Energy Audit Report

Of

The People's Education Society's

Jamkhed Mahavidhyalaya,

Jamkhed, Dist. Ahmednagar

Auditing Agency –
Prathamesh Energy Solution,
A-302, Shiv Unnati Residency,
Kalepadal, Hadapsar
Pune- 411 028

Prathamesh Energy Solution

A-302, Shiv Unnati Residency, Kalepadal, Hadapsar
Pune 411028

Ref: EC/JMJ/22-23/05 Date: 20/02/2023

CERTIFICATE

This is to certify that we have conducted Energy Audit at **Jamkhed Mahavidhyalaya, Jamkhed, Dist. Ahmednagar,** in the Academic year 2022-23

The College has adopted following Energy Efficient practices:

- Usage of Energy Efficient LED Fittings
- Maximum usage of Day Lighting
- Installation of 10 kWp Roof Top Solar PV Plant.
- Vermi-compost system
- Green Campus
- Rain water Harvesting system

We appreciate the support of Management, involvement of faculty members and students in the process of making the Campus Energy Efficient.

For,

Prathamesh Energy Solution,

MAHARASHTRA ENERGY DEVELOPMENT AGENCY

Maharashtra Energy Development Agency
(Government of Maharashtra Institution)
Aundh Road, Opposite Spicer College Road, Near Commissionerate of Animal Husbandary,
Aundh, Pune, Maharashtra 411067
Ph No: 020-35000450
Email: eee@mahaurja.com, Web: www.mahaurja.com

ECN/2021-22/CR-13/3273 29th June, 2021

CERTIFICATE OF REGISTRATION
FOR CLASS 'A'

We hereby certify that, the firm having following particulars is registered with ***MAHARASHTRA ENERGY DEVELOPMENT AGENCY (MEDA)*** under given category as "Energy Planner & Energy Auditor" in Maharashtra for Energy Conservation Programme of MEDA.

Name and Address of the firm : M/s Prathamesh Energy Solution
A-302, Shiv Unnati Residency,
Opposite to Indryani Managal Karyalya Kalepadal,
Hadapsar, Pune-411028.

Registration Category : *Empanelled Consultant for Energy Conservation Programme for Class 'A'*

Registration Number : ***MEDA/ECN/2021-22/Class A/EA-04***

- Energy Conservation Programme intends to identify areas where wasteful use of energy occurs and to evaluate the scope for Energy Conservation and take concrete steps to achieve the evaluated energy savings.
- MEDA reserves the right to visit at any time without giving prior information to verify quarterly activities performed by the firm and canceling the registration, if the information is found incorrect.
- This empanelment is valid till **28th June, 2023** from the date of registration, to carry out energy audits under the Energy Conservation Programme
- The Director General, MEDA reserves the right to cancel the registration at any time without assigning any reasons thereof.

General Manager (EC)

INDEX

ACKNOWLEDGEMENT

We at Prathamesh Energy Solution, Pune, express our sincere gratitude to the management and Principal of Jamkhed Mahavidyalaya, Jamkhed for awarding us the assignment of Energy audit of their College campus located at Jamkhed, Dist. Ahmednagar.

We are very much thankful to

- Prin. Dr. M. L. Dongare, Principal, Jamkhed Mahavidhyalaya, Jamkhed
- Dr. S. Y. Narke, Vice-Principal, Jamkhed Mahavidhyalaya, Jamkhed.
- Prof. S. N. Gadekar, Coordinator, IQAC, Jamkhed Mahavidhyalaya, Jamkhed.

for giving us opportunity to conduct detailed energy audit of the institute and provide all the required data and information promptly for the smooth conduction of detailed energy and green audit.

We are also thankful to various Head of Departments, IQAC team & other Staff members for helping us during the field measurements.

We are also thankful to all the technical staff and office staff for helping during the measurements at the electrical distribution center.

EXECUTIVE SUMMARY

After the Field measurements & analysis, we present herewith important observations made and various measures to reduce the Energy Consumption & mitigate the CO_2 emissions

1. Jamkhed Mahavidhyalaya, Jamkhed, consumes electrical Energy in majority used for various gadgets & office operations.

2. The various projects already implemented by the College are

- Installed solar roof top plant of capacity 10kWp. At present solar roof top is with net metering and it is meeting requirement electricity demand of college building.
- Usage of natural day lights and natural air circulation
- Usage of Natural Day light in corridors specifically
- Usage of LED lighting for Admin & outdoor lighting
- Fire extinguishers are installed and maintained for fire safety in the college campus.

3. Important Parameters: Electrical Energy:

Electricity is used for different purposes and at different sections in the college campus. The details of electricity distribution as mentioned below.

Sr. No.	Consumer No.	Electrical Meter No.	Location/Purpose	Payee
1	158010046982	055-X1021183	College building/building operation	Principal, Jamkhed Mahavidhyalaya

The important parameters of electrical consumption through solar roof top as per Consumer no. in the campus are mentioned as below.

Sr. No	Consumer No.	Parameter	Max	Min	Average
1	158010046982	Units consumed, kWh	949	0	387.91
		Total average units consumed per annum, kWh			4655

4. Benchmark: In terms of Electrical Energy:

We now present important benchmarks in respect of Electrical Energy consumption as under.

No	Particulars	Value	Unit
1	Electrical Energy consumed	**0.14**	kWh/sq ft

6. Recommendations:

We present herewith various proposals to reduce the Electrical Energy demand.

No	Recommendation	Annual saving potential in kWh /Kg of LPG	Annual Saving Potential in MT of CO_2	Annual monetary gain, Rs.
1	Solar street lights	262.8 kWh	0.21	2628
2	Solar powered light for hoarding	-	-	-
3	Solar charging stations	-	-	-
	Total	262.8 kWh	0.21	2628

Notes & assumptions:

1. 1 Unit of Electrical Energy releases 0.8 Kg of CO_2 into atmosphere
2. 1 Kg of LPG releases 3 Kg of CO_2 into atmosphere
3. Daily working hours-10
4. Annual working Days-280
5. Average Rate of Electrical Energy- Rs 10 per kWh

ABBREVIATIONS

DP	:	Double Pole
CFL	:	Compact Fluorescent Lamp
EESL	:	Energy Efficiency Services Limited
F P	:	Feeder Pillar
MSEDCL	:	Maharashtra State Electricity Distribution Company Ltd.
MEDA	:	Maharashtra Energy Development Agency
MIDC	:	Maharashtra Industrial Development Corporation
V	:	Voltage
I	:	Current
kW	:	kilo-Watt
kVA	:	Apparent Power
kVAr	:	Reactive Power
P F	:	Power Factor
kWp	:	Kilo Watt peak

CHAPTER-I
ENERGY AUDIT: INTRODUCTION

1.1 Objectives:

1. To study present level of Energy Consumption
2. To assess the various equipment/facilities from Energy efficiency aspect
3. To measure various Electrical parameters
4. To study Scope for usage of Renewable Energy
5. To study various measures to reduce the Energy Consumption

1.2 Audit Methodology:

1. Study of connected load
2. Study of various Electrical parameters
3. To prepare the Report with various ENCON measures with payback analysis

1.3 Energy Audit Instruments:

1. Portable Power Analyzer
2. Lux meter
3. Anemometer
4. Digital Temperature Indicator
5. CO_2 Meter

1.4 General Details of Jamkhed Mahavidhyalaya, Jamkhed:

No	Head	Particulars
1	Name of Institution	Jamkhed Mahavidhyalaya, Jamkhed
2	Address	Jamkhed, Dist. Ahmednagar
3	Year of Establishment	1984
4	Salient Features	Affiliated to Savitribai Phule Pune University
4	Courses offered	1. Bachelors of Arts, Commerce, Science and Business Administration (BBA CA) 2. Masters of Chemistry, History and Marathi
5	No of Students	1108
6	Total built up area	32400 Sq ft

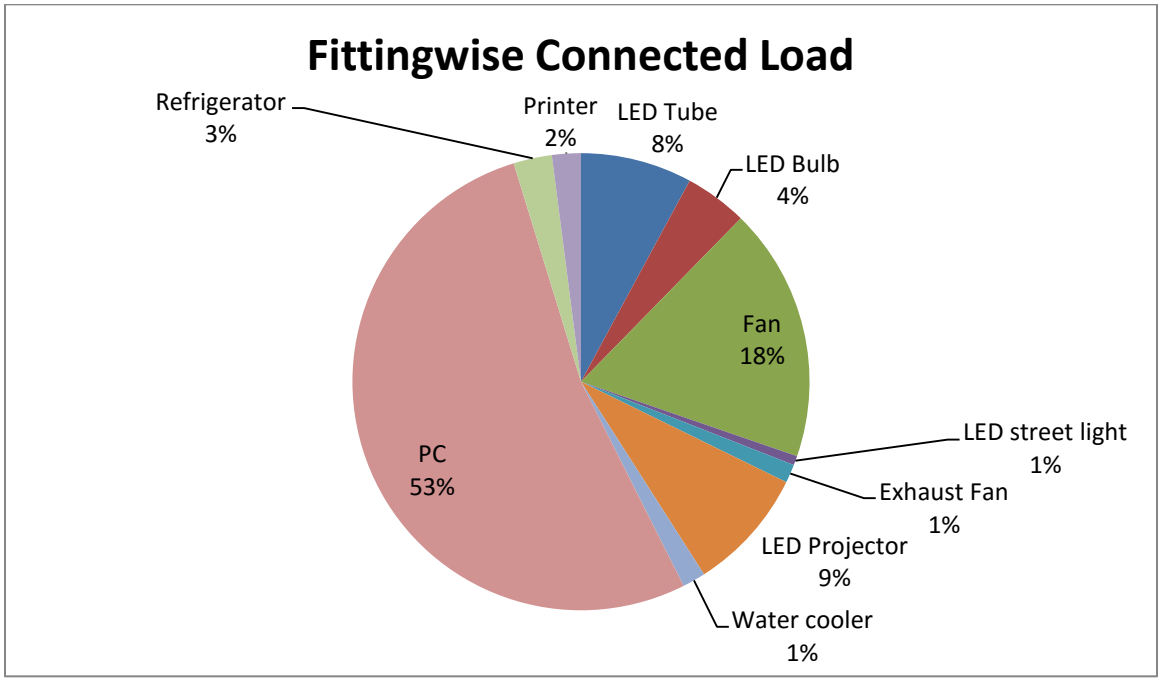
CHAPTER-II
STUDY OF CONNECTED LOAD

In this chapter, we present the details of various Electrical loads as under

2.1 Study of Fitting wise Connected Load:

No	Type of Fitting	Load/Unit	Qty	Load in kW
1	LED Tube	28	104	2.9
2	LED Bulb	18	91	1.63
3	Fan	75	88	6.6
4	LED street light	9	27	0.24
5	Exhaust Fan	40	12	0.48
6	LED Projector	800	4	3.2
9	Water cooler	600	1	0.6
10	PC	150	129	19.35
11	Refrigerator	1000	1	1
12	Printer	50	15	0.75
	Total			**36.75**

We present the same in a PIE Chart as under



CHAPTER-III
HISTORICAL DATA ANALYSIS: ELECTRICAL ENERGY

In this chapter, we present the analysis of last year Electricity Bills

3.1 Consumer No. 158010046982

This consumer is the major contributors for billing. Monthly consumption for last few months and bill amount is as follows.

Table No. 1: Electrical Bill Analysis- 2021-22: 170019006487

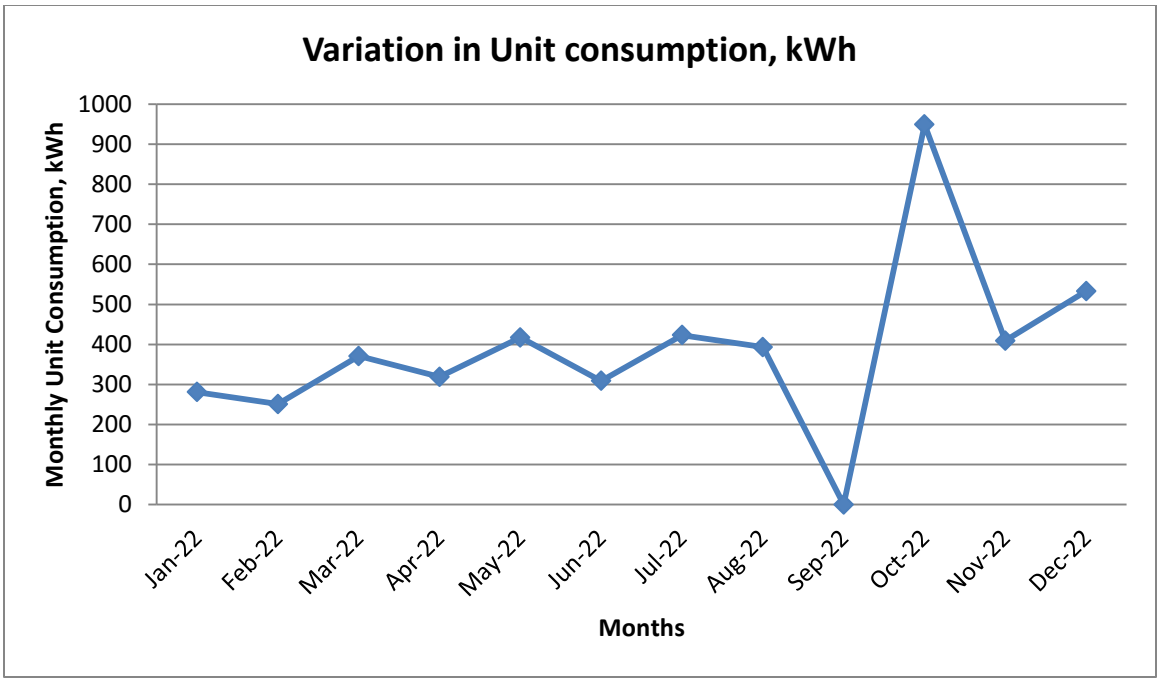
Sr. No	Month	kWh	Amount
1	Dec-2022	**0**	430
2	Nov-2022	**0**	427
3	Oct-2022	**0**	427
4	Sep-2022	**0**	427
5	Aug-2022	**0**	427
6	July-2022	**0**	427
7	June-2022	**0**	427
8	May-2022	**0**	427
9	April-2022	**0**	427
10	March-2022	**0**	415.84
11	Feb-2022	**0**	415
12	Jan-2022	**0**	415
13	Total	**0**	**5091.84**
14	Average	**0**	**424**
15	Max	**0**	**430**
16	Min	**0**	**415**

3.2 Solar roof top units of electricity export and Import

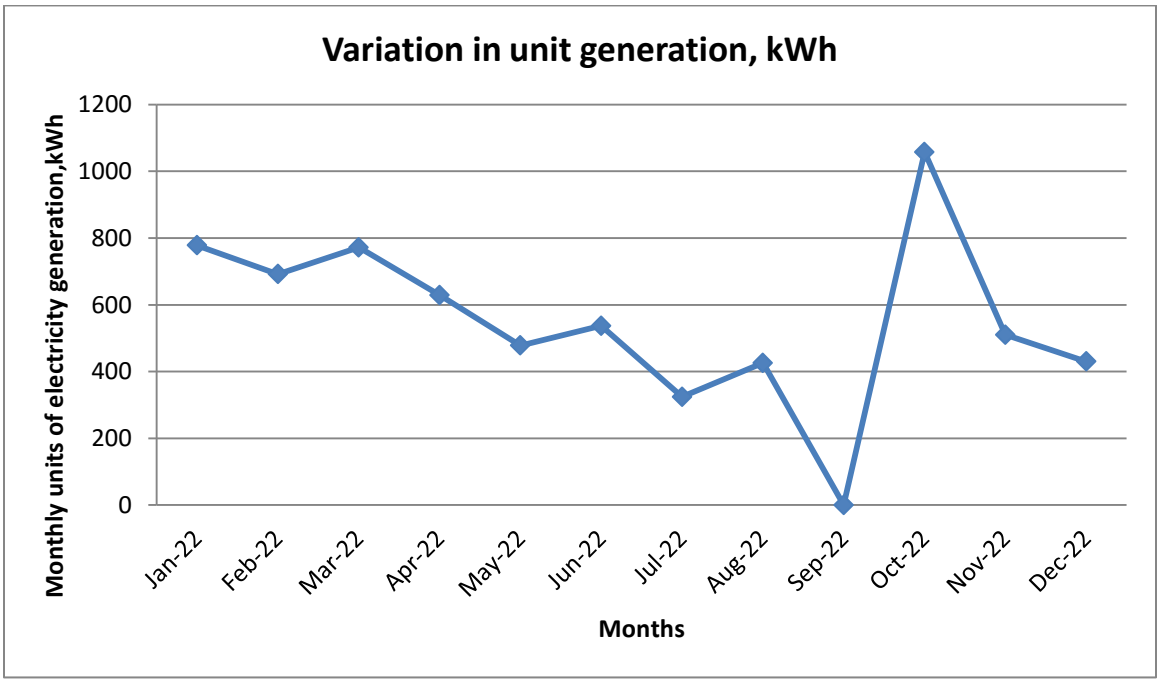
Solar roof top is with net metering and meeting the needs of electricity usage of college campus. The details of electricity generation, export and adjusted units of electricity is as shown below.

Sr. No.	Month	Units export	Units Import
1	Dec-2022	430	533
2	Nov-2022	510	409
3	Oct-2022	1058	949
4	Sep-2022	0	0
5	Aug-2022	426	393
6	July-2022	324	423
7	June-2022	537	309
8	May-2022	478	417
9	April-2022	629	319
10	March-2022	772	371
11	Feb-2022	692	251
12	Jan-2022	778	281
13	Total	6634	4655
14	Average	552.8333	387.91
15	Max	1058	949
16	Min	0	0

a. To study the variation of Monthly Units' Consumption:



b. To study the variation of Monthly units of Electricity generation by Solar roof top:



3.3 Benchmarking:

Now we compute the Electrical Energy Consumed per square feet of the College Building as under

No	Parameter	Value	Unit
1	Units consumed, kWh	**4655**	kWh
2	College area	32400	Sq ft
3	**Unit consumed/sq ft**	**0.14**	**kWh/sq ft**

CHAPTER-IV
USAGE OF RENEWABLE ENERGY AT COLLEGE CAMPUS

4.1 Installation of 10 kWp Solar PV Power Plant:

Solar roof top power plant having capacity 10 kWp is installed at the college campus which meets the requirement of electricity demand of the Institute. The Solar roof top plant is successfully installed and it is in operation to meet the requirement of electricity of institute building. The existing solar roof top installed technical specifications and details are given below.

Technical Specifications:

Jamkhed Mahavidhyalaya, Jamkhed has installed solar roof top power plant. The brief specifications and details of the plant are mentioned below.

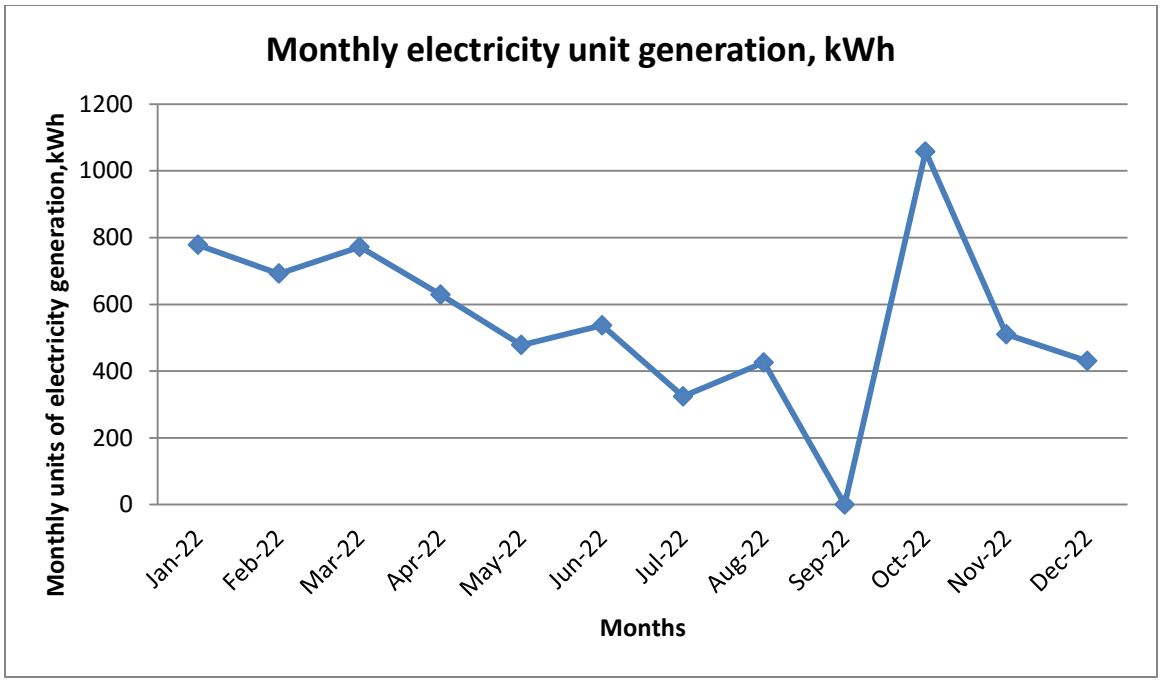
- **System Capacity:** 10 kW
- **PV Module:** Model- VikramSolar-ELDORA-VSP.72.330.03.04-330 Wp X31 nos.
- **Output:** 5.5 kWh/Sq.m/day (All output is under STC, 25°C)

Photo: 10 kW solar roof top on institute building roof.

The installed solar roof top in operation and its electricity generation from last 12 months is mentioned as below.

Sr. No.	Month	Units export	Units Import
1	Dec-2022	430	533
2	Nov-2022	510	409
3	Oct-2022	1058	949
4	Sep-2022	0	0
5	Aug-2022	426	393
6	July-2022	324	423
7	June-2022	537	309
8	May-2022	478	417
9	April-2022	629	319
10	March-2022	772	371
11	Feb-2022	692	251
12	Jan-2022	778	281
13	Total	6634	4655
14	Average	552.8333	387.91
15	Max	1058	949
16	Min	0	0

The graphical representation of electricity unit generation in last 12 months is as shown below.



4.2 Solar powered light for hoarding

Lighting solar systems are the fixed installations designed for domestic as well as small scale commercial application. The component of the solar lighting system includes solar PV module (solar cells), charge controller, solar battery and lighting system (lamps & fans). Modules are installed in the open on roof/terrace - exposed to sunlight and the charge controller and battery are kept inside a protected place in the house.

Figure-1: Solar powered light for Hoarding

This system comes with multiple benefits such as:

- **Economical:** Since the sun provides energy free of charge, 30% power savings on the electricity bill can be availed with longer back up lighting system at zero running cost.
- **Non-Polluting:** Powered by the sun's renewable energy, the system is energy neutral and an absolutely clean source of illumination. 1kWp solar installation reduces 1⁄2 ton of CO_2 (carbon dioxide) per annum.
- **No Maintenance:** The system has few moveable parts – reducing the risk of breakage. Once installed, it lasts for long time and requires little attention.

This system can be used to power the huge hoardings in the college campus.

Solar powered hoarding lighting system proposed will provide a better, faster, cheaper (and cleaner) alternative with solar. Since this product competes with diesel or conventional fuels, we needed to ensure we beat the cost of a diesel solution. In order to achieve that with solar, we consider the following system:

1. Highly Efficient Solar Panel

2. Charge Controllers with MPPT Technology – increases solar electricity production by up to 30% compared to conventional charge controllers

3. LED Projection Light – consumes 10-times less electricity compared to conventional bulbs, and has a 50,000 hour warranty.

Features:

- Auto on off
- 4 Days Battery Back Up
- Robust housing
- Weather proof

With this entire put together, we ended up with systems that provide 6 hours of lighting each night with 4 -lamp system to light up boards up to 15′x30′, and a 8-lamp system to light larger boards up to 20′x40′.More importantly, with these options, payback of the system will come around 2.5 years. This system provides a way to reduce the lightings costs, get rid of all the operational hassles of owning a diesel generator, plus brand benefits from being "green" with the use of renewable energy like solar powered light hoarding board.

4.3 Solar charging stations

Solar cell phone chargers use solar panels to charge cell phone batteries. They are an alternative to conventional electrical cell phone chargers and in some cases can be plugged into an electrical outlet. Solar mobile charger is a device which can charge mobile phones using solar radiation. Its major component is a compact solar panel. This solar panel traps solar energy and produces an output voltage. But, since the light radiations falling on the solar panel can vary, the output voltage becomes unstable. For charging a mobile phone, stable voltage is required. So, to make the output voltage stable and regulated, voltage regulator circuit along with the solar panel is used.

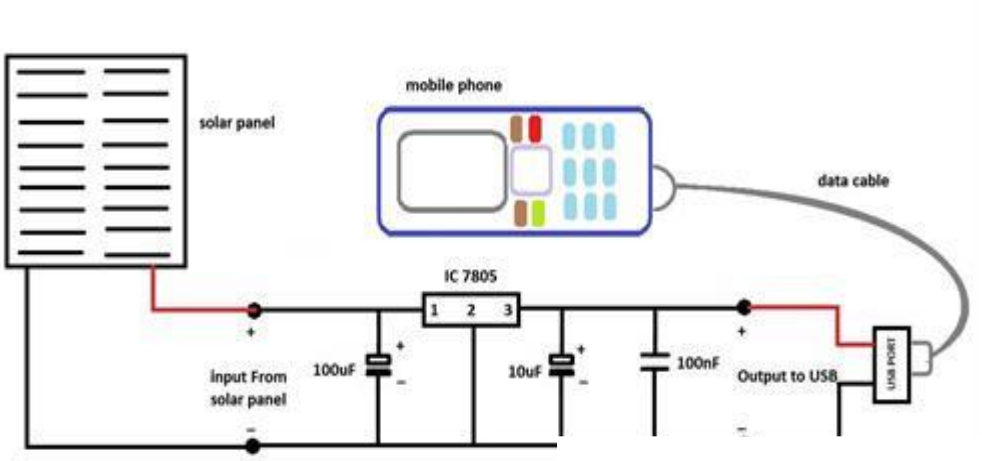


Figure-2: Solar charging Stations

Most of the mobile phones have computer connectivity via USB cable. USB port establishes 4 connection terminals. The connection terminals at the two extreme ends are the supply terminals. In a female USB connector (port via which we plug in USB devices to computer), these terminals carry 5V DC. When a mobile phone is connected to the USB port of a computer, it utilizes this 5V supply to recharge battery. This feature is used in a solar mobile charger. It converts and regulates solar energy to 5V DC and the output will be available through the female USB connector. To this connector, we can easily connect a mobile phone via data cable.

Chapter V
SUGGESTIONS AND RECOMMENDATIONS

Following Energy Conservation Opportunities and actions on the basis of energy audit are suggested to implement in the campus on the basis of funds availability and institute preferences.

a) Energy Audit: Energy Conservation opportunities:

- Installation of 20 Nos. Solar street lights in the college campus
- Installation of Solar powered light for hoarding
- Installation of 05 Nos. solar mobile phone charging stations in the college campus.
- Water management system must be in place. Time of the day (TOD) can be implemented for water pumping for filling the overhead water tanks.