ENERGY AUDIT REPORT

Maharaja Agrasen International College, Samta Colony Raipur (C.G.)

MAIC

2022

Greenserve Energy
Managment Solutions

ENERGY AUDIT REPORT

Maharaja Agrasen International College, Samta Colony Raipur (C.G.)

July 2022

Prepared By:

Greenserve Energy Management Solutions

Vijay Nagar,

Durg (C.G.) - 491001

Acknowledgement

We are thankful to the Management and the Principal of the Maharaja Agrasen International College, Samta Colony, Raipur(C.G.) for entrusting processes of Energy auditing with us. We thank all the participants of the auditing team especially 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.

Audit Team Members

1	Rahul Agrawal	Certified Energy Auditor
2	Jayendra Mohabe	Senior Energy Engineer
3	Bhumesh Jagnit	Energy Engineer

Table of Contents

List of Figures

List of Tables

List of Abbreviations

Word	Meaning
ECM	Energy Conservation Measure
EE	Energy Efficiency
kVA	Kilo Volt Ampere
kVAh	Kilo Volt Ampere hour
kVAr	Kilo Volt Ampere reactive
kW	Kilo Watt
kWh	Kilo Watt hour
PF	Power Factor
RH	Relative Humidity
THD	Total Harmonic Distortion
TR	Tons of Refrigerant
INR	Indian Rupees
kV	Kilo Volt
V	Volt
A	Ampere
EB	Electricity Board
m/s	Meter per seconds
m2	Meter Square
CFL	Compact Fluorescent Lamp
FTL	Fluorescent Tube Light
LED	Light Emitting Diodes
FY	Financial Year
HP	Horse Power

Section 1: Executive Summary

1. Executive Summary

Sno	Energy saving measures	Investment (Lakh Rs.)	Energy Saving Electricity (kWh/Year)	Annual Energy Cost savings (Lakh Rs.)	Payback Period (Months)
1	Replacement of Existing Ceiling Fan to Energy Efficient Fan in Old Building	7.230	19521	1.445	60
	Total	**7.230**	**19521**	**1.445**	**60**

The Annual electrical energy savings (in kWh) are calculated and mentioned in the below table:

Total annual Energy savings, kWh	19521
Total Investment, Rs Lakh	7.230
Total Monetary savings, Rs Lakh	**1.445**
Simple Payback Period, Months	**60**

Section 2: Introduction

2. Introduction

2.1 About Maharaja Agrasen International College, Raipur

Maharaja Agrasen International College (MAIC) is affiliated to Pandit Ravishankar Shukla University, Raipur, Chhattisgarh. Located in the center of the city in Samta Colony, it provides quality education. Established by the Maharaja Agrasen Charitable Trust in 2006, the college has evolved into one of the premier institutions of the Chhattisgarh with a National Assessment and Accreditation Council (NAAC) B+ grade in the year 2017.

it was soon to possess a building of its own. With a campus spread across 2 acres, the college has a fine infrastructure. herbal and botanical gardens, a big ground and other sports and games & Library facilities.

At present, the work of teaching studies at the undergraduate level in all the four faculties of Arts, Commerce, Computers & Science is going on smoothly in a self-constructed building on about 1 acres of land. A total of about one thousand three hundred students are studying in the college and making their dreams of higher education come true.

VISION AND MISSION

Institutional Vision

To be an exemplary institution that thrives on value-based education for talent development in scientific knowledge and humanities for a vibrant and inclusive society with holistic development.

Mission

Providing education for life with instilling patriotic fervour coupled with global competitiveness in which faculty, staff and students can develop the wisdom to ensure family and social values along with scientific understanding for happy and sustainable Society.

To achieve our Mission, we provide:

- Excellence in education based in human values.
- Life skills programs for improvement of life.
- Unique skill development programs like LEARN VILLA, MAIC-BAND, JCI, ROVER & RANGER.
- Holistic Development of students through curricular, co-curricular and extra-curricular activities.
- Beyond the boundary collaborations with educational institutions, industries and social groups.
- Service to the society, nation and world with compassion.
- Sensitiveness to our cultural heritage.
- Environment to develop the responsibility to the self, family, society, country, world, ecosystem and the universe.

Location:

Maharaj Agrasen International College, Samta Colony, Raipur and the GPS Coordinates of the college is **21.2444005 81.6251739**

The installed capacity of each load is given as follows:

Sr. No.	Connected Load Breakup(kW)	
1	AC Load	233
2	Fan, Cooler & Exhaust Fan Load	21.2
3	Computers & Printers Load	24.5
4	Lighting Load	13.8
5	Board & Smart TV	39.6
6	CCTV, Lift & Water Purifier	4.5
Total Load		**337**

Table 1: Connected Load Break up

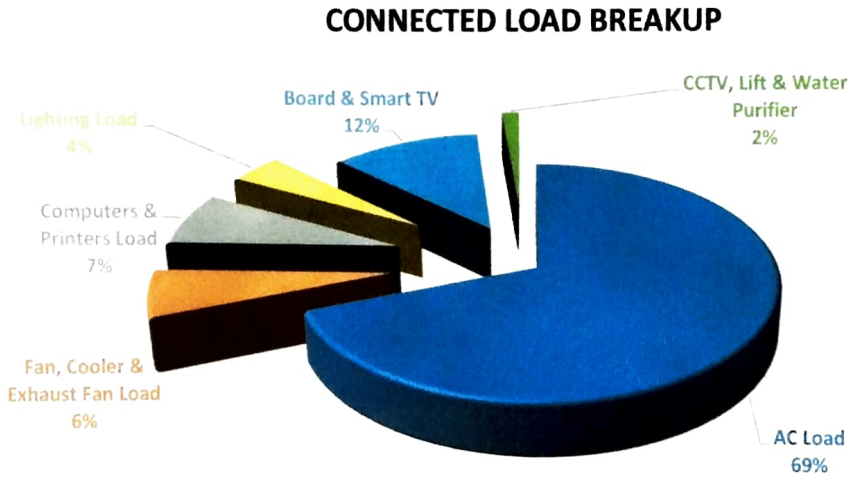


Figure 1: Connected Load Breakup

2.2 Methodology

The methodology adopted for energy audit study is given below:

- Kick off meeting
- Analysis of past performance data
- Measurements of required electrical parameters
- Conduct of efficiency and performance improvement trials (if required)
- Discussion of the findings and recommendations with Electrical Team.
- Detailed techno-economic analysis
- Report submission

2.3 Instruments used for study

The following Instruments were used during energy audit study:

S. No	Name of the Instrument	Make of the instrument	Details
1.	Portable power quality analyser	Hioki	Range: 5A-5000Amps Accuracy: Uncertainty in measurement is ±0.77% Voltage & ±0.7% (current), ±0.31% (watts)
2.	Thermal Imaging camera	Fluke TS10	Temperature Range: -10 to 350 °C (14 to 662 °F)
4.	RH meter	TESTO	Temperature range: 0°C to 50°C. with 100% RH
5.	Lux meter	Ten mars (NEDA 1604)	Range:0-2000, 0-20000 & 0-50000 Lux (3 Ranges)
6.	Digital Pressure Meter	Metravi	Range : 0 to 2.131 PSI
7.	Anemometer	Lutron (AM 4201)	Range of Velocity: 0-30 m/s
8.	Ultrasonic flow meter	ADOPT Fluid Dynamics, pune	Range: 0-2500 m^3/hr Resolution: 0.01m^3/hr

Table 2: Instruments used for the study

Climatic condition

The average high temperature and low temperature profile of Raipur is given as follows:

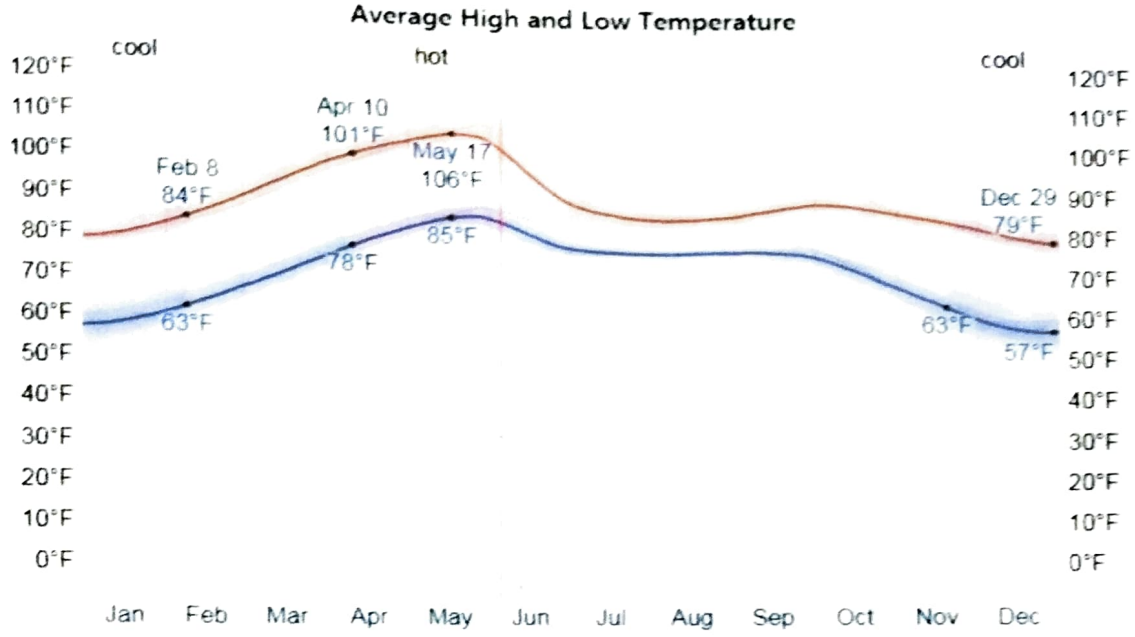


Figure 2: Climatic condition of Raipur

The hot season lasts for 1.9 months, from April 10 to June 8, with an average daily high temperature above 101°F (38°C). The hottest day of the year is May 17, with an average high of 106°F (41°C) and low of 85°F (29°C).

The cool season lasts for 2.6 months, from November 19 to February 8, with an average daily high temperature below 84°F(29°C). The coldest day of the year is December 29, with an average low of 57°F(14°C) and high of 79°F(26°C).

2.4 Present Energy Scenario at Maharaja Agrasen International College, Raipur

2.4.1 Source of Electricity

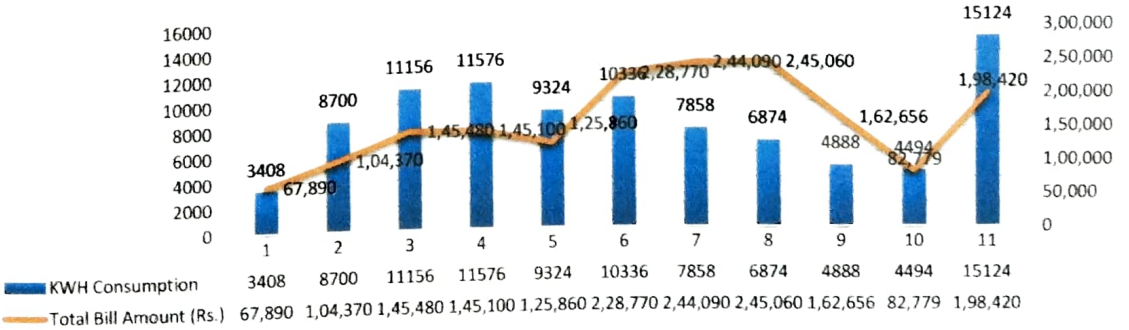
Electricity is sourced from Chhattisgarh State Power Distribution Company Limited (CSPDCL). The sanctioned demand of the facility is 277 KVA.

2.4.2 Electricity Board Bill Analysis

Electricity details including bills paid, demand recorded, and consumption is tabulated below. Electricity bill data of the facility from April 2021 to March 2022 is analysed as per billing month and summarised as follows:

Bill Month	KWH Consumption	KVAH Consumption	Contract Demand (KVA)	Demand (KVA)	Avg. P.F	Total Bill Amount (Rs.)	Charge Per Unit KWH (Rs.)	Charge Per Unit KVAH (Rs.)
Apr-21	3408	4716	277	112.8	0.72	67,890	19.9	14.4
May-21	8700	10568	277	142.4	0.82	1,04,370	12.0	9.9
Jun-21	11156	13524	277	105.6	0.82	1,45,480	13.0	10.8
Jul-21	11576	13448	277	105.6	0.86	1,45,100	12.5	10.8
Aug-21	9324	11164	277	128.8	0.84	1,25,860	13.5	11.3
Sep-21	10336	21764	277	164	0.47	2,28,770	22.1	10.5
Nov-21	7858	24454	277	70.24	0.32	2,44,090	31.1	10.0
Dec-21	6874	24160	277	62.56	0.28	2,45,060	35.7	10.1
Jan-22	4888	14570	277	50.56	0.34	1,62,656	33.3	11.2
Feb-22	4494	4920	277	86.72	0.91	82,779	18.4	16.8
Mar-22	15124	17226	277	222.08	0.88	1,98,420	13.1	11.5
Total	**58898**	**118258**				**1287635**		
Average			**277**	**109.36**	**0.535**		**23.9**	**11.6**
Maximum	**15124**	**24454**			**0.913**	**245060**		
Minimum	**3408**	**4716**			**0.285**	**67890**		

kWH Vs Total Bill Paid Comparision Chart



Energy consumption (kWh) was maximum during March 2022 and minimum during April 2021. The energy cost paid was maximum during Dec 2021 and minimum during April 2021.

Section3: Performance Assessment

3. Performance Assessment

The Maharaja Agrasen International college, Raipur, has One Energy Meter. The facility has AC's, Fans, lighting and Computers as the major energy consuming utilities.

3.1 Load Analysis

The power logging monitoring has been done for main incomer feeder.

Main Incomer reading

Sr No.	Panel Name	Measured												
		Voltage (V)					Current(A)					Power	Power	
		RY	YB	BR	Average	% imbalance	RY	YB	BR	Average	% Imbalance	Factor	kW	KVA
1	TRF Main Incomer	426	425	424	425.0	0.24	72	54.5	71.2	65.9	9.3	0.960	46.6	48.5

Voltage profile

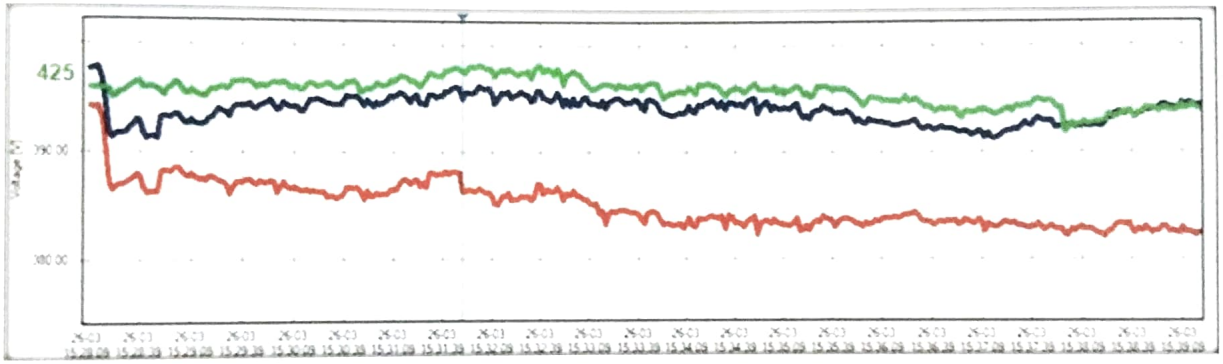


*Figure 3: **Voltage profile-***

Current profile

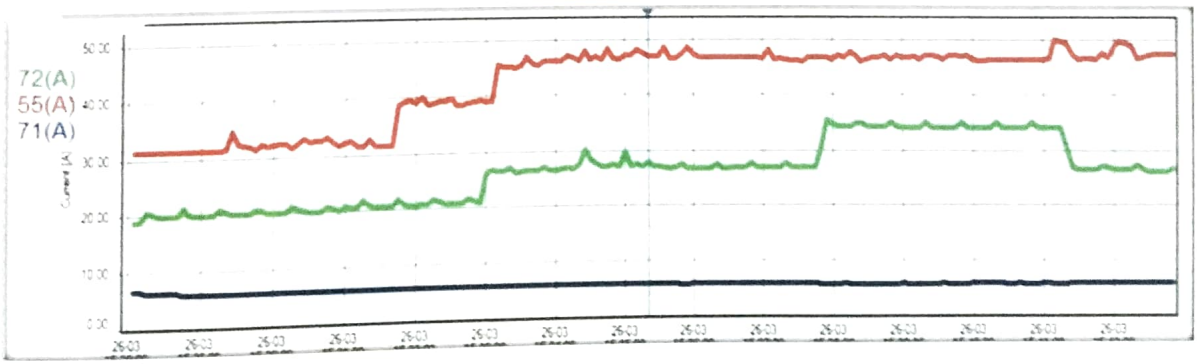


Figure 4: Current profile

3.2 Illumination Survey

Sl. No.	Location / Room No.	kWH/Day
	Ground Floor	
1	G/1 BOARD ROOM	60.0
2	G/2 STAFF ROOM	67.5
3	G/3 BCA I	27.9
4	G/4 BCA II	23.1
5	G/5 BCA III	24.9
6	G/6 B. COM II A	24.9
7	G/7 B.COM	24.9
8	G/8 B COM III	24.9
9	G/9 B.COM	24.9
10	G/10 B COM I	24.9
11	G/11 B.COM I	45.0
12	G/12 STORE	23.1
13	G/13 PGDCA	45.2
14	G/14 MUSIC ROOM	24.9
15	G/15 MUSIC ROOM	24.9
16	EXM. CONTROL	29.1
17	ADMIN BLOCK	183.0
18	LIBRARY	59.8
19	CUMPUTER LAB	185.6
20	SEMI.-MUSIC ROOM	144.9
21	CANTEEN	69.0
22	RECEPTION	52.8
	First Floor	
1	F/1 BSC LAB	44.9
2	F/2 BBA I PRAPOSE	24.9
3	F/3 B.COM STAFF	27.9
4	F/4 RECORD ROOM	1.8
5	F/5 GEST ROOM	23.3
6	F/6 BED CLASS ROOM	48.1
7	F/7 BBA-I	24.9
8	F/8 BBA I/II	24.9
9	F/9 BSC-III	24.9
10	F/11 CONFRANCE HALL	141.3
11	F/ 10 SPORT ROOM	26.7
12	F/12 BBA V/ VI	45.2
13	F/13 ROVER RANGER	24.6
14	F/ 14 BBA III, IV	44.8
15	F/15 BCA	45.0
16	F/16 BSC	44.8

Sl. No.	Location / Room No.	kWH/Day
17	F/17 STAFF ROOM B.VOC	60.7
18	F/18 B.VOC I.D.D.I	25.2
19	F/19 B.VOC I.D.D.I	45.0
20	F/20	41.1
	2nd Floor	
1	BCA FIRST YEAR	68.1
2	CUMPUTER LAB	44.8
3	PHIYCSIC LAB	67.2
4	STAFF ROOM	51.7
5	DLED -5	2.7
6	BSC FIRST YEAR	45.4
7	BCA III	44.7
8	B.COM III	44.8
9	DLED -9	66.0
10	ADUDITORIUM INNER	252.9
11	AUDITORIUM OUTER	38.2

3.3 Connected Load

Sr.No.	Type of Fitting	Qty.	Watts	Total KW
	COLLEGE BUILDING			
1	AC -1.5 Tonne	46	2000	92.0
2	AC-2 Tonne	30	2500	75.0
3	AC -3 Tonne	20	3300	66.0
4	Fan	241	75	18.1
5	Cooler	11	240	2.6
15	Exhaust Fan	10	45	0.5
6	LED Tube Light	564	18	10.2
7	LED Bulb	100	9	0.9
8	Metal Halide Halogen	2	600	1.2
9	LED Hyalogen	6	250	1.5
10	Board & Smart TV	132	300	39.6
11	Printers	20	350	7.0
12	Computers	70	250	17.5
13	CC TV	50	10	0.5
14	Lift	1	2000	2.0
16	Water Purifier	5	400	2.0
	Total Load			**337**

3.4 Room Wise Energy Consumption

Sl. No.	Location / Room No.	kWH/Day
	Ground Floor	
1	G/1 BOARD ROOM	60.0
2	G/2 STAFF ROOM	67.5
3	G/3 BCA I	27.9
4	G/4 BCA II	23.1
5	G/5 BCA III	24.9
6	G/6 B. COM II A	24.9
7	G/7 B.COM	24.9
8	G/8 B COM III	24.9
9	G/9 B.COM	24.9
10	G/10 B COM I	24.9
11	G/11 B.COM I	45.0
12	G/12 STORE	23.1
13	G/13 PGDCA	45.2
14	G/14 MUSIC ROOM	24.9
15	G/15 MUSIC ROOM	24.9
16	EXM. CONTROL	29.1
17	ADMIN BLOCK	183.0
18	LIBRARY	59.8
19	CUMPUTER LAB	185.6
20	SEMI.-MUSIC ROOM	144.9
21	CANTEEN	69.0
22	RECEPTION	52.8
	First Floor	
1	F/1 BSC LAB	44.9
2	F/2 BBA I PRAPOSE	24.9
3	F/3 B.COM STAFF	27.9
4	F/4 RECORD ROOM	1.8
5	F/5 GEST ROOM	23.3
6	F/6 BED CLASS ROOM	48.1
7	F/7 BBA-I	24.9
8	F/8 BBA I/II	24.9
9	F/9 BSC-III	24.9
10	F/11 CONFRANCE HALL	141.3
11	F/ 10 SPORT ROOM	26.7
12	F/12 BBA V/ VI	45.2
13	F/13 ROVER RANGER	24.6
14	F/ 14 BBA III, IV	44.8
15	F/15 BCA	45.0
16	F/16 BSC	44.8
17	F/17 STAFF ROOM B.VOC	60.7

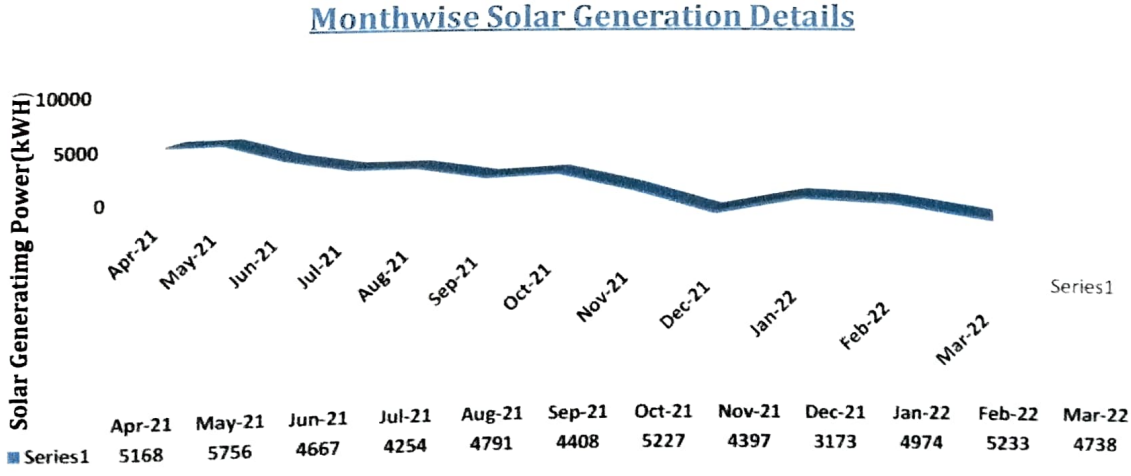
Sl. No.	Location / Room No.	kWH/Day
18	F/18 B.VOC I.D.D.I	25.2
19	F/19 B.VOC I.D.D.I	45.0
20	F/20	41.1
	Second Floor	
1	BCA FIRST YEAR	68.1
2	CUMPUTER LAB	44.8
3	PHIYCSIC LAB	67.2
4	STAFF ROOM	51.7
5	DLED -5	2.7
6	BSC FIRST YEAR	45.4
7	BCA III	44.7
8	B.COM III	44.8
9	DLED -9	66.0
10	ADUDITORIUM INNER	252.9
11	AUDITORIUM OUTER	38.2

3.5 Month Wise solar Power Generation Deetails(kWH)

Month wise Solar Power Generation details Report tabulated below

Solar Power Generation data of the facility from April 2021 to March 2022 is analysed as per month and summarised as follows:

Month	Solar Generating Power(kWH)
Apr-21	5168
May-21	5756
Jun-21	4667
Jul-21	4254
Aug-21	4791
Sep-21	4408
Oct-21	5227
Nov-21	4397
Dec-21	3173
Jan-22	4974
Feb-22	5233
Mar-22	4738
Total	**56785.77**
Max.	**5756**
Min.	**3173**



Solar Generation (kWh) was maximum during May2021 and minimum during Dec 2021.

Section4: Energy Conservation Measures (ECM)

4. Energy Conservation Measures

ECM 1: Replacement of Existing Ceiling Fan to Energy Efficient Fan in College Building.

Existing condition

Sr.No.	Location	Existing Ceiling Fan Fittings (75 Watt)			Proposed Fan to be Replaced with Energy Efficient ceiling Fan (1200 mm) 30 Watt				
		Watt	Qty.	Total Watt	Watt	Qty.	Total Watt	Approx. Each Price in Rs.	Amount in Rs.
1	College Building	75	241	18075	30	241	7230	3000	723000
	Total			**18075**			**7230**		**723000**

Recommendation

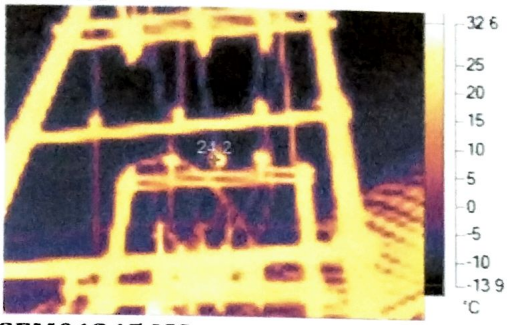
Replacement of existing Ceiling Fan to Energy Efficient fan in College Building

1	**Existing Fitting energy consumption**	**Watt**	**18075**
2	**Proposed Fitting energy consumption**	**Watt**	**7230**
3	**After replacement energy saving**	**Watt**	**10845**
4	**Energy Saving in Percentage**	**%**	**60.00**
5	**Operating hour per day**	**hours/day**	**6**
6	**Operating days per years**	**days/Year**	**300**
7	**Energy Saving After Replacement**	**Watt Hour**	**65070**
		kWh/year	**19521**
		Lakh kWh/year	**0.195**
8	**Energy Cost**	**Rs./kWh**	**7.40**
9	**Saving in Terms of Amount**	**Lakh Rs. /year**	**1.445**
10	**Estimated Investment for Energy Efficient ceiling fan**	**Lakh Rs.**	**7.230**
11	**Simple Payback Period**	**Year**	**5.01**
		Month	**60.06**
		Say Month	**60**

Thermal Images

-

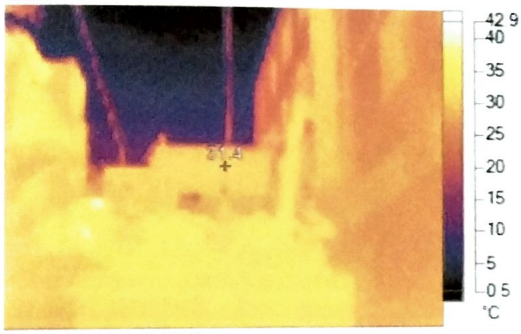
Isolator



GEM01245.IS2

Visible Light Image

TRF

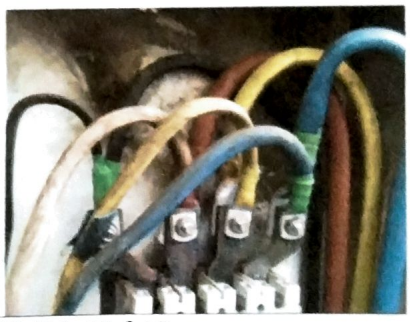


GEM01246.IS2

Visible Light Image

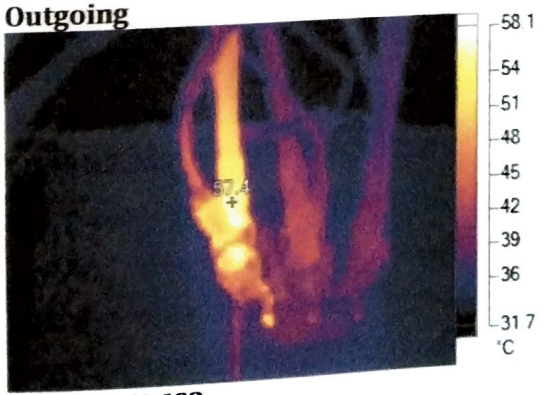
Main Incomer

GEM01247.IS2



Visible Light Image

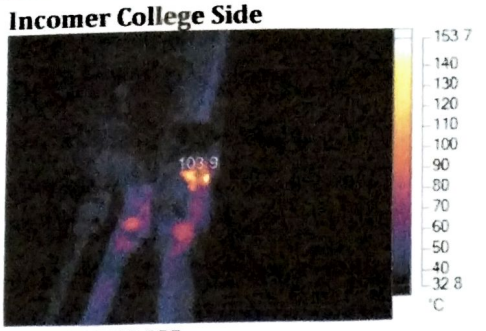
Outgoing



GEM01250.IS2

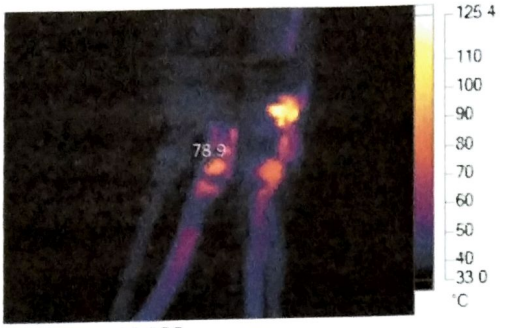
Visible Light Image

Incomer College Side



GEM01252.IS2

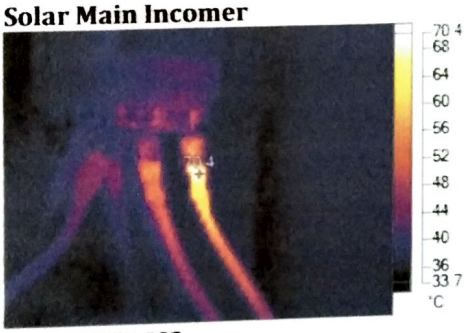
Visible Light Image



GEM01253.IS2

Visible Light Image

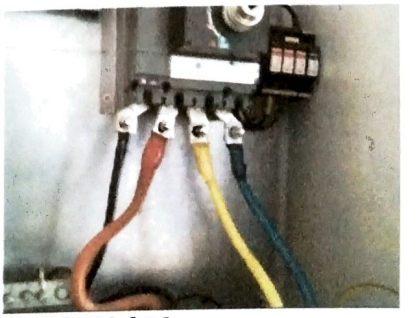
Solar Main Incomer



GEM01254.IS2

Visible Light Image

GEM01255.IS2



Visible Light Image

Registration Number : D-DURG-159-2016-15
Phone Number : 7752533330, 9098148400
Email id : greenserve.energy@gmail.com

CERTIFICATION

This Part shall indicate certification by Certified Energy Auditor stating that:

-

I. The data collection has been carried out diligently and truthfully.
II. All data monitoring devices are in good working condition and have been calibrated or certified by approved agencies authorized and no tampering of such device has occurred.
III. All reasonable professional skill, care and diligence had been taken in preparing the Energy Audit Report and the contents thereof are a true representation of the facts.
IV. Adequate training provided to personnel involved in daily operation after implementation of recommendation.
V. The Energy Audit has been carried out in accordance with the Bureau of Energy Efficiency (Manner and intervals of time for the conduct of Energy Audit) Regulation, 2010.

Signature:

Certified Energy Auditor EA-20984 BEE Rahul Agrawal

Name of the Certified Energy Auditor: Mr. Rahul Agrawal
Certification Detail: EA-20984