

SHREE GURU GOBIND SINGH JEE GOVERNMENT COLLEGE PAONTA SAHIB, (H.P.)



ENERGY AUDIT REPORT



SGGSJ Government Degree College Paonta Sahib
ENERGY AUDIT COMMITTEE

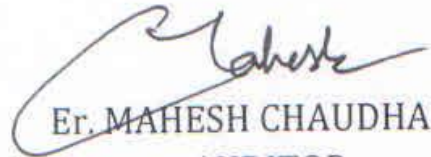
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ENERGY AUDIT CERTIFICATE

It is certified that an Energy audit has been conducted in SGGSJ Government College, Paonta Sahib, Distt. Sirmour (H.P.) Energy costs, Energy supply reliability and methods to reduce energy consumption has been assessed.



MANDEEP SINGH GANDHI
CONVENOR



Er. MAHESH CHAUDHARY
AUDITOR

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SUMMARY

Energy plays an important role in development today. It is an important required basic need. Energy cost is an important factor for all type of economic activity. With energy demand increasing day by day, a gap is being created in demand and availability of energy. Therefore, conservation of energy becomes important aspect to save energy. With conservation of energy, we can make it available and bridge gap between availability and demand.

Energy Audit is important to assess use of energy, energy management, and reducing maintenance costs. It helps in reducing consumption and reduces energy bills.

1. INTRODUCTION

Energy processes involve generation, transmission, distribution and efficient use. It is important to reduce wastage and maximize efficiency. It ensures productive use of energy.

EC Act 2001, Section 14(c) applies to industries with 5000kW and higher consumption. These institutions carry out energy audits by designated firms .

Bureau of Energy efficiency under Union Ministry of Power ,created in 2002 under 2001 energy conservation act, is responsible for conservation and efficient use of energy.

Energy Audit in college

Energy audit has been carried out with verification of energy use practices, technical analysis, suggestions to improve efficiency and way to reduce energy cost along with consumption.

The process has been carried out in three stages:

Stage 1

Collection of information:

Data was collected using various methods such as Physical observations, survey with team visit around the campus.

- 1) Team visited Science Block, Administrative Block, New Block, Kalam Block, Old Block, Library and Canteen.
- 2) Data of appliances used and usage practices were collected through observation.
- 3) Average power consumption was noted down.

Stage II

Analysis of data was done that included power consumption bills.

Stage III

After thorough observations and analysis , team recommended various steps to reduce energy consumption.

2 Energy Audit

2.1 First Stage of Energy Audit

2.1.1 Collection of data:

- Electricity bill for last five years
- LPG cylinders uses per year
- Money spent by college on power and LPG
- Number of Fluorescent tubes, LED Bulbs, CFL, Incandescent bulbs used in college and their energy consumption.
- Number of ceiling fans and their energy consumption.
- Number of ceiling computers and their energy consumption.
- Number of Refrigerators and their energy consumption
- Number of Photo copier machine and their energy consumption
- Number of Air conditioners and their energy consumption.
- Number of Inverters and their energy consumption.
- Generator set and its energy consumption.
- Number of Heaters and their energy consumption.
- Number of Streetlights and their energy consumption.
- Public address system and it's energy consumption.
- Number of interactive panels and their energy consumption.

- How many boards displayed for awareness of energy saving.

2.2 Second Stage of Energy Audit

Energy audit process was carried out by audit team by

- Walking through all departments, blocks, play ground, library, corridors and canteen.
- Team noted details of various appliances and their usage.
- Staff and students were interviewed to get usage details.
- Documents like electricity bills and LPG consumption were reviewed.
- A campus visit was carried out to see solar lights, street lights. LPG cylinders use in Labs and canteen were counted.

2.2.1 College area and building area: Table 1

Place	Area in Square meters
Total	21850.8
Building covered	5767
Open space and ground	16083.8

2.2.2 Sources of Energy

1) Transformer 11/0.4 kV , 250KVA installed outside the campus.

2) Generator- 100 KVA (Diesel)

with efficiency 80%

3) Two Inverters –Physics Lab-01, Community College lab -01

2.2.3 Power Consumption:

Table 2: Month wise details of Electricity Bill

Year	Month	Consumer ID-1131121648			Consumer ID-1131115510			Consumer ID-1131125340		
		100008002136			100002208786			100003024591		
		New	Old	Difference	New	Old	Difference	New	Old	Difference
2017	September	48570	48055	515.00	380918	379828	1090.00	3659	3519	140.00
2017	October	49225	48570	655.00	381833	380918	915.00	3891	3659	232.00
2017	November	49865	49225	640.00	382969	381833	1136.00	3981	3891	90.00
2017	December	50688	49865	823.00	384540	382969	1571.00	4066	3981	85.00
2018	January	50917	50688	229.00	385290	384540	750.00	4159	4066	93.00
2018	February	51500	50917	583.00	387068	385290	1778.00	4179	4159	20.00
2018	March	52083	51500	583.00	388064	387068	996.00	4283	4179	104.00
2018	April	52936	52083	853.00	389200	388064	1136.00	4399	4283	116.00
2018	May	106465	105869	596.00	390530	389200	1330.00	4515	4399	116.00
2018	June	106465	106465	0.00	391695	390530	1165.00	4587	4515	72.00
2018	July	109058	106465	2593.00	393148	391695	1453.00	4749	4587	162.00
2018	August	110399	109058	1341.00	395646	393148	2498.00	5037	4749	288.00
2018	September	111970	110399	1571.00	397666	395646	2020.00	5377	5037	340.00
2018	October	113345	111970	1375.00	399063	397666	1397.00	5609	5377	232.00
2018	November	168186.22	166660	1526.22	400517	399630	887.00	5629	5609	20.00
2018	December	169045.26	168159	886.26	401480	400517	963.00	5701	5629	72.00

Year	Month	Consumer ID-1131121648			Consumer ID-1131115510			Consumer ID-1131125340		
		100008002136			100002208786			100003024591		
		New	Old	Difference	New	Old	Difference	New	Old	Difference
2019	January	170504.52	169020	1484.52	402444	401480	964.00	5831	5701	130.00
2019	February	171907.42	170477	1430.42	403956	402444	1512.00	5940	5831	109.00
2019	March	173617.88	171881	1736.88	405219	403956	1263.00	6064	5940	124.00
2019	April	174752	173591	1161.78	406288	405214	1074.00	6231	6064	167.00
2019	May	176205	174752	1453.00	407652	406288	1364.00	6368	6231	137.00
2019	June	178113.14	176205	1908.14	408938	407652	1286.00	6430	6368	62.00
2019	July	178105.5	178083	22.50	411420	408938	2482.00	6721	6430	291.00
2019	August	414031	411420	2611.00	414031	411420	2611.00	6965	6721	244.00
2019	September	186796.68	183379	3417.68	417134	414031	3103.00	7221	6965	256.00
2019	October	189617.46	186764	2853.46	418607	417134	1473.00	7385	7221	164.00
2019	November	191297	189587	1710.00	419993	418607	1386.00	7533	7385	148.00
2019	December	192963	191268	1695.02	421468	419993	1475.00	7665	7533	132.00
2020	January	194821	192963	1858.00	422988	421468	1520.00	7665	7665	0.00
2020	February	195864.68	194821	1043.68	424374	422988	1386.00	8004	7665	339.00
2020	March	198309	195839	2469.66	425405	424374	1031.00	8104	8004	100.00
2020	April	199874	198309	1565.00	426117	425405	712.00	8194	8104	90.00
2020	May	200360.84	199874	486.84	427107	426117	990.00	8284	8194	90.00
2020	June	200856.56	200336	520.56	427921	427107	814.00	8284	8284	0.00
2020	July	201417.04	200831	586.04	428567	427921	646.00	8291	8284	7.00
2020	August	202168.52	201392	776.52	429951	428567	1384.00	8418	8291	127.00
2020	September	203509.58	202141	1368.58	432301	429951	2350.00	8911	8418	493.00
2020	October	205335.22	203482	1853.22	433410	429951	3459.00	9019	8418	601.00
2020	November	206845.7	205306	1539.70	434374	433410	964.00	9115	9019	96.00
2020	December	207639.08	206818	821.08	435110	434374	736.00	9146	9115	31.00

Year	Month	Consumer ID-1131121648			Consumer ID-1131115510			Consumer ID-1131125340		
		100008002136			100002208786			100003024591		
		New	Old	Difference	New	Old	Difference	New	Old	Difference
2021	January	208667.54	207614	1053.54	436632	435110	1522.00	9205	9146	59.00
2021	February	209991.24	208641	1350.24	437524	436632	892.00	9246	9205	41.00
2021	March	211324.50	209965.00	1359.50	438781.00	437524.00	1257.00	9425.00	9246.00	179.00
2021	April	212843	211298.00	1544.64	439799.00	438781.00	1018.00	9503.00	9425.00	78.00
2021	May	213867	212843	1024.00	440715	439799	916.00	9503	9503	0.00
2021	June	214936.60	213867.00	1069.60	442069	440715	1354.00	9521.00	9503.00	18.00
2021	July	216251.90	214909.00	1342.90	443662	442069	1593.00	9521	9521	0.00
2021	August	218602.66	216224.00	2378.66	447398.00	443662.00	3736.00	10618.00	9521.00	1097.00
2021	September	221250	218572.00	2678.12	449413	447398	2015.00	11010.00	10618.00	392.00
2021	October	223003	221250	1753.00	451250	449413	1837.00	11312.00	11010.00	302.00
2021	November	225931	223003	2928.00	452801	451250	1551.00	11505.00	11312.00	193.00
2021	December	227588.48	225931	1657.48	455346.00	452801.00	2545.00	11685	11505	180.00
2022	January	229639.32	227563	2076.32	455895	455346	549.00	12000	11685	315.00

Monthly average consumption of units in last five years:

Consumer ID-1131121648	Consumer ID-1131115510	Consumer ID-1131125340	Total Units Consumed	Average Monthly Bill @ Rs 5.50
KO No. 100008002136	KO No. 100002208786	KO No. 100003024591		
1413.53	1655.943	204.3158	3273.7888	Rs 18006

2.2.4 Energy Usages as per observations

On the basis of data collected with documents in record and information collected, following energy consumption was noted:

Electricity bill – Rs 18006 /Month

GENERATOR- 100 kVA

Diesel consumption per month- 25 liters

Total energy cost @Rs 80/liter- Rs. 2000

No of Fluorescent tubes- 374

No of LED Bulbs- 114

No. of CFL -20

No incandescent bulbs- 10

No of fans- 213

Digital Podium -03

No. of Projectors- 03

Water Cooler with RO- 06

Submersible Pumps-02

No of solar street lights-20

No of photo Copier machines- 01

No of computers -31

No. of Printers-15

Fax Machine-01

Laptop-01

No of Air Conditioners (2 tons) - 19

No of Air Conditioners (1.5 tons) - 01

No of Interactive panels-13

Lab equipments-

No of Geysers (1000 Watt) – 07

Refrigerators (165 L) - 03

S. No	Name	Number	Average time Usage	Wattage (in Watt)	Energy consumption per day (in KWh)
1	Fluorescent tubes	374	10	20	73.8
2	LED Bulbs	114	10	11	12.5
3	CFL	20	10	23	4.6
4	Incandescent bulb	10	10	100	10.0
5	Ceiling Fan	213	8	28	47.7
6	Digital Podium	03	0.5	150	0.225
7	Solar Street Light	20	10	15	03.0
8	Computer	31	10	150	46.5
9	Laser Printer	15	01	375	5.625
10	Projector	03	0.5	150	0.225
11	Water Cooler	06	12	750	54.0
12	Submersible Pump	02	01	1000	02
13	Photostat Machine	01	0.5	1100	0.55
14	Fax Machine	01	0.5	15	0.075
15	Laptop	01	06	30	0.18
16	Air conditioner	20	08	2100	336.0
17	Interactive Panels	13	06	250	19.5
18	Geysers	07	0.5	2000	7.0
19	Refrigerators	03	22	150	9.9
20	Lab Equipment	20	02		
21	Public Address System	01	0.5	1100	0.55
22	LPG Cylinder	04	05	NA	NA

2.2.5 Energy Saving Practices:

- Switch off electrical equipment's when not in use.
- Avoid artificial lighting during day time.
- Unplug overhead Projectors, Interactive Panels when not in use.
- If Air conditioner is in use, then keep doors closed to maintain the Temperature.
- Remember to turn the lights, fans and any other electrical appliances off while leaving a class room.
- Master switches installed outside rooms.
- Timely switch off water motor installed in campus
- Use lights and fans as required . Do not switch on all the lights and fans of the room
- Don't overcool; Set room temperature to 24°C–27°C , while using Air Conditioners.
- CFLs are being replaced by more efficient LEDs.
- Use computers and electronic equipment's in power saving mode.

2.2.6 Recommendations for Better Energy Efficiency

Energy audit team recommended certain steps for improving energy efficiency. Through Cost Analysis of certain appliances team recommended measures that need to be performed along with general measures for energy efficiency. Described below are some important recommendations for better energy efficiency:

2.2.6.1 Low or No Investment

i) Housekeeping

Curtains - Curtains play vital role in saving energy as follows:

Day Light: with curtains moved aside we can use day light against lamps to save energy.

Direct sun light: This can heat up room and increase consumption of energy by ACs.

There is need to keep curtains on windows to prevent direct sunlight inside the room to avoid heating of cooled air. This can reduce AC load significantly.

ii) Better Practices for use of Air Conditioners

College has in total 20 split type AC's which make a very large part of total energy consumption of the campus. But, at many places it was found that AC is not used with best recommended practices. Even simple things, such as insulation, are not taken care of. Window panes were found broken at many places. Also, at certain places ACs were found to be used without keeping curtains. These poor practices account for increase in AC load and thus consumption.

Summarized below are some guidelines for most efficient use of ACs:

Proper Insulation-Good quality insulation must be maintained in the air-conditioned rooms by keeping all doors and windows closed properly so as to prevent cool air go out and hot air come in.

Operating - The ACs should be switched on 15 minutes before actual use and should be switched off before leaving the room.

2.2.6.2 Low Investment Few year time of Replacement,

1) To Replace CFLs and Incandescent bulbs with LEDs lamps

The traditional 23W CFLs and 100W Incandescent bulbs at some places in campus indicate a total of 20 CFLs and 10 incandescent bulbs. If these CFLs and incandescent bulbs are replaced by LEDs 10-12W power can be saved per CFL/incandescent bulb.

Cost Analysis of Replacing CFLs with LEDs:

- Total No. of CFLs in Campus = 20
- Power consumption of CFL = 460W
- Total No. of Incandescent bulbs in Campus = 10
- Power consumption of Incandescent bulbs = 1000W
- Average Power of LED = 11W
- Power saved per LED against CFL = 12W
- Power Saved per LED against Incandescent bulb=89W
- Total Power saving = 1130 W
- Average Use of CFL per year = $20 * 10 \text{ hours} * 365 = 73 \text{ KWh}$

- Average Use of Incandescent bulbs per year = 10×10 hours $\times 365 = 36.5 \text{KWh}$
- Total Energy saved per year = $1130 \times 10 \times 365 = 4124.5 \text{KWh}$
- Saving in Rs. Per year = $4124.5 \times 5.5 = 22684$
- Average Cost of Replacing each CFL and Incandescent bulb = Rs 100
- Total Cost of Replacing all CFLs and Incandescent bulbs = Rs 3000
- Capital Cost Recovery time = 1.3 years

Hence, the capital cost recovery time for replacing all CFLs of the campus is around 1.3 years.

2.2.6.3 High/medium Investment with Long Term Replacement

1. Energy substitution (electrical energy to solar energy)

There is a high electrical Energy consumption in College which need to be substituted with alternate energy source. A very good option is solar energy.

Energy consumption of solar street light put in use in college campus in September, 2020 has saved energy at nominal cost of their installation.

Cost analysis of solar Energy lights is as under

- Watt hour per day- $15\text{W} \times 10\text{Hr} \times 20\text{No} = 3000\text{Wh}$
- Total watt peak rating- 15W
- No. of Solar street lights in campus-20
- Cost of Street lights- $\text{Rs}2000 \times 20\text{No} = \text{Rs} 40000$
- *KWH saved per month- $20\text{W} \times 20\text{No} \times 10\text{Hr} \times 30\text{days} = 120\text{KWh}$
- Annual savings in Rs. – $120\text{KWh} \times 12 \text{ months} \times \text{Rs}5.50 = \text{Rs} 7920$
- Payback period- 5 years one month

***Solar street light (15W) has been put against 20W LED Street light**

Table 4: Energy saving by using SOLAR Street Lights in place of LEDs

AREA	Watt Hour PER DAY	TOTAL Wh NEEDED	NO OF SOLAR LIGHTS	COST OF SOLAR LIGHTS	KWh SAVED	SAVING IN Rs. ANNUALLY	PAY BACK TIME
ADM. BLOCK	15*10*1=150	150	01	2000	0.2	396	5 years 1 month
NEW BLOCK	15*10*1=150	120	01	2000	0.2	396	5 years 1 month
KALAM BLOCK	15*10*2=300	240	02	4000	0.4	792	5 years 1 month
IGNOU BUILDING	15*10*1=150	120	01	2000	0.2	396	5 years 1 month
SCIENCE BLOCK	15*10*2=300	240	02	4000	0.4	792	5 years 1 month
COLLEGE CANTEEN	15*10*1=150	120	01	2000	0.2	396	5 years 1 month
COLLEGE GROUND	15*10*12=1440	1800	12	24000	2.4	4752	5 years 1 month
TOTAL	2400	2790	20	40000	4.0	7920	5 years 1 month

Wh: WATT HOURS KWh: Kilo Watt Hour

2.2.7 Observations by Energy audit team

- Regular monitoring of electrical equipments is undertaken and immediate maintenance, rectification is done.
- Energy efficient equipments are placed in place of outdated non efficient.
- Efforts to reduce energy consumption at all places are satisfactory.
- Electricity bill per month is not high.

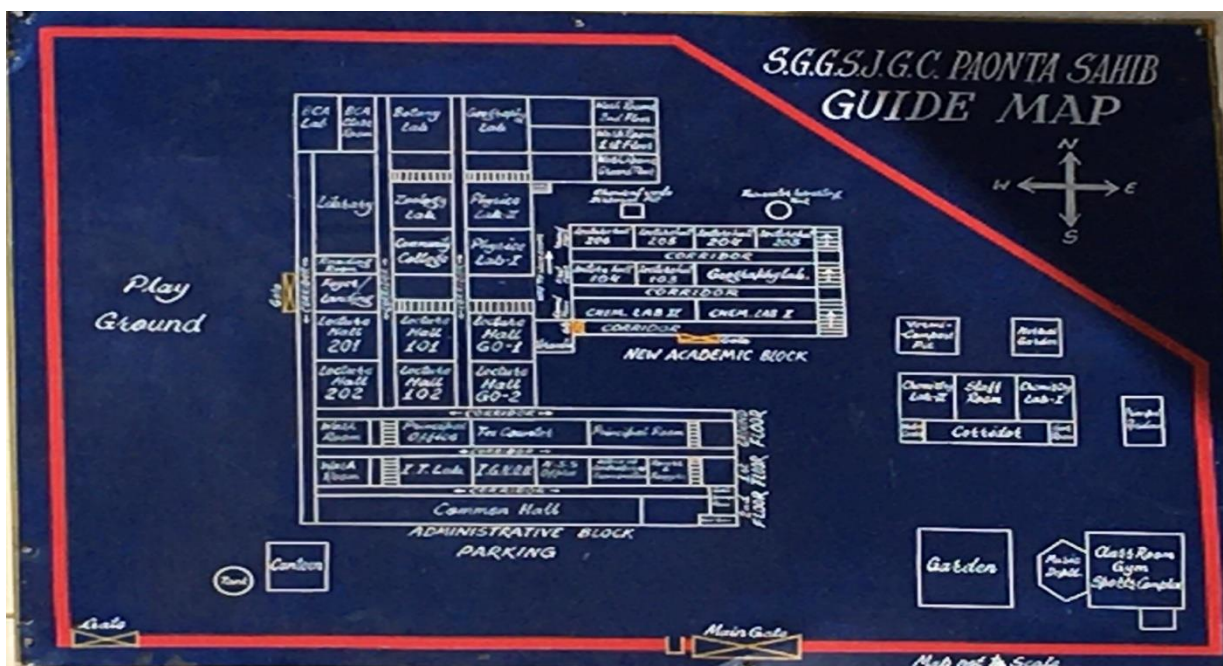
2.2.8 Final Findings by Energy Audit Team

- The communication for awareness to save Energy is adequate.
- Power factor is....0.98
- Electrical load assessment is being calculated.
- Power consumption per month in campus is not high.
- Efforts to save energy are sufficient.
- Energy efficient equipments are replacing old ones in phased manner.
- Equipments are regularly monitored by electricity committee and replacement /rectification is done in a routine manner.

2.3 Action Plan

Energy audit is an important process. Energy saving methods need to be adopted and implemented every year to make the college environmentally sustainable. Energy audit recommendations need to be implemented before the next audit.

Photographs:





Guidelines for using electrical appliances

1. Switch off all the appliances when they are not in use.
2. Avoid artificial lighting in day time.
3. Using external monitors, computers, and other devices when not in use.
4. If the conditioner is not used, then keep doors closed to maintain the temperature.
5. Remember to turn the lights, fans and any other electrical appliances off when you leave a classroom.
6. Turn off the water meter installed in the campus.
7. Use lights and fans as required, do not switch on all the lights and fans of the room.
8. Don't overcool, set your room temperature above 24°C/75°F, while using the Conditioners.



S



References:

1. Record available with college office.
2. Power consumption bills from Himachal Pradesh State Electricity Board
3. Physical observations and studies.
4. Internet websites.
5. Energy Conservation Act 2010.