors For water									6763



Table No. 1.3: Connected AC load in Laboratory Instruments

Sr. No.	Instruments	Quantity	AVG. Watt/V
1	Freeze	1	1200
2	CCTV camera	30	100
3	Auto Crucible Furnace	1	1000
4	Hot Plate	2	2000
5	Hot air Oven	1	2000
6	Thermostat	1	2000
7	Vacuum electrical Suction pump	1	100
8	Centrifuge power	1	100
9	Distillation plant	1	1000
10	CRO	6	270
11	Digital Polarimeter	2	80
12	Magnetic Stirrer	2	1000
13	c/m Thomson tube	1	100
14	Four probe apparatus	1	500
15	Band gap energy apparatus	1	100
16	Newton's Ring apparatus	2	400
17	Spectrometric apparatus	1	400

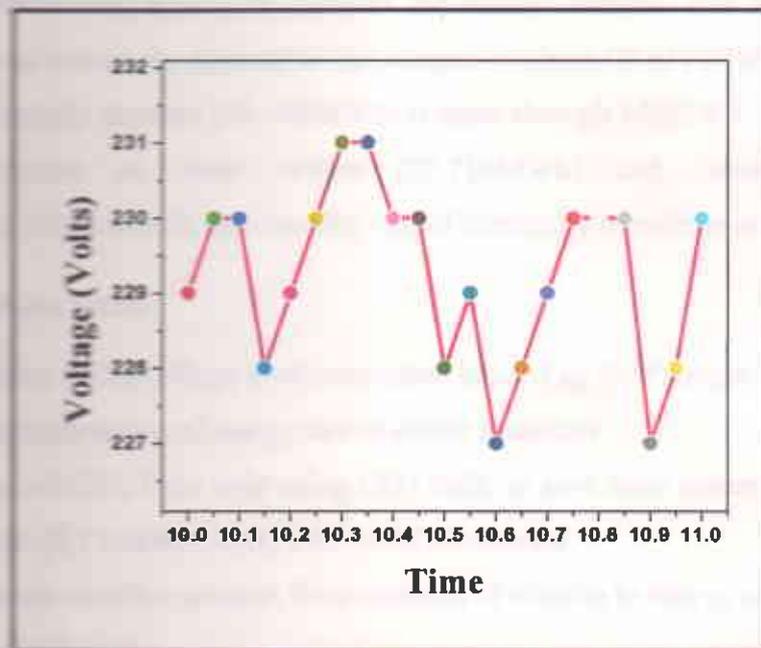
Table No. 1.4: Electrical Power Generated by Units

Sr.No.	Power Supply Units	Quantity	Units
1	Generator 62.5 KV	1	62.5 KV
2	Generator 5 KV	1	5 KV
3	Generator 2.4 KV	1	2.4 KV
4	Solar Street Lamp	4	16 Watt
5	Solar Water Heater	6	1000 liter



### 3.3 VOLTAGE PROFILES

The voltage profile has been tested in SCS campus by connecting voltmeter in parallel with main socket for time of days (10.00 am to 11.00 am) and showed in fig. 1.4 given as below.



**Fig1.4: Voltage Profile measured of campus**

As per permissible limit of Indian Electricity rule, a MSEDCL has permissible voltage limit  $\pm 5\%$  of LT 230 Volt. But an actual accessible volt is given below in table 1.5.

**Table 1.5: Voltage Profile measured of campus**

Voltage	
Average	230
Minimum	227
Maximum	231



#### 4. CONCLUSION AND RECOMMENDATION

##### CONCLUSION:

In conclusion, data generated in energy audit are useful to understand the energy distribution and utilization of college. It is concluded that the total electricity load given to college was 142255 kWh. But actually out of total electricity load connected only 1% (99637 kWh) electricity utilized for college campus due to educational institution. Total electricity demand in the campus is about 99.637 MWh. Out of this, maximum electricity demand (59.148 MWh) is met through MSEDCL and rest from renewable sources as Solar system (22.710 MWh) and Diesel Generator (17.779 MWh). It is concluded that monthly use of electricity in college is not high.

##### RECOMMENDATION:

1. Formation of the college level committee headed by the Principal to review the implementation of energy conservation measures.
2. Replace all CFL Tube light using LED Bulb, to save more power.
3. Replace CRT monitor using LED or LCD monitor.
4. The communication process for awareness in relation to energy conservation is found adequate.
5. Regular monitoring of equipment and immediate rectification of any problem is being done.



## REFERENCES

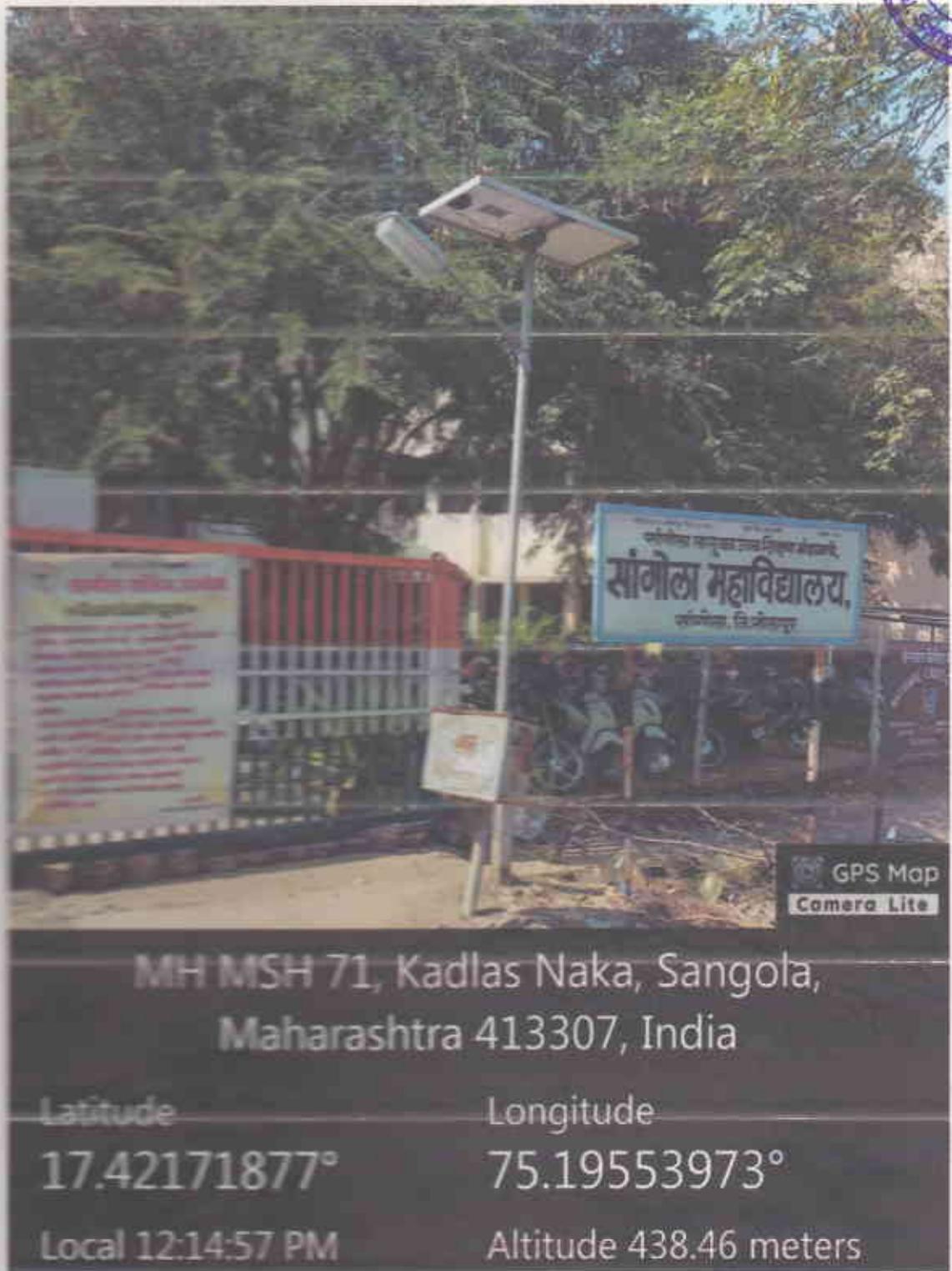
- [1] J. C. Andreas, (1992) **Energy-Efficient Electric Motors**, Revised and Expanded. CRC Press.
- [2] W.C. Turner, **Energy Management Handbook**, Wiley, New York, 1982.  
(<https://www.ecm.gov/biblio-6876358> )
- [3] **Guide Books for the National Certificate Examination for Energy Managers and Energy Auditors** (<https://ecm.gov.in/content/energy-auditors>)
- [4] S.P. Sukhatme, **Solar Energy**, Tata McGraw Hill Publ., New Delhi, 1996.  
(<https://www.worldcat.org/title/solar-energy-principles-of-thermal-collection-and-storage/oclc/60185312> )
- [5] US Government's **Energy Star** page for fluorescent bulbs,  
(<https://www.energystar.gov/index.cfm> )
- [6] **Electric Energy: An Introduction**, Third Edition Book by Mohamed A. El-Sharkawi.
- [7] **Electric Energy Systems: Analysis and Operation**, Antonio Gomez-Exposito, Antonio J. Conejo, Claudio Canizares.



**PHOTO: SOLAR PANEL**



**PHOTO: SOLAR PANEL CONNECTED TO MSEB**



**PHOTO: SOLAR STREET LAMP**



**PHOTO: SOLAR WATER HEATER**



**PHOTO: GENERATOR OF 62.5 K.V. CAPACITY**