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JAWAHARLAL NEHRU NEW COLLEGE OF ENGINEERING

SHIVAMOGGA - 577 204

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UG programs: CE, ME, EEE, ECE, CSE, ISE, ETE accredited by NBA: 1.7.2022 to 30.6.2025,
Recognized by Govt. of Karnataka and Affiliated to VTU, Belagavi)



ENVIRONMENT AND ENERGY AUDIT

September 2022



[Signature]
Principal
J N N College of Engineering
Shivamogga.



▶ Prepared by

MALNAD GREEN TECH INDUSTRIES, SHIVAMOGGA

ENVIRONMENT AND ENERGY AUDIT

Report of

J N N College of Engineering
Shivamogga-Karnataka State

September -2022



Prepared by
MALNAD GREEN TECH INDUSTRIES, SHIVAMOGGA


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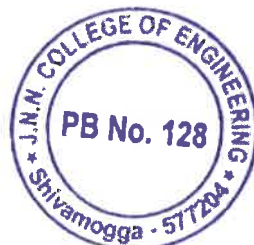
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1. Summary

Environment and Energy auditing of Jawaharlal Nehru New college of Engineering(JNNCE), Shimoga has been carried out in order to assess the sustainability of the institution campus. The auditing is carried out by M/S MalnadGreentech Industries based on the data provided and field observations. The audit report has assessed the actions taken by the institution in achieving the green campus status. The campus has 64% open area which is good enough to offer clean air and light for the campus.

Section 3 of the report documents the green policy of the institution. The policy is being implemented in the institute in its letter and spirit. Section 5 details the energy auditing of the institute. The main electrical loads are ceiling fans, computers and water pumps. The monthly average electrical energy consumption is 46500 kWh for the period from July 2021 to June 2022. There is scope to reduce the electrical energy consumption by switching over to energy efficient fans and changing the present water distribution system. 80 % of the students commute to institution using institution transport buses the remaining use two wheelers. All the staff members of the institute commute by private vehicles. There is scope to reduce the carbon emission by encouraging the staff members to use green transport methods like bicycles and Electric vehicles. Institute can increase the production of green electricity and provide charging facility for e-vehicles. Section 6 gives the water auditing. It is observed that, the quality of canal water is not good for usage. It is recommended to collect the surface flow water in artificial pond for later usage. Water distribution system is to be simplified to avoid usage of pumps at multiple stages. It is advised to construct three over head tanks for mess, hostel and gardening requirements. Dead borewell can be used for recharging the surface flow water. Section 7 brings out the auditing of the waste disposal system. The action taken in handling the both the solid and liquid waste is appreciated. It is suggested to enforce the solid waste segregation at the source more systematically. The institute has its own sewage treatment facility which consumes significant amount of electrical energy. Anaerobic digester or phyto-remediation system would decrease the energy consumption required to treat the used water. It is suggested to install an E-waste handling system. The bio diversity of the campus is discussed in section 8. The efforts made in maintaining green campus is laudable. Section 9 documents the green initiatives of the institute. It has two major green initiatives namely; 1) District Bio Energy Research, Information and Demonstration Center and 2) Chirantana Green Technology Center. Both are active since more than 10 years. Section 10 lists the major observations and recommendations of the energy and environment auditing.


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2. About the institution

The history of JNNCE is marked by events that have made it synonymous with quality education. Established in 1980 by National Education Society (NES), the Institution is affiliated to Visvesvaraya Technological University, Belagavi, recognized by the All India Council for Technical Education (AICTE) and Government of Karnataka. JNNCE is a flagship Institute of the NES, established by freedom fighters and philanthropists. It has, during 76 years of its existence, spread its wings in several disciplines of education through establishment of 35 educational institutions in the Malnad region of Karnataka state. The Mission of NES is “To provide quality education at reasonable cost”

JNNCE, is one of the technical institutions of Karnataka, providing excellent technical education and training to students from all parts of India. Started in the year 1980, the institution has completed 41 years of its fruitful existence towards achieving perfection in all aspects of technical education and training and has emerged as one of the most sought-after destination for technical and management education by students and parents from all over India.

JNNCE is affiliated to Visvesvaraya Technological University (VTU), Belagavi and recognized by the All India Council for Technical Education (AICTE). The institution offers BE courses in 9* branches of engineering, namely, Civil, Mechanical, Electrical and Electronics, Electronics and Communication, Computer Science and Engineering, Information Science and Engineering and Electronics and Telecommunication Engineering, Artificial Intelligence and Machine Learning, Robotics and Artificial Intelligence. As many as seven disciplines, namely, Civil, Mechanical, Electrical and Electronics, Electronics and Communication, Computer Science and Engineering, Information Science and Engineering and Electronics and Telecommunication Engineering were accredited from the National Board of Accreditation (NBA), New Delhi. Further, the institution has been accredited by NAAC with “B” Grade. The institution also offers 4 PG courses, namely, MCA, MBA and M.Tech., in Computer Science and Engineering, and Transportation Engineering and Management.

JNNCE is also a University recognized research centre in Civil Engineering, Mechanical Engineering, Computer Science and Engineering, Electrical and Electronics

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Engineering, Electronics and Communication Engineering, MBA, Physics, Chemistry and Mathematics leading to the award of M.Sc. (Engg.) and Ph.D. So for more than 30 candidates have been awarded Ph.D. from our research centers.

The lush green sprawling campus of about 39.4 acres caters to the needs of nearly 3750 students and 450 staff, with state-of-the-art technology back-up, well-equipped laboratories and workshops, library, hostels, playgrounds and other amenities. The dedicated faculty of the institute comprises of nearly 52 Ph.Ds, and 138 PG qualification amongst whom 56 are pursuing Ph.D. There are 23 Professors, 22 Associate Professors, 131 Assistant professors. The technical and supporting staff of the institute work with lot of concern and commitment

Other salient features of the institute includes excellent infrastructure with spacious class rooms with modern teaching aids, state-of-the art laboratories and computers. There is a hostel for both boys and girls accommodating about 600 boys and 450 girls. Sports facilities abound with multi gym, Turf cricket pitch and a modern playground. The Turf cricket pitch and new pavilion is as per Karnataka State Cricket Association Bangalore standards and hosted cricket matches like Ranji Trophy, South zone and other State level matches.


Rainwater Harvesting system, Sewage Treatment Plant, Solid waste management system and Solar roof top PV power generation systems have been implemented in the campus. This eco-friendly project is well appreciated for its conservation of water, recycling of water and pollution control.

Vision:

To be a pacesetter institute in technical & management education and research for producing highly competent engineers, managers & entrepreneurs to meet the needs of industry and society.

Mission:

- Impart quality education through flexible and innovative teaching learning process.
- Enable and Ignite young minds to excel in their career and life with entrepreneurial spirit, professional ethics and human values.
- Facilitate invention based research and collaborate with industries to address societal needs.


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Quality policy:

- Providing state-of-the-art technology support and best possible educational infrastructure.
- Development of faculty through supporting policies and procedures towards achieving higher qualifications, short-term courses, participation and presentation in seminars and conferences.
- Encourage R&D, consultancy and improve teaching-learning process by introducing innovative pedagogical and student interaction mechanism.

Table 1. Salient features of the institution

Name	Jawaharlal Nehru New College of Engineering
Location	Navul, Shimoga, Karnataka-577204 Longitude:75.6 degree E Latitude: 13.93 degree N
Campus area	1,40,425Sq.m
Built up area	50,784 Sq.m(34%)
Percentage of open area	66%
Green area	33471 Sq.m (25%)
Road, foot path and drain area	56170 Sq.m (39%)
Students' strength	3750
Staff strength	450
In campus hostel strength	600
Number of Departments	9
Number of courses offered	9 UG courses and 4 PG courses

Table 2.Environment and Energy details

Green area	33471 Sq.m
Energy Sources	Grid supply with 475 KVA Sanctioned demand 400 kW Roof Top Solar PV system Diesel Generators 320KVA




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Table 2 contd.....

Water Sources	Municipal supply: 11.5 kld (average) Channel water : 41 kld(Average) Rain water:6.6kld (Average) Tube wells : 115.1 kld (Average)
Sewage treatment plant	Capacity: 200 kld (Active sludge plant)
Solid waste disposal system	3 tones per day
Canteen facility	Available
In campus hostel facility	Available

The data given in the Table 1 indicate that, the institution has sufficient space for academic activities. The infrastructure is sufficient to cater to the needs of the students and staff of the institution. The institution has achieved self sufficiency in its electrical energy demands shown in Table 2. It laudable to mention that, the institution also has rain water harvesting system and waste disposal system in its premises.




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3. JNNCE Green Policy Document

A. Purpose

This document describes *Jawaharlal Nehru New College of Engineering*, (JNNCE) policies and procedures for conducting their operations and activities in an environmentally responsible and sustainable manner.

B. Background

In 2019, the *National Education Society*® (NES) umbrella institution of JNNCE, officially declares a commitment to the protection of environment, responsible and efficient use of natural resources under its permissible limits. As the leading educational institution in the malnad region, to be a model institution for practices in efficient use of natural resources, to embrace pollution prevention while continually seeking the reduced resources consumption, the institution is committing itself for sustainable development by initiating *green policy*.

The *JNNCE* environmental policy establishes the following important commitments:

- Compliance to government environmental laws and regulations.
- Prevention of pollution by minimizing the generation of wastes where possible, reducing consumption, recycling materials, and disposing of wastes in an environmentally responsible manner.
- Reduce the environmental impact of students commuting to and from institution and home by using the institution transportation facility.
- To go for institution *green audit* in compliance with govt. rules and regulations.

All JNNCE staff and students are responsible for being aware of the environmental and health impacts of their jobs and for continually striving to minimize these impacts as set forth in this policy.




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C. Policy

JNNCE is committed to green initiatives by conducting its operations and activities in an environmentally responsible and sustainable manner. We are committed to complying with all applicable laws and regulations. We recognize that reducing and, where possible, eliminating the environmental impacts of our activities is an important part of our mission as institution of technical education. We strive to be a leader among all the Institutes in achieving environmental excellence and will work with our employees and other internal and external entities to establish and follow principles, in conjunction with the Environmental Policy of the NES that will guide JNNCEs environmental practices.

The JNNCE guiding principles and practices to achieve resource conservation, waste reduction, and sustainability overall are summarized below:

- Comply with mandatory requirements and conduct our activities and operate our facilities within applicable environmental laws and regulations
- Conserve energy and other natural resources
- Encourage employees to use mass transit
- Reduce, reuse, and recycle to reduce waste
- Adopt green procurement practices
- Ensure all employees complete the environmental awareness training
- Continue to review and minimize the impacts of our activities

D. Responsibilities

a) Energy Conservation

Staff and students shall:

1. Turn off lights when not in use and use natural light when possible.
2. Turn off, not just log off, all computers, terminals, speakers and other office equipment at the end of every work day.
3. Activate the power down features on your computer and monitor to enter into a low-power or sleep mode when not in use.



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4. Unplug equipment that drains energy even when not in use (e.g., cell phone chargers, fans, desktop printers).
5. Use compact LED bulbs wherever possible.

b) Reduction of Materials Consumption

Staff and students shall:

1. Avoid using paper by distributing and storing documents electronically.
2. Print and photocopy only what you need and double side your jobs when possible.
3. Tell staff and colleagues that you prefer double-sided documents.
4. Use the back side of old documents for faxes, scrap paper, or drafts.

c) Reduce Fossil Fuel Consumption and Air Pollution

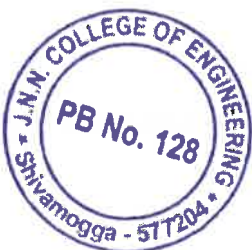
Staff and students shall:

1. Use institution transportation or other alternative forms of mass transportation, wherever possible.
2. Use carpools or vanpools, when possible, over single use cars.
3. Commuting by bicycle for a day in a month, if possible.

d) Minimize Waste and Increase Recycling

Staff and students shall:

1. Use durable reusable beverage containers, plates, and utensils.
2. Reduce the amount of toner in documents that will be printed when possible.
3. Print documents in black and white or grayscale wherever possible.
4. Dispose waste paper, paper products, plastic, binders, folders, catalogs, boxes, bottles, cans, batteries, electronics, toner and ink cartridges in specified places only.




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5. Donate used furniture and electronic gadgets through the proper disposal system.

e) Minimize Toxics and Hazardous Waste(Laboratories)

Staff and students shall:

1. Not pour toxic or hazardous substances down the drain.
2. Reduce the use of toxic chemicals and use less toxic alternatives wherever possible.
3. Not use or purchase mercury or mercury-containing equipment, unless approval has been obtained.
4. Design experiments, whenever possible, to use less toxic or hazardous substances.
5. Purchase chemicals in the smallest quantities needed to avoid over-ordering.
6. Dispose of hazardous chemicals appropriately and in accordance with the govt. Disposal Guide and other legal requirements.

f) Commitment to Green Purchasing

Institution shall:

1. Purchase only Five Star rated electric equipment's.
2. Maintain green area of a minimum of 50% area.
3. Install solar power generation for the required quantity, minimum limited to 80% of total power requirements.
4. Purchase equipment's having less carbon footprint.
5. Use the energy efficient or five star rated electronics equipment's.
6. Purchase products that contain bio-based content wherever possible.
7. Purchase office supplies and furniture that contain the highest percentage of recycled and non-toxic content wherever possible.
8. Purchase of quality furniture with longer life span.
9. Go for *green audit* once in a year and control the CO₂ emissions below the permissible limits.



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4. About Energy and Environment Audit

Energy and Environment audit or Green Audit is a process of systematic identification, quantification, recording, reporting and analysis of resource usage in a premises in order to grade the premises for sustainability. Green audit can be a useful tool for a institution to determine how and where they are using the most energy or water or resources; the institution can then consider how to implement changes and make savings. It can also be used to determine the type and volume of waste, which can be used for a recycling project or to improve waste minimization plan.

The rapid urbanization and economic development at local, regional and global level has led to several environmental and ecological crises. On this background, it becomes essential to adopt the system of the Green Campus for the institutes which will lead for sustainable development and at the same time reduce a sizable amount of carbon-di-oxide emission to the environment. It is part of Corporate Social Responsibility of the Higher Educational Institutions to ensure that they contribute towards the reduction of global warming through Carbon Footprint reduction measures.

Therefore, the purpose of the present green audit is to identify, quantify, describe and prioritize framework of Environment Sustainability in compliance with the applicable regulations, policies and standards.

4.1 Objectives of Green Audit:

1. To assess the usage of energy, water and the other resources inside the campus
2. To analyse usage of transportation energy of staff and students of the institution
3. To study the waste disposal methodology adopted in the campus
4. To assess the water management system of the institute
5. To suggest suitable techniques, technologies, practices to improve the green campus standards of the institution campus




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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



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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	



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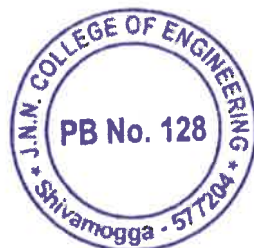
Table 4 contd.....

	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.



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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





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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 monoblock-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




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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 CO₂ 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 CO₂ 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 busses	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.



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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 emission per 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. Table 8 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	-185.9
		Grid- 283900	209
		Generator- 21700	17.64
2	Transportation- Institute car	3200	9
	Transportation Institution busses	100000	280



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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 $(3750+392) = 4142$



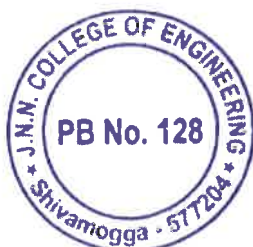

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6. Water Audit

Water is a natural resource; all living organisms depend on water. While freely available in many natural environments, in human settlements potable (drinkable) water is less readily available. Groundwater depletion and water contamination are taking place at an alarming rate. Climate change has added another dimension to water crisis. The monsoon is becoming erratic and increased air temperature sucks up more water from water bodies and soil. Hence, it is essential to judiciously use every drop of water. Water auditing is conducted for the evaluation of facilities of raw water intake and determining the facilities for water treatment and reuse. Table 9 gives the details of the water management system exists in the institution. It is observed that, the institution is primarily dependent on ground water for its in house student's water requirements. However, tube well sources are not dependable. Table 10 gives the data on current utilization of rain water and its potential. It is observed that, there is scope for collection roof water and reduce the dependency on tube wells. Table 11. Gives the data on water quality test.

Table 9. Data on Water Sources of JNNCE

Sl No.	Sources	Purpose of usage	Usage kilo liter/year
1	Municipal supply	Drinking and mess	4235
2	Ground water (Two tube wells)	Hostel and mess	42000
3	Rain water and canal water	Departments	15000
4	Recycled water	Gardening	54000
5	Surface flow water	Gardening	No data
	Total		115235
	Per capita water consumption for students and staff (Excluding gardening)		50



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Table 10. Details of Rain water harvesting system

Particulars	Available area	Potential, kl/Y
Current utilization	No data on quantity of collection. 70% of the buildings have rain water collection facility.	
Scope for roof top rain water collection	Built up area of 50784 sq.m	35500
Surface flow rain water collection	Road and pavement area 56100 sq.m	22400
	Green area 33400 sq.m	6700
Total surface flow collection		29100
900 mm per year rain fall is assumed for JNNCE		
Collection coefficient of 0.7 is assumed for roof water		
Collection coefficient of 0.4 is assumed for road and pavement flow		
Collection coefficient of 0.2 assumed for green area		

Table 11 gives the results of water quality tests for different samples of water. It is found that, the untreated water has BOD, COD and TDS values beyond the stipulated maximum limit. As observed, the canal water quality is not good and it is being mixed with pure roof top rain water. The treated water parameters are within the specified limit. However, the canal water may contain heavy metals, agro chemicals and pesticides. These parameters are not tested. Hence, it is advisable to use the canal water only for gardening purposes. The tube well water has TDS value higher than the maximum safe limit. As it is being used for drinking and cooking purposes, it is to be ensured that, the quality of water after purification using water purifier systems meet the stipulated norms. As observed in the section on energy audit, the water supply system has more than forty pumps of various capacities and it is difficult to maintain these many pumps on regular basis. The system has to be restructured to have less than 10 number pumps.



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Table 11. Water quality test data



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JAWAHARLAL NEHRU NEW COLLEGE OF ENGINEERING

(Approved by AICTE and Affiliated to Visvesvaraya Technological University, Belagavi)

Navule, Savalanga Road, SHIVAMOGGA – 577204, Karnataka.

Department of water and waste water quality monitoring laboratory.

Test reports:

1) Analysis of Sewage water parameters:

A). Untreated (Raw water):

Parameters	Results in mg/l
1.pH	6.2
2.BOD	28
3.COD	107.78
4.Total suspended solids(TSS)	14
5.Total dissolved solids(TDS)	860

B) Treated water:

(Results from SLN testing laboratory recognized by MOEFCC and an ISO 9001:2015, Bangalore)

Parameters	Results in mg/l	KSPCB standards (mg/l)
1.pH	7.25	6.5-9.0
2.BOD	7.0	10 max
3.COD	42.0	50 max
4.TSS	8.7	20 max
5.Total Nitrogen	8.2	10 max
6.Ammonical Nitrogen	2.4	5 max
7.Fecal coliform	60	100 max

2).Analysis of campus water parameters:

Parameters	Borewell water (mg/l)	Channel water (mg/l)	Channel treated water (mg/l)	Municipal water (mg/l)	BIS for drinking water
1.pH	7.63	8.2	7.5	7.5	6.5 to 8.5
2.TSS	20	24	7	7	<10
3.TDS	74.82	70	29	18	<100
4.Biological contamination	Negative	Positive	Negative	Negative	Negative

Analysis by:
RASHMI.M.S.
STP Supervisor
JNICE, Shivamoga.
Rashmi.M.S.

Incharge:
Shelhan
Mr. Shelhan S.G.
Dept. of Chemistry.

Signature

Professor & Head
Department of Civil Engineering
J.N. College of Engineering,
Shivamogga-577 204.



Signature
Principal
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6.1 Observations and Suggestions on Water Management:

1. Roof top rain water system has potential to meet more than 75% of pure water requirement of the institution. Separate storage tanks need to be constructed for collecting the roof water.
2. Roof water and canal water are collected in one reservoir. The quality of canal water appears to be bad. Hence, usage of the same has to be avoided.
3. Tube well water quality is not good especially the TDS value is higher than the permissible limits. Measures have to be taken either to improve the quality or to use rain water.
4. Dead tube well can be recharged using surface flow water. Further, a lake or water body can be created to collect the surface flow rain water. This water body in addition to meet the gardening water requirement adds to the aesthetics of the campus.
5. Considering that, only about 10% of the total institution strength out of 4100 persons (Staff and students) reside in the campus hostels, per capita water consumption 50 liters is much higher than the standard value of 20 liter per person per day. It indicates significant wastage of water.




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7. Solid and Liquid Waste Management Audit

Waste management is an important feature of green campus. Both the solid and liquid waste generated inside the campus should be disposed off in a safe and eco friendly way. The health and hygiene of the campus inmates and also the surrounding localities depend on how best the waste generated inside the campus is disposed off. Reducing, reusing and recycling of waste reduces the carbon foot print of the campus. JNNCE has well maintained solid waste and liquid waste management systems.

7.1 Solid Waste Management System at JNNCE, Shimoga

Solid Waste Management(SWM) means, managing the generation, storage, collection, transport or transfer, processing and disposal of solid waste materials in a way that best addresses the range of public health, conservation, economics, aesthetic, engineering and other environmental considerations. In its scope, solid waste management includes planning, administrative, financial, and engineering functions in the process of solving problems arising from waste materials.

In accordance with green policy of the institute, JNN College of Engineering has installed one ton per day capacity solid waste management system in the year 2017 to handle the organic waste being generated in the institution campus in an environmentally benign manner. The whole project can be viewed from two different angles one is “**Pollution Prevention**” and the other is **recovery and reuse** of waste i.e. reuse of organic waste as valuable organic manure.

Organic Waste:

Following are the typically generated organic waste in an educational campus.

- a. Food waste and vegetable waste from Hostels and Canteen.
- b. Waste from garden due to periodical cutting of lawn grass etc.
- c. Fallen leaves and flowers from trees and other items of vegetation.

All the above are biologically degradable which can be utilized to produce organic manure.




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Dry inorganic waste:

These include Plastic bottles, waste plastic, waste rubber material, e-waste and other scrap materials are termed as dry inorganic waste. They can be segregated from the organic waste and sold to recycling centres.


Benefits of SWM System:

Waste is not something that should be discarded or disposed of with no regard for future use. It can be a valuable resource if addressed correctly, through policy and practice. With rational and consistent waste management practices there is an opportunity to reap a range of benefits. Those benefits include:

1. **Economic** – Manure production from organic waste leads to income generation. Good quality manure may be sold at Rs.4.00 per kg.
2. **Social** - By reducing adverse impacts on health by proper waste management practices, institution campus looks clean and better placed socially.
3. **Environmental** - Reducing or eliminating adverse impacts on the environmental through reducing, reusing and recycling, and minimizing resource extraction can provide improved air and water quality and help in the reduction of greenhouse gas emissions.
4. **Educative:** The SWM system adds to the list of green technologies already in operation at the campus. These systems may used to give demonstration to inmates as well as students and general public from outside.

The SWM system requires a minimum of a Chopper Machine to cut the stick like big size organic waste into small pieces and a Shredder Machine to powder the organic material. The waste is allowed to decay in open or semi closed enclosure. In order to increase the rate of decay waste is added with compost culture. Typically it requires two months for the biodegradable waste to get converted into compost. The produced compost is utilized either internally for garden or sold to farmers for agriculture purpose. Fig. 1 show the chopper and shredder machines installed in the campus. Fig.2. shows the segregation of non biodegradable waste and composting the waste in beds. Fig.3 show the screening the compost and packing




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it for marketing. The manure is mainly utilised internally for gardening and a small quantity is sold to farmers also.



Chopper machine

Shredding machine

Fig. 1 Machines used for solid waste management at JNNCE



Fig. 2 Segregation and composting



Fig. 3 Screening and packing of compost manure

Table 12. Data on Liquid and Solid Waste Generation at JNNCE

Type of waste	Source/Type	Quantity	Unit
Liquid waste	Mess, hostels and academic area	54500	kl/Y
Bio degradable solid waste	Tree pruning's, leaves, paper	20	T/Y
Non bio degradable solid waste	Plastic, rubber, glass etc.	3.5	T/Y
E- Waste	discarded electrical and electronic items	No data	

Table 12 gives the data on both the liquid and solid waste generated in the campus. Separate degradable and non degradable waste collection bins are provided in all the buildings. But the segregation at the source is not done properly. Non biodegradable waste is not properly segregated and recycled. Bio degradable waste is converted into manure and utilized. It is observed that, the E-waste generation data is not available

7.2 Liquid Waste Management;

It is appreciable to note that, the institution has a well maintained liquid waste treatment plant(STP) of capacity 200 kld per day(Fig. 4). However, it is observed in Table 2 that, the STP alone consumes 55 kWh daily. There are many technologies available for sewage water treatment which consumes lesser amount of electrical energy. Phyto-remediation is one such technology. The institute has installed a 5kldphyto- remediation plant on trial basis (Fig.5).



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Fig. 4 Sewage Treatment Plant



Fig. 5 5kld Phyto-remediation system

7.3 Observation and Recommendations on Waste Management

- Solid waste is not properly segregated into degradable and non degradable waste at the source. Degradable waste is being converted to compost and utilized. Non degradable waste is not properly disposed. No data on E-waste is available.
- E-waste collection and recycling unit can be installed in the campus
- Kitchen waste gas plant should be installed to handle mess wet waste.
- Phyto-remediation technology may be used for treating the liquid waste to reduce the energy consumption.




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8. Greenery Audit

Greenery inside the campus keeps the air fresh and cool. It adds to the aesthetics also. Table gives the list of plants found in the campus. The trees are tall and give good shade. Students sit under the tree for reading and discussion activities. Fig.6 shows photos of green cover of the campus. Table 13 lists the varieties of plants grown in the campus.



Fig.6 Photos of Green cover of the campus

Table 13. List of Major Trees found in JNNCE Campus

Sl.No.	Local name	Scientific name	Number of plants
1	Ashoka	Saracaasoca	30
2	Jamoon	Eugenia jambolanacam	4
4	Pongamia	Pongamia pinnata	200
5	Pethudia	Petonia axillaris	10
6	Silver Oak	Gravillea robusta	10
7	Jackfruit	Artocarpu sheterophyllus	4
8	Holematti	Terminalia arjuna	3
9	Eukalyptus	Eucalyptus globulus	10
10	Mango	Mangifera indica	3
11	AkashMallige Indian cork tree	Millingtonia hortensis	2
12	Seemetangadi	Casia fistula	20
13	Wild Badam	Terminalia catappa	5



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14	Teak	Tectona grandis	115
15	Acasia	Acacia mearnsii	10
16	Flame of the forest	Buteamono sperma	2
17	Coconut	Cocos nucifera	5
18	Cashew nut	Anacardium occidentale	2
19	Rain tree	Samanea saman	30
20	Sapota	Manilkara zapota	2
21	Atti	Ficusra cemosia	3
22	Peepal	Ficusrelia giosa	2
23	May flower	Crataegus monogyna	3
24	Xmas tree	Araucaria columnaris	3
25	Bamboo	Bambusa vulgaris	100
	Miscellaneous		30
	Total		612

As given Table 1, the green area of the campus is around 25% and the open area is 66%. Lawns and shading trees are grown with proper maintenance. The eastern boundary of the campus is adjacent to a busy highway. To reduce the sound and air pollution due to vehicular traffic, a green belt of around 10 meters may be maintained along the eastern boundary of the campus.




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9. Green Initiatives of the Institute

Being a the leading educational institution in the Malnad region, it is a model institution for practices in efficient use of natural resources, to embrace pollution prevention while continually seeking the reduced resources consumption. The institution is committing itself for sustainable development by initiating *green policy*. It has taken many initiatives to full fill it's social responsibility in safe guarding the pristine environment of malnad region. It is the first of it's kind in installing rain water harvesting system, waste management system and solar energy generation system. It has founded two centers to carry out research and demonstration in the area of green technologies. Details of the same are given under.

9.1 Chirantana Green Technology Center.

The center was established in the year 2006. The Objectives of the Center are

- To create awareness about the environmental impact of conventional fuels among the public.
- To create awareness about the usage of renewable energy sources.
- To communicate the importance of energy saving and its methodologies.
- To carry out research and development activities on eco-friendly technologies.

The typical activities that are being carried out in this centre are

1. Offering technical guidance on
 - Solar water heater and solar PV system installation
 - Rain water harvesting
 - Eco friendly house construction
 - Installation of Kitchen waste gas plant
2. Production and marketing of biodiesel and by products.
3. Demonstration of Gasifier system for heating and electricity generation
4. Carrying out awareness programs on various environmental issues and usage of green technologies
5. Carrying out research on green technology devices and systems
6. Guiding and providing facility to students in carrying out research projects



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The centre has following system for demonstration

1. Solar cookers
2. Solar street lamp
3. Bio massgasifier with Gas Engine for power generation..
4. High efficiency chulas
5. Hand operated water Pump
6. Rain water collection pond
7. Biodiesel unit
8. Kitchen waste gas plant
9. Waste plastic to Oil unit
10. Phyto- remediation system
11. Bio compost production unit
12. 400 kW Roof top grid tied solar system

Around 20 awareness and training programs are conducted every year for NGO's, school and college students and farmers. Bio diesel and it's by products like cake, hand wash, floor wash are produced and marketed. Bio compost is sold to farmers. The green initiatives of the center are reported in print and visual media extensively. BBC Discovery channel has covered the activities of the center in its Change maker's series. Fig. 7 and Fig.8 show sample photos of programs of Chirantana center. Fig 9. shows a photo of solar pannels installed on the roof top of JNNCE.



Fig.7 An awareness rally by Chirantana



Fig.8 Demonstration of Chula to women



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Fig. 9 Photot of Solar Roof Top PV system

9.2 District Bio Energy Research, Demonstration and Information Center

District Biofuel Research, Information, and Demonstration Center, JNNCE, Shimoga has been established in June 2011 by Karnataka State Bio-Energy Development Board, Govt. of Karnataka, Bangalore. This research and information center has been conceptualized to study, promote & demonstrate all aspects related to bio-fuel. Through this center, it is possible to provide information on Bio energy, identification of various non edible oil seeds, agro practices for these sources, Post-harvest technologies like seed collection, oil expelling, treatment, uses of oils, Trans-esterification process. It also carries out R&D and extension services to purchase oil seeds from Shimoga region and encourage the farmers to take up biofuel activities. Since 10 years, BRID center is actively engaged in fulfilling all objectives listed above by providing information to farmers, entrepreneurs, research students, end users and the general public. Many research and development activities are being carried out at the center. School and college students and teachers visit the center regularly. It has collected around 90 tons of oil seeds and also around 7000 liters of fried cooking oil is collected from various hotels in Shimoga district. The center arranges environmental awareness programs and participate in all the major government and other institutional exhibitions. Further, it



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provides research facilities for M.Tech., B.E., M.Sc., B.Sc. and B.Ed., Students and encourage them to take up research projects on various aspects of Bio-fuel and environment. Table 14.gives the statistical highlights of the centre since its inception. It is fulfilled its mandate in spreading the awareness about the use of bio fuels in energy sector. While Fig.10 shows the esterification unit used to prepare bio diesel, Fig.11 shows a sample awareness program.

Table 14.Statistical Highlights (From theyear 2011 to 2022)

Sl no	Particulars	Details
1	Year of establishment	2011
2	Grant received from KSBDB	Rs. 64 lakhs
3	Special program grants	Rs 3.7 lakhs
4	Seeds purchased	88 tones
5	Seed cake production	57 tones
6	Used oil collection	10000liters
7	Bio diesel production	20500liters
8	Carbon emission prevented	50 Tonnes
9	Bio soap production	8000 number
10	Floor cleaner production	460 liters
11	Awareness programs conducted	230
12	Training programs conducted	60
13	Exhibitions	35
14	Research projects	19



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Fig.10 Esterification unit at bio energy center



Fig.11 Bio energy awareness program



A handwritten signature in blue ink, consisting of a stylized 'P' followed by a long horizontal stroke.

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10. Overall Observations and Recommendations

The energy and environment audit of JNNCE has been carried out based on the data provided and the factual confirmation where ever possible. The overall major observations and recommendations are listed as under.

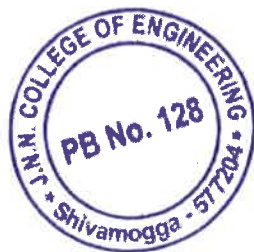
1. JNNCE has made remarkable achievement in implementing it's green energy policy. It has not only implemented the green technology systems like rain water harvesting, solid and liquid waste management system, solar roof top system but also involved its students and staff to carry out research and demonstrations to create knowledge and awareness about various other green technology systems.
2. Roof top solar system is meeting almost 95 percent of the electrical energy consumption of the institute which is highly commendable.
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. There is scope for decreasing the transportation energy by encouraging the staff and students to use E-vehicles and bicycles
6. Roof top rain water system has potential to meet more than 75% of pure water requirement of the institution. Separate storage tanks need to be constructed for collecting the roof water.
7. Water supply system consumes 35% of the total energy utilization. Construction three over head tanks at an elevated place and distributing water by gravity to all the buildings would reduce the energy bill and maintenance of water supply system.
8. Roof water and canal water are collected in one reservoir. The quality of canal water appears to be bad. Hence, usage of the same has to be avoided.
9. Dead tube well can be recharged using surface flow water. Further, a lake or water body can be created to collect the surface flow rain water. This water body in addition to meet the gardening water requirement adds to the aesthetics of the campus.
10. Considering that, only about 10% of the total institution strength out of 4100 persons(Staff and students)reside in the campus hostels, per capita water



- consumption 50 liters is much higher than the standard value of 20 liter per person per day. It indicates significant wastage of water.
11. Solid waste is not properly segregated into degradable and non degradable waste at the source. Degradable waste is being converted to compost and utilized. Non degradable waste is not properly disposed. No data on E-waste is available.
 12. E-waste collection and recycling unit can be installed in the campus
 13. Kitchen waste gas plant should be installed to handle mess wet waste.

Date: 20-09-2022


For 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




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We offer : Consultancy on Rainwater Harvesting, Green Auditing,
Solar Thermal and PV Systems

We Supply : Bio fuel Oil and Non-Edible Oil



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