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SHIVAMOGGA - 577 204

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ENVIRONMENT AND ENERGY AUDIT

September 2022

Prepared by

MALNAD GREEN TECH INDUSTRIES, SHIVAMOGGA

ENVIRONMENT AND ENERGY AUDIT

Report of

J N N College of Engineering
Shivamogga-Karnataka State

September -2022

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MALNAD GREENTECH INDUSTRIES
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ENVIRONMENT AND ENERGY AUDIT CERTIFICATE

This is to certify that, green auditing of JNN COLLEGE OF ENGINEERING, SHIMOGA has been carried out successfully from 19-08-2022 to 20-09-2022. All the provided data pertaining to Energy, Water, Waste and Greenery are analyzed and the observations are listed. The suggestions to improve the green campus status are also given in the report.

Date: 20-09-2022

FOR MALNAD GREENTECH INDUSTRIES

J.N.N. COLLEGE OF ENGINEERING
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5 Energy Audit

JNNCE consumes mainly three types of energy resource.

1. Electrical energy
2. Petrol and Diesel for transportation
3. LPG for hostels and canteen

5.1 Electrical Energy Audit

Electrical Energy consumption is vital for the activities of the institution. It is just like the blood inside veins of a living organism. All most all the gadgets under use consume electricity and it is a major expenditure component of any organisation. Further, the grid and generator electricity production leads to carbon emission linked climate change. Hence, the current consumption of electricity and scope for reducing the consumption are important components of electrical energy audit. Table 3 gives the production and consumption of electricity in the institution. It is observed that, solar roof top power generation system is catering to the total power consumption by more than 95%. The solar electricity production can be further increased by installing more number of panels on the remaining roof top space available.

Table 3. Details of electricity production and consumption

(July 2021 to June 2022)

Month	Solar production , kWh	Grid import, kWh	Solar export, kWh	Net consumption, kWh
21-Jul	35,063	14,400	21,575	27,888
21-Aug	35,291	19,675	20,275	34,691
21-Sep	39,562	18,150	20,750	36,962
21-Oct	42,590	22,550	19,750	45,390
21-Nov	35,055	25,225	14,700	45,580
21-Dec	44,405	27,725	21,150	50,980
22-Jan	51,600	25,100	29,425	47,275
22-Feb	48,000	22,350	28,375	41,975
22-Mar	48,000	26,625	25,575	49,050
22-Apr	46,680	24,500	20,600	50,580
22-May	40,920	28,025	18,950	49,995

Table 3 contd.....

22-Jun	38,280	29,600	11,925	55,955
Total	5,05,446	2,83,925	2,53,050	5,36,321
	Electricity supplied from Diesel Generator			21,760
	Total consumption per year			5,58,121
	Daily average of annual consumption			1530

The details of electrical gadgets other than water pumps are listed in Table 4. The table gives the average hours of operation per day of each gadget and the corresponding energy consumption also. It indicates that, the major share of electricity consumption is for fluorescent lights, fans and computers. 50% of the total consumption of electrical energy is for fans only.

Table 4. Electrical Energy Gadgets other than Water Pumps at JNNCE

Sl. No.	Item	Rating (W)	Number	Hours per day	Energy consumption kWh
1	Fluorescent Lamps(Institution)	40	462	4	73.92
	Fluorescent Lamps(canteen)	40	26	8	8.32
	Fluorescent Lamps (guest house)	31	40	1	1.24
	Fluorescent Lamps (Mess)	40	12	2	0.96
	Fluorescent lamps (Hostels)	40	457	4	73.12
	Total		997		**157.56**
	LED tube lights(Institution)	20	694	4	55.52
	LED (Mess)	20	47	2	1.88
	LED (Hostels)	20	298	4	23.84
	LED tube lights(Bank)	36	6	8	1.728
	Total				**82.968**
2	Ceiling Fan(institution)	80	2771	3	665.04
	Ceiling Fan(Canteen))	50	10	8	4
	Ceiling Fan(Guest house)	80	15	1	1.2
	Ceiling Fan(Bank)	80	4	6	1.92
	Celing fan (Mess)	80	26	4	8.32
	Celing fan (Hostels)	80	366	4	117.12
	Total				**1077.84**
3	Street lights	100	62	10	62
3	Computer(Desk top)	120	1183	3	425
	Computer(Lap top)	80	37	1	2.96

Table 4 contd.....

	Total				**570**
4	Printers	450	85	0.2	7.65
6	LCD Projector	250	95	0.2	4.75
7	UPS losses 10% of computer usage (37 UPS with 60AH 523 number batteries)				57
	Exhaust fan (Canteen)	350	1	2	0.7
	Daily average grand total for 280 days				**1536**
	Average per day for 365 days				**1178.0**
	reduction in power consumption by replacing fluorescent lamps with LED tube lights	20			**80**
	reduction in power consumption by replacing fans with efficient fans	35			**470**
	Net reduction in energy consumption				**550**
	Percentage reduction (Approximate)				25

It is observed that, replacing the fluorescent bulbs of 40 W capacity with LED tube lights of 20 W capacity and replacing the existing fans with energy efficient fans of 35W capacity would reduce the power consumption by 25% . There is further scope for reducing the power consumption by using the fans judiciously. Awareness about the same has to be created among the students and staff of the institution.

Table 5. gives the details of electrical energyconsumption of water pumps under usage at JNNCE. It is observed that, there are 11 pumps for lifting water from tube wells, canal and open well. The total energy consumption is around 400 units per day which amounts to 60 % of the total consumption for pumps. The next type of pumps is distribution pumps. It is found that, there are 46 pumps at different locations for lifting water from sumps to over head tanks. The energy consumption is around 200 units per day. By restructuring the watersupply and distribution system, as given below it is possible to reduce the energy requirement to a great extent.

1. Installing energy efficient pumps for supply system
2. Construction three over head tanks at an elevated place and distributing water by gravity to all the buildings.
3. Reducing the per capita water consumption by creating awareness about the importance of saving water.

Table 5. Details of Electrical Energy Consumption of Water Pumps at JNNCE

Sl. No.	Types of pumps	Capacity, HP	Location	Duration of working, Hrs/day	Energy consumed, kWh
	Water supply				
1.	2 HP submersible bore	2	Near gasifire plant	1	1.492
2.	3 HP submersible	3	Plantation	5	**11.19**
3.	10HP submersible	10	Navle	10	74.6
4.	5 HP submersible	5	Navle	10	37.3
5.	10to15 HPmonoblock	12.5	Navle	10	**93.25**
6.	5 HP submersible bore	5	Mess	12	44.76
7.	2HP submersible bore well	2	MBA/MCA	1	1.492
8.	1.10HPmonoblock	10	Regular near well	12	89.52
9.	3HP Submersible bore	3	Plantation-1st	6	**13.428**
10.	5 HP submersible bore	5	Ashok water plantation	3	**11.19**
11.	3HP Submersible bore	3	Plantation 2nd new	5	**11.19**
	Total				**389.412**
	Distribution				
1.	1 HP monoblock drinking	1	MBA/MCA	0.5	0.373
2.	7.5HP submersible	7.5	Storage pond-stadium	1	5.595
3.	5HP mono block	5			0
4.	A.Running	5	Storage tank	2	7.46
5.	B.Spare	5	Storage tank		0
6.	3HP blower	3	Storage tank	8	**17.904**
7.	1HPmonoblock	1		0.5	0.373
8.	5HP submersible	5	Krishna hostel	7	26.11
9.	7.5 HP submersible	7.5	diplamo	1	5.595
10.	A.1.5 HP monoblock	1.5	MBA/MCA usage	1	1.119
11.	B.5 to 7.5HP	5	mba garden	2	7.46
12.	3HPmonoblock	3	Drinking water regular	2	4.476
13.	5 HP submersible	5	Three hostels	10	37.3
14.	1.5HP mono block	1.5	Guest house	0.5	0.5595
15.	2HP submersible	2	canteen	0.5	0.746
16.	1.5 HPmonoblock	1.5	Step building	1	1.119
17.	a.2HPmonoblock	2	Computer science	0.5	0.746
18.	b.1 HP submersible	1	Computer science	0.5	0.373
19.	1HPmonoblock	1	Bus shelter	0.5	0.373
20.	1.5HP mono block	1.5	Drinking (EEE)	0.5	0.5595
21.	1.5HP mono block	1.5	Library	5	5.595
22.	a.5HP coupling motar	5	MBA garden	2	7.46
23.	b.5HP coupling motar	5	CMSgowdown	2	7.46

Table 5 contd.....

24.	5HPmonoblock	5	Ladies waiting room	0.5	1.865
25.	3HPmonoblock	3	AD Block	0.5	1.119
26.	1.5HP mono block	1.5	Stadium	2	2.238
27.	7HP submersible	7	Stadium	2	**10.444**
28.	7 HP mono block	7	Stadium	2	**10.444**
29.	2HP mono block	2	Tunga hostel	1	1.492
30.	a.2HP submersible	2	Tunga hot water	1	1.492
31.	b.1.5HP submersible	1.5	Tunga cold water	1	1.119
32.	3HP submersible	3	Mess	12	**26.856**
33.	3HP mono sub	3	Ladies waiting room	0.5	1.119
34.	1.5HP mono block	1.5	Polutechnic	0.5	0.5595
35.	3HP submersible(32a)	3	Ladies waiting room	0.5	1.119
36.	1.5HP mono block	1.5	STP platform	2	2.238
37.	Tractor pully pump-5HP	5	Tractor	1	3.73
38.	0.5HPself priming		Spare	0	0
39.	0.75 HP submersible	0.75	EEE	0.5	0.27975
40.	2HP open well submersible		Spare	0	0
41.	1HP grinder motor		Spare	0	0
42.	2HP jet pump	2	Library drinking	1	1.492
43.	2HP submersible	2	AD Block	0.5	0.746
44.	2HP submersible bore well		Mess spare	0	0
45.	1.5HP mono block		Spare	0	0
46.	Seepage motor 2HP-2no.	2	Library	1	1.492
	total				**208.60025**
	Water treatment				
1.	A.chemical mixing	1	Storage tank	1	0.746
2.	B.delivery	1	Storage tank	0.5	0.373
3.	5HPSluggemotar	5	Well	3	**11.19**
4.	0.5HP mono block	0.5	Mess RO system	2	0.746
					13.055
	STP				
1.	5HP monoblocl-2no.	5	STP	1	3.73
2.	7to10HP monoblock-2no	7.5	STP	1	5.595
3.	Blower motor 7.5HP-2	7.5	STP	8	**44.76**
					54.085
	Grand total per day for 280 days				**650**
	Daily average for 365 days				**500**

5.1.1. Observations and Recommendations based on Electrical Energy Audit:

1. Considering the current price tariff, the energy bill is a major expenditure component for the institution.
2. Roof top solar system is meeting almost 95 % of the electrical energy consumption of the institute.
3. Considering the future increase in demand, there is scope for increasing the solar energy production further by installing the PV modules on vacant roof area. However, economics of the same has to be worked out.
4. Fans consume almost 50% of the total energy. Hence, proper monitoring of correct usage of the same is essential to reduce the power consumption.
5. The details of power generation by the diesel generator are not maintained properly. As the cost of power generation using diesel is three times higher than that of grid supply, the data have to be maintained and analysed properly
6. A local smart grid system would help in analysing the power supply parameters more accurately. It helps to analyze the load curve, leakage losses etc. It is also used to integrate solar, grid and other supply sources. Hence, it is advised to install smart grid system for the campus.
7. Replacing the fluorescent bulbs with LED tube lights, installing energy efficient fans in place of existing fans and restructuring the water management system would reduce the daily energy consumption by at least 35%.
8. The entire hot water requirement of all the hostels is met with solar water heaters.
9. 35% of the total electrical energy consumption is for water supply system. Restructurings the same would decrease the energy consumption

5.2 Transportation Energy Audit:

Staff and students of the institution use different types of transportation system for commuting to institution. Table 6.gives the details of mode of transportation and the corresponding CO_2 emission. It is observed that, the maximum fuel consumption is for institution buses but the per capita carbon emission is low. The fuel consumption of students

with two wheelers is also very high. There is scope for reducing the carbon emission by encouraging the students to use institution busses. Further, the students and staff may be encouraged to use electric vehicles for daily travel and at least one day per week to use bicycles.

Table 6. Mode of Transport of Staff and Students and Corresponding CO_2 Emission

Sl.No.	Particulars	Numbers	Travel distance, km/Y*	Petrol consumption, liters/Y**	Diesel consumption , Lit/Y	Carbon emission, T/Y	Per capita emission, T/Y
1	Institution Car	1			3,200	9	8.96
2	Institution buses	34	4,33,920		1,00,000	280	0.21
3	Two wheelers (Staff)	266	8,61,840	21,546		53.9	0.2
4	Cars (Staff)-Petrol	56	2,16,540	10,827		27.1	0.48
5	Cars (Staff)-Diesel	38	1,71,990		8,600	24.1	0.63
5	Buses (STAFF)	23	1,20,300		430	1.2	0.05
6	Two wheelers (20% of students strength)	750	30,00,000	75,000		165	0.22
7	Electric	5	32	0	0	0	0
			Total			560.3	0.15
Data available for 219 staff members have been extrapolated for 392 staff members							
* 250 working days and 20 km per day is assumed for students using bikes							
** 40km per liter mileage for two wheelers							
300 working days assumed for staff							
40 passengers assumed for public transport busses							
15km mileage assumed for cars							
Bus mileage = 7km/liter							
CO_2 emission of petrol= 2.5 kg/liter							
CO_2 emission of Diesel= 2.8 kg/liter							
Average persons per bus = 40							

5.3 Cooking Fuel Energy Audit

LPG (Liquid Petroleum Gas) is a non eco-friendly energy source and it is sourced from petroleum. 85% of the petroleum demand in India is met with imported petroleum. Hence, it is essential to reduce the usage of LPG. Table 7 gives the details of LPG usage in the institution. It is observed that, there is scope for reducing the usage of LPG by using bio mass as a source. In campus supply of biomass may be used to meet the requirement.

Table 7. Details of LPG usage in the Institution

Sl.No.	Particulars	No of cylinders /month	LPG usage kg / month	LPG usage per year tones**	Carbon emission tones*
1	Canteen	36	576	6.9	20.7
2	Mess	39	702	7	21
	Total			13.9	41.7
	* 3 tones of carbon emissionper ton of LPG				
	** 11 months of working for canteen 10 months of working for mess				

5.4 Carbon Foot Print Audit

Carbon foot print of the campus is an important parameter in green auditing of the institution. It is measured in terms of amount of carbon dioxide released to atmosphere due to various energy consumption activities of the institution. To address the climate change impacts, the carbon foot print should be as low as possible and efforts should be made to decrease the same. Table8.gives the details of carbon foot print of the campus.As discussed in the energy audit section, solar is contributing to 90% of the total electricity demand of the institution. The solar generation capacity should be increased further and staff should be encouraged to use electric vehicles as much as possible. It is found that, the per capita carbon emission is around 0.14 tonnes per year which is reasonably good. But the emissions of the student's two wheelers are higher. They should be encouraged to use institute busses or use bicycles.

Table 8.Carbon Foot Print of the Campus

Sl. No	Activity	Fuel usage/year	CO2 emission (Tones/year)
1	Electricity, kWh	Solar export -253050 Grid- 283900 Generator- 21700	-185.9 209 17.64
2	Transportation-Institute car	3200	9
	Transportation Institution buses	100000	280

Table 8. contd.....

	Transportation- Staff Two wheelers- Petrol	21546 lit	53.9
	Transportation- Staff Cars- petrol	10827 lit	27.1
	Transportation- Staff Cars- Diesel	8600 lit	24.1
	Transportation- Staff Buses	430 lit	1.2
	Transportation-Students Two wheelers- Petrol	75000 lit	165
3	LPG usage	13.9 tones	41.7
	Total		416
	Per capita consumption		0.10

- Assuming 65% of the exported solar energy prevents the use of coal
- Assuming 65% of import electrical energy is generated using coal
- CO2 emission per unit of electricity reaching the load is 1.13 kg/kWh
- The total strength of the institute is (3750+392) = 4142