REPORT FOR

GREEN AUDIT

At

Veer Narmad South Gujarat University, Surat

December, 2021

SUBMITTED BY

Ener'G Consulting

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ACKNOWLEDGEMENT

EnerG Consulting places on record its sincere thanks to Veer Narmad South Gujarat University, Surat for entrusting the task of conducting resource study as "Green Audit" as per NAAC requirements during December 2021.

We hereby express our sincere thanks to Dr. Rajesh K Patel for their proactive support and courtesy extended to the team during field study. We also thank other officials from VNSGU for their cooperation and support provided during data collection. We are also grateful to all those we interacted with during the audit who gave us some operational insights.

EXECUTIVE SUMMARY

The vision of Veer Narmad South Gujarat University, as envisaged in the University Act, is to contribute to the field of higher education in the region and committed to maintain high standards in both undergraduate and postgraduate teaching, promoting research and undertaking the requisite extension activities that would reach out to every section of society.

Green audit services include the audit for facility as per National Assessment and Accreditation Council (NAAC) requirements as per key indicator "7.1 – Institutional Values and Social Responsibilities" to aid the university in accreditation requirement of achieving higher ratings and add values to the functions of the university. In this regard, Veer Narmad South Gujarat University, Surat has invited ener'G Consulting to perform the green audit services for their university though order no.: **Biosci./Order/CDF/78/2022 dated 08-Jan-2022**. This service includes preparation of green audit report as required by NAAC accreditation process to comply the applicable requirements under key indicators 7.1, 7.2 & 7.3.

Based on the requirements, green audit was conducted during month Nov-2021 and Dec-2021, where, various data analysis was performed including site visits. Following are the major opportunities related to various parts of green audits.

1. Improvement in Energy Performance
2. Improvement in Water Performance
3. Improvement in Waste Management
4. Improvement in Environmental Management
5. Improvement in Renewable Energy Systems
6. Improvement in Rain Water Management
7. Improvement in Health and Safety Management

Findings and details are given in the respective chapters of this report as well as in opportunities of improvement section and annexure – 1.

We places on record sincere thanks to Veer Narmad South Gujarat University, Surat for entrusting the task of conducting "Green Audit". We hereby express our sincere thanks to VNSGU management and concerned staff members for their proactive support and courtesy extended during field study. We also thank other officials from VNSGU for their cooperation and support provided during data collection. We are also grateful to all those we interacted with during the audit who gave us some operational insights.

Govind Patel
BE Chemical, Certified Energy Auditor - (EA-2438), LEED AP (USA)
NEBOSH IGC (UK), Chartered Engineer (M-140322-7),

INTRODUCTION

Veer Narmad South Gujarat University has endeavored to be an institution of excellence in higher education since its existence, keeping in view the regional needs and the emerging trends in the global scenario. A semi-urban University located at Surat city; the University has a campus spread over 210 acres. The University, re-accredited 'A' grade with 3.02 CGPA by the National Accreditation and Assessment Council in 2017, is also accredited with 'B++' grade with 2.90 CGPA under Academic and Administrative Audit (AAA) by Knowledge Consortium of Gujarat, Education Department, Government of Gujarat in 2016. The university was originally established under the South Gujarat University Act, 1965 passed by the Gujarat State Legislative Assembly. It became functional from the academic year of 1966 and was incorporated as a university on 23 May 1967. Recognized by the University Grants Commission in 1968, it was renamed as Veer Narmad South Gujarat University in 2004 after the great Gujarati poet Narmad, Narmadshankar Lalshankar Dave. The mandate of the University is to meet the developmental needs of the seven districts and two Union Territory in the region and attempts at realizing their potential in every walk of life ranging from technology, university, industry and commerce to language, culture, and fine arts. The basic objectives of the University as envisaged by the University Act are:

- Undergraduate and Post-graduate teaching, maintaining their high standards, and award of degrees to the candidates successful in their respective examinations.
- Promotion of research and extension activities relevant to the requirements of the region in accordance with the interests of nation building.

Departments and Colleges

The University's jurisdiction extends to the seven districts of Surat, Navasari, Valsad, Narmada, Dangs, Bharuch and Tapi and the Union Territory of Daman and Dadra and Nagar Haveli. There are 25 Post Graduate Departments / Institutes on the University campus that offers 95 programmes with multiple specializations including 19 M. Phil and 19 Ph.D. programmes. The University has 34 Government, 59 Grant-in-aid and 190 Self-financed Colleges and 104 Post-graduate Teaching Centers (subject wise) attached to affiliated colleges. The University offers 36 Postgraduate, 4 Graduate, 3 Integrated and 9 PG Diploma and 05 Certificate programs including self-financed programs with semester credit-based system at university campus. In its Post Graduate Departments, more than 4000 students are studying on the campus. The University has twelve faculties such as Arts, Commerce, Science, Education, Management Studies, Rural Studies, Engineering and Technology, Medicine, Law, Computer Science, Homoeopathic and Architecture. In pursuance of its vision, the University offers an academic environment conducive for the integral development of its students. All the departments emphasize interdisciplinary areas of study that can open possibilities in new fields of research. Several major and minor research projects are underway in various departments. There are over two-lakh students currently enrolled in various courses in the University including affiliated colleges.

The VNSGU is excelling in its area by adapting the following points:

- To obtain, maintain and improve institutional accreditation from NAAC
- To adopt, implement and improve upon methodology for ranking university and colleges in India as per NIRF requirements
- To improve on ARIIA (Atal Ranking of Institutions on Innovation Achievements)
- To continue review and monitor our practice to raise standard
- To be always evaluative for constant improvement
- To provide high quality teaching learning experiences.
- To encourage creative minds.
- To foster activity bases learning.
- To be flexible and adaptable and open to opportunities.

Green Audit is assigned to the Criteria 7 of NAAC, National Assessment and Accreditation Council which is a self- governing institute of India that declares the institutions as Grade A, Grade B or Grade C according to the scores assigned at the time of accreditation.

The intention of organizing Green Audit is to upgrade the environment condition in and around the institutes, colleges, companies and other institutes. It is carried out with the aid of performing tasks like waste management, energy saving and others to turn into a better environmentally friendly institute.

SCOPE OF WORK AND METHODOLOGY

Project Details

The scope of work for the mentioned services has been prepared on the basis the following projects details.

Physical Boundary:

Veer Narmad South Gujarat University
Udhna-Magdalla Road, Surat 395 007 (Gujarat) India
Tel: 0261-2227141, Toll Free: 1800 2333 011, Fax: 0261-2227312
Email: info@vnsgu.ac.in, quality@vnsgu.ac.in URL: www.vnsgu.ac.in

Programmatic Boundaries: The requirements of green audit system are further applicable to following on-campus assets within physical boundary.

Academic Department			
Aquatic Biology	Chemistry	Computer Science	English
Biosciences	Commerce	Economics	Management
Bio Technology	Comparative Literature	Education	Gujarati
HRD	Information Science and Technology	Law	Library and Information Science
Mathematics	Physics	Public Administration	Rural Studies
Architecture	Interior Design	Fine Arts	Journalism
Sociology	Statistics	USIC	Botanical Research Centre

Administrative Section			
Administrative Building	VC office	Estate Section	Account Section
	Pro VC office	Physical Education Section	Senates and Syndicates Section
	Registrar Office	NSS Section	RTI Cell
	CDC	Legal Cell	IQA Cell
	General Section	UGC/CDC/KCG Cell	Academic Section
	Dispatch	SC-ST Cell/Statistical Cell/AISHE Cell	Post Graduate Section
	Placement Cell/Career Counselling Cell	Grievance Redressal Cell/Information Cell/MYSY	IPR/Research Cell/Research and Consultancy Project/MOU
Examination Building	Exam section	Computer Pool	Evaluation Section
Utility Section	Electrical Distribution Section	Water Management	Sanitation Management
	Security Section	Landscaping	Waste Management
Auditoriums	Convention Hall	Art Gallery	Senate Hall
	Prayer Hall	Narmad Hall	
Other Centers	Woman Developmental Cell/Day Care Cell	Phycological Guidance and Counselling Centre	University Health Centre
	SEC	SSIP	SSIC
	Competitive Exam Training Centre		
Central Library/Research Repository Centre			
Hostels			
Quarters and Guest House			
Canteen			
Sports Facilities			

Objectives of Green Audit

1. Securing the environment and cut down the threats posed to human health and ecological health.
2. To ensure compliance of applicable rules and regulations.
3. To avoid the interruptions in environment that are more difficult to handle and their correction requires high cost.
4. To identify the opportunities for improving performance in energy, environment and resource related activities.
5. To suggest the best protocols for adding to sustainable development.
6. To submit the audit report in accordance with NAAC requirements.

Scope of work for Green Audit

1. Water Audit: Evaluating the water consumption for the university and determining the effectiveness of water treatment. Estimation of water saving potential considering 3Rs and best practices. Investigation with the relevant method that can be adopted and implemented to balance the demand and supply of water.
2. Waste Audit: Estimation of waste generation (all types) and finding the opportunities to improve performance on waste management.
3. Energy Audit: It deals with the energy use and methods to reduce its consumption. Estimation of energy saving opportunities to reduce the energy cost.
4. Environmental Audit: It analyzes the air quality, noise level and the programs undertaken by the university for plantation. The green belt should be maintained to reduce the pollution level by decreasing the carbon dioxide level.
5. Health Audit: It analyzes the occupational diseases and safety measures undertaken within the university. advocate the college initiative to encourage students to respect environment and conserve it through plantations.
6. Using Renewable Energy: Resources which can be replenished should be used such as rain, sunlight, wind, tides, etc. These resources are more advantageous as they cause least pollution.
7. Carbon accounting: It undertakes the measure of bulk of carbon dioxide equivalents exhaled by the university through which the carbon accounting is done. It is necessary to know how much the university is contributing towards the sustainable development. The auditor considers several efforts practiced by the university to lower the green-house gases in the atmosphere in order to make the campus more environmentally friendly.

Methodology for Green Audit

1. Plan the audit (preparation of internal team, data requirements checklist and timeline)
2. Acquire the background information (Data collection as per prescribed formats)
3. Analyze the strengths and weaknesses of the internal controls
4. Conduct the online survey
5. Site Visit
6. Evaluate the audit data to evaluate performance and identify opportunities
7. Prepare and distribute final report
8. Prepare and submit action plans for implementation

Benefits of Green Audit

If green audit outcomes are implemented in an effective way, then there are many advantages that could be adopted from it.

1. It would help to safeguard the environment
2. Operation and maintenance cost savings from various measures
3. Point out the prevailing and forthcoming complications
4. Authenticate conformity with the implemented laws
5. Empower the university to frame a better resource performance
6. It portrays a good image of a university which helps building better relationships with the group of stakeholders
7. Enhance the alertness for green guidelines and duties

Timeline of Green Audit

Based on the scope of work, there will be a requirement of data from university. Following would be the recommend timeline of the project.

Step	Description	Estimated Period
1	Receipt of service order	Nov 1
2	Submission of data collection formats (by EnerG)	Nov 2 to Nov 10
3	Submission of data filled in formats (by Client)	Nov 11 to Nov 25
4	Analysis of submitted data (by EnerG)	Nov 26 to Dec 5
5	Conduct the survey (Online - EnerG & Client) for more clarifications	Dec 6 to Dec 7
6	Site Visit (Physical verification and primary discussions on findings)	Dec 8 to Dec 9
7	Update of data analysis and observations	Dec 10 to Dec 15
8	Report and action plan preparation and submission	Dec 16 to Dec 30

This timeline is subject to change with respect to data availability. During planning stage detailed timeline shall be submitted.

WATER MANAGEMENT:

There are two water sources for the university, one is Surat Municipal Corporation (SMC) and second is Canal Supply. Water from SMC is stored in underground water storage tanks and distributed for various use. There is no water treatment required except RO treatment, as SMC supply is meeting with drinking water standards. Water from canal supply is stored in open pond from where it being used for horticulture requirements. Generated sewage is again sent back to SMC's drainage systems. Following are the details of water consumption from SMC.

Month From	Month To	Water Consumption in Litres	Bill Value in Rs	Rate Rs/kL	Nos of Months
Jan-20	Jan-20	12562000	75320	5.996	1
Feb-20	Feb-20	49883000	299067	5.995	1
Mar-20	Jul-20	44288000	265507	5.995	5
Aug-20	Oct-20	30799000	184638	5.995	3
Nov-20	Dec-20	35516000	212918	5.995	2
Jan-21	Feb-21	45621000	273534	5.996	2
Mar-21	Jun-21	5921000	35358	5.972	4
Total Values		224590000	1346342	5.995	18

Apart from fresh water use, VNSGU also harvest water from roof top to open pond. Estimated roof top water collection is given below.

Total Site Area: 210 Acre = 849840 Sqm

Average Rainfall: 1242 mm

Total Roof Area: 78344.8 Sqm - (Annual Roof Top Water - 77345 kL)

Total Pavement Area: 80000 Sqm - (Annual Pavement Water - 49680 kL)

Total Landscape Area: 691997 Sqm - (Annual Landscape Water - 257838 kL)

Total annual water harvesting potential: 384863 kL

At VNSGU, installed capacity for water harvesting from roof top is 2325.789 kL, which is just 3% of total rooftop water harvesting potential.

Apart from rooftop collection, rainwater from pavement and landscape is also diverted to big pond (Capacity - 11805.5 kL) and storage and recharge wells (near chemistry department) within university campus.

Following are the observations related to water management.

1. Monthly average water use is 12477 kL from SMC for the period of Jan-20 to Jun-21, which seems high compare to regular occupancy (@3500 persons per day) and total landscape area.
2. Average monthly billing is Rs. 74797 for the period of Jan-20 to Jun-21.
3. Billing cycle from SMC is observed irregular and no consistency in billing cycle is observed.
4. Water is mainly used for drinking, sanitation, gardening and canteen.
5. Very small quantity of water is used for laboratory operations.
6. No water treatment is required as water quality available conforms to drinking water standards.
7. No sewage treatment is required as sewage is sent back to SMC's drainage system.
8. There are 54 water coolers with total capacity of 3120 liter/hr and total storage capacity of 5070 liters installed at various locations for drinking water requirements.
9. Total connected load of all the water coolers is 46.8 kW
10. There are 61 numbers of pumps installed at VNSGU to cater various water requirements across the campus. (Total connected load is 201.066 kW)
11. It is observed that, majority of the plumbing fixtures are not water efficient for washrooms. VNSGU can update water efficient plumbing fixtures for all washrooms.
12. VNSGU has implemented ISO 140001:2015 and water saving related objective is taken to reduce 5% of water consumption with respect to FY 2020-21 on or before 31st Mar 2022.
13. Installed rainwater harvesting system (14131.3 kL) corresponds to 3.67% of total rain water harvesting potential (384863 kL). VNSGU can take more initiative to increase more rain water harvesting measures.
14. Waste water treatment (sewage) is not practiced in the university as grey water/sewage treatment/recycle facility is not provided. VNSGU can use treated sewage for gardening purpose.
15. Chemical waste water generated from chemical laboratories in the university is also connected to SMC's sewerage system. VNSGU can install appropriate size of treatment schemes to treat the water at acceptable quality or divert the effluent to common effluent treatment facility within Surat, e.g., CETP, Palsana.

WASTE MANAGEMENT:

Paper Waste

Being academic institution, waste paper is the main solid waste generated in the premises. The university has taken steps to minimize and avoid paper usage.

It was observed that:

1. Prints and photocopies are to be taken on both sides of the pages to avoid excess paper usage.
2. Rather than photocopy, digitalization (scanning) is to be practiced.
3. Internal notices and communications are to be performed through E mail/SMS.
4. Faculty and administration staff can use old papers and envelops for internal usages as rough work, file markers, page separators etc.
5. Paper notices are displayed on the notice boards. The dissertation reports, journals, and answer papers are stored as per the University rules. After couple of years, old submissions and answer papers will be archived and stored in a record room. Old publications are still stored in the library.
6. It is noticed that, old paper waste is then burnt in open fire within university campus. It is recommended, that old paper waste recycling facility and reuse system is to be developed to reduce the paper waste and any paper waste generated then after, must be denoted after shredding to avoid any misuse.
7. Accounting of paper waste is also to be started and records of paper waste generated as well as diverted are to be kept on monthly basis.
8. As per the memo, for the disposal of old newspaper scrap dealer is called by central purchase department.

e-Waste

At VNSGU, second highest waste generated is e-waste. Following are the observations regarding e-waste management.

1. VNSGU is digitalized to some extent.
2. The university has 970 PCs, approximately 500 printers, 373 air conditioners in working condition.
3. The generation of E-waste is also large.
4. All E-waste is collected and stored in respected department and once in ten year this e-waste is collected from respective department and given to authorize recycler.
5. The data on E-waste generation and its disposal is not available.
6. There is no documented policy for collection, segregation of e-waste.

Organic Waste

It was observed that:

a) Wet waste and dry waste segregation is not practiced in the premises. No separate bins are provided for wet biodegradable and dry recyclable waste.
b) Combined waste is directly handed over to the SMC.
c) Hostel and canteen is the main area where biodegradable and non-biodegradable waste is generated.
d) The amount of biodegradable waste generation is not recorded and there is no signage on the food wastage or segregation of wet and dry waste.

Facility Alteration and Modification Waste

It was observed that:

a) Generated waste due to facility alteration and modification like replacement of furniture, building modifications, replacement of lamps and batteries, electrical items etc., are not recorded.
b) No separate bins or identified spaces are provided for facility alteration and modification waste.

ENERGY MANAGEMENT:

It deals with the energy use and methods to reduce its consumption. Estimation of energy saving opportunities to reduce the energy cost. Following are the overall electricity consumption details within university campus.

Electricity Supply Details

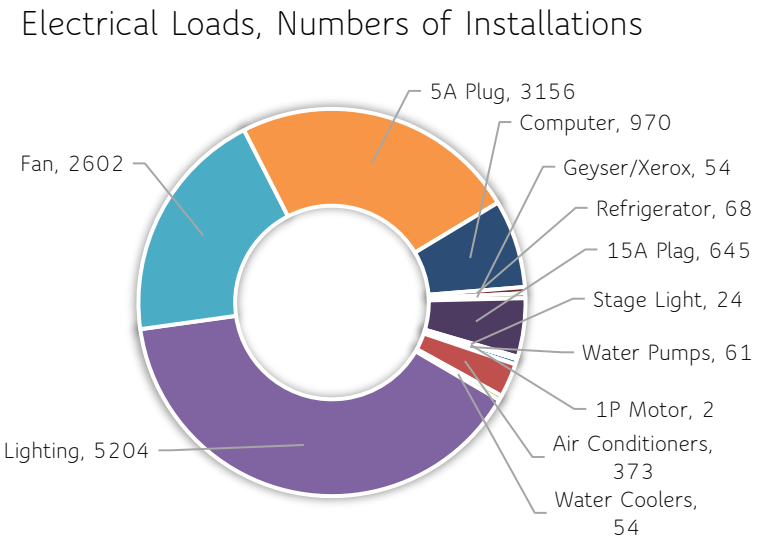
1. Electricity Supplier: DGVCL, Surat
2. Supply Voltage: 22 kV
3. Transformers: 2 Nos - 500 kVA each, 22 kV/433 V
4. Number of HT Substations: One
5. Number of HT Connections: Three
6. Consumer Numbers: 11663, 11639 and 10206
7. Contract Demand: 375 kVA, 200 kVA and 475 kVA respectively
8. Total connected load: 2600 kW approximately
9. Diversity Factor: 0.183

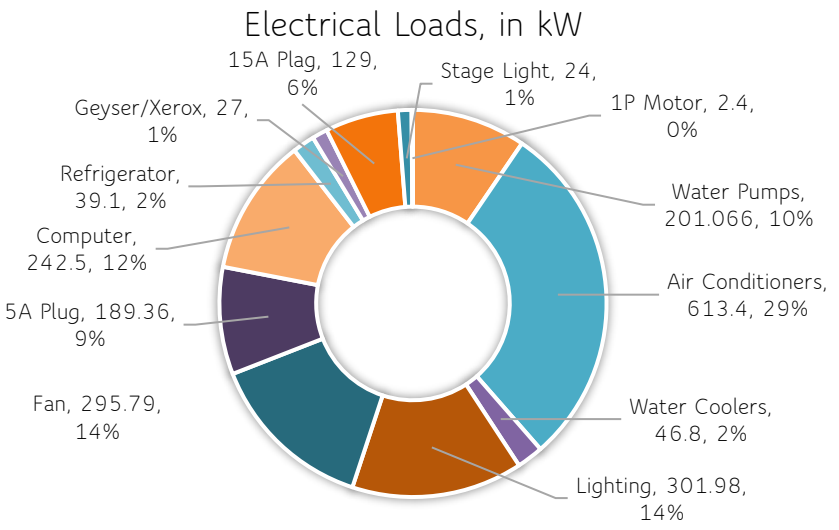
Diesel Generator (DG set) Details

Sr No	DG Location	Capacity (kVA)
1	Convention Hall	380
2	Main Building	160
3	Computer Science	160
4	HRD	160
	Total	**860**

Connected Load Details

It is observed that, total electrical connected load is 2112.4 kW and following are the further details of the same including population of electrical assets and connected load of each category in kW.





Electricity Consumption Details

It is observed that, total electrical consumption of the university is 830552.3 kWh including units generated from solar plants. Following are the further details of the same including various parameters of electrical consumption for each consumer.

Month	Consumer No 10206	Consumer No 11663	Consumer No 11639	Total
Aug-20	42790			42790
Sep-20	70736	2929	1517.1	75182.1
Oct-20	68490	5634	1535.7	75659.7
Nov-20	57520	2703	1792.2	62015.2
Dec-20	41094	5915	1983.6	48992.6
Jan-21	40613	1959	3118.5	45690.5
Feb-21	56786	1820	3548.7	62154.7
Mar-21	79304	3906	4107.3	87317.3
Apr-21	71981	2963	3262.5	78206.5
May-21	67402	3097	3492.6	73991.6
Jun-21	64904	2700	3488.4	71092.4
Jul-21	88887	3343	5037.3	97267.3
Aug-21		4880	5312.4	10192.4
Total	750507	41849	38196.3	830552.3

Electrical Consumption in kWh as per DGVCL Bills

Month	Consumer No 10206	Consumer No 11663	Consumer No 11639	Total
Aug-20	595			595
Sep-20	4	642	4870.5	5516.5
Oct-20	122	378	5985.9	6485.9
Nov-20	1260	1096	7118.7	9474.7
Dec-20	1040	580	4184.4	5804.4
Jan-21	829	1243	0	2072
Feb-21	308	1025	0	1333
Mar-21	0	408	0	408
Apr-21	8	956	0	964
May-21	4	754	0.9	758.9
Jun-21	560	820	0	1380
Jul-21	144	498	0.6	642.6
Aug-21				
Total	4874	8400	22161	35435

Solar Electricity Generation in kWh as per DGVCL Bills

Month	Consumer No 10206	Consumer No 11663	Consumer No 11639	Total
Aug-20	365858			365858
Sep-20	559840	75813	29085	664738
Oct-20	543268	103778	29102	676147
Nov-20	446279	70262	29069	545610
Dec-20	337723	106878	29128	473729
Jan-21	342151	62064	65651	469867
Feb-21	449263	62860	69875	581998
Mar-21	603496	85827	73129	762452
Apr-21	553501	74854	65973	694328
May-21	521152	77914	70148	669214
Jun-21	500549	73205	67027	640780
Jul-21	671584	81690	80776	834050
Aug-21		96291	83417	179707
Total	**5894663**	**971435**	**692380**	**7558478**

Net Electricity Bill Value (Excluding Solar) in INR as per DGVCL Bills

Month	Consumer No 10206	Consumer No 11663	Consumer No 11639	Net Unit Rate, Rs/kWh
Aug-20	8.55			8.67
Sep-20	7.91	25.88	30.8	9.54
Oct-20	7.93	18.42	31.3	9.77
Nov-20	7.76	25.99	28.2	10.38
Dec-20	8.22	18.07	26.3	10.97
Jan-21	8.42	31.68	21.1	10.77
Feb-21	7.91	34.54	19.7	9.57
Mar-21	7.61	21.97	17.8	8.77
Apr-21	7.69	25.26	20.2	8.99
May-21	7.73	25.16	20.1	9.14
Jun-21	7.71	27.11	19.2	9.19
Jul-21	7.56	24.44	16.0	8.63
Aug-21		19.73	15.7	17.63
Overall	**7.92**	**24.86**	**22.2**	**9.51**

Net Electricity Unit Rate in INR as per DGVCL Bills

It is observed that,

1. Average actual demand for consumer number 11639 is 23.75 kVA against contract demand of 200 kVA.
2. Average actual demand for consumer number 11663 is 62.5 kVA against contract demand of 375 kVA.
3. Average actual demand for consumer number 10206 is 287.33 kVA against contract demand of 475 kVA.
4. VNSGU can optimize the contract demand to ensure proper billing demand and actual demand to reduce the demand charges @ Rs 554880 per year, (7.3% of total bill Value).
5. Average power factor for consumer number 11639 is 0.379 against minimum power factor requirement of 0.900.
6. Average power factor for consumer number 11663 is 0.578 against minimum power factor requirement of 0.900.
7. Average power factor for consumer number 10206 is 0.922 against minimum power factor requirement of 0.900.
8. VNSGU can control the power factor requirement to reduce the power factor penalty @ Rs 250251 per year (3.3% of total bill Value).
9. Export of solar energy to be reduced particularly for consumer number 11639 with proper load planning and operations.
10. At VNSGU, majority lighting fixtures are observed as conventional, however, VNSGU has implemented policy that, any failed lighting fixtures are to be replaced with energy efficient LED fixtures.
11. Lighting controls are to be adopted (photo sensors, timers, infrared sensors, thermal sensors etc.) to optimize the lighting consumption.
12. Majority of fans are also observed as conventional, it is recommended that, VNSGU can replace these fans with energy efficient fans
13. Average life of installed air conditioners are more than 8 years. VNSGU can update these ACs with inverter-based energy efficient models.
14. Average life of installed pumps are also more than 8 years. VNSGU can update these pumps with energy efficient pumps or optimize the water consumption to reduce the pumping related energy.
15. There is a scope for adding more capacity for solar rooftop. However, other details of installed solar rooftop is given in "Renewable Energy Section"
16. Additional energy meters are to be installed (building wise and utility wise) to capture more details on energy consumption. Records of such meters to be kept on daily and monthly basis and analysis is to be performed to achieve more energy savings.
17. Implementation & certification of ISO 50001:2018 (Energy Management System) – A systematic approach on energy management to be adopted.

ENVIRONMENT MANAGEMENT:

At VNSGU, majority area is naturally ventilated with sufficient daylights. The programs undertaken by the university for plantation. The green belt is maintained to reduce the pollution level by decreasing the carbon dioxide level. Following are the observations related to environment management at VNSGU.

1. There is wide and easy access to the main building from the main road. Staircase is provided for staff and students.
2. There are wide windows in the staircase as well as in corridor which allow sufficient light and ventilation.
3. Since the access and staircases are wide and free from clutter, it is possible to have a safe evacuation during emergency.
4. Fire extinguishers and fire hydrants are provided in a few areas for emergency, but required to be serviced and inspected by a fire protection service company at least annually.
5. There is no signage for emergency fire exit.
6. The University has a sprawling campus of 210 acres.
7. Large trees are planted in the campus. In the periphery of the campus, along the rear and wings, a thick belt of large trees is planted to bring down noise and cut down dust storms.
8. This plantation will also help keep down severe heat and cold.
9. The trees are planted in such a way that it should not completely obstruct the view of the building from outside and sunlight to room.
10. Indoor plants can be potted along the corridors and entrance of the building.
11. For enhancing the scenic beauty, it is suggested to plant flowering trees, which bloom in different seasons, in front of the large trees along the periphery.
12. Vertical Gardening can be done on the compound wall of the university.
13. The university has installed solar panels (@ 358 kW) at various buildings to promote use of renewable energy.
14. Wide range of activities such as student camps, poster competition, film shows, field visit/survey, seminars, projects, environment campaign, water awareness conservation and harvesting and wall poster competition, essay competition are organized to inculcate ecological awareness among the students.
15. Car/bike pooling is being planned by staff members or students which is a sustainable initiative which reduces the air pollutions and fuel conservation etc.
16. VNSGU is registered with sustainable tool "ARC Skoru" of USGBC to track carbon accounting.
17. VNSGU is certified with ISO 14001:2015 – for effective environment management system.

Following are the details of various plantations and its population within VNSGU Campus.

Sr.	Species	No.	Sr.	Species	No.
1	Acacia nilotica	2	101	Jatropha pandurifolia	1
2	Acasia auriculum	32	102	Justicia adhatoda	10
3	Accacia auriculiformis	4	103	Kalanchoe pinnata	2
4	Achorus zapota	18	104	Khatumbda	3
5	Adansonia digitat	2	105	Kigelia africana	8
6	Adenanthera pavoni	5	106	Kigelia pinnata	26
7	Adenocalymna	1	107	Lagerstomia indica	21
8	Adiantum	1	108	Lagerstomia sp	1
9	Adina cardifolia	1	109	Lantana camara	1
10	Agave	5	110	Lawsonia inermis	2
11	Albizia lebbeck	1	111	Leucaena leucocephala	1
12	Albizzica	169	112	Limonia acidissima	4
13	Allium sativum	2	113	Madhuca indica	5
14	Alocasia macrorhiza	10	114	Manilkara hexandra	1
15	Anacardium occidentale	1	115	Manilkara zapota	3
16	Annona reticulata	1	116	Melia azadirech	1
17	Annona squamosa	1	117	Mengifera indica	38
18	Anthocephalus cadamba	61	118	Millingtonia hortensis	1
19	Araucaria	16	119	Mimusops ellingi	4
20	Ardisia solanacia	10	120	Mimusopus elingi	1
21	Argyreia nervosa	1	121	Mitragyna parvifolia	56
22	Averhoea carambela	2	122	Monstera	2
23	Azadirachta indica	413	123	Moringa oleifera	10
24	Bambusa vulgaris	2	124	Morus alba	1
25	Bauhinia purpurea	28	125	Mucuna pruriens	1
26	Bauhinia racemosa	3	126	Murraga koenigii	4
27	Bauhinia varigata	50	127	Murraya panniculata	29
28	Bignonia magnifica	1	128	Musa paradisica	59
29	Bixa Orellana	1	129	Mussaenda	2
30	Blackboard tree	37	130	Mutingia glabra	1
31	Bombax ceiba	18	131	Nerium indicum	36
32	Borassus flabellifer	14	132	Nerium oleander	1
33	Bridelia retusa	3	133	Nyctanthes arbor-tristis	6
34	Butea monosperma	24	134	Ochna	1
35	Caccia fistula	4	135	Oroxylum indicum	3
36	Caesalpinia crista	4	136	Ougeinia oojeinensis	2
37	Caesalpinia pulcherima	1	137	Pandanus odoratissimus	1
38	Calistemon brachyandrus	6	138	Paribhattak	1

Sr.	Species	No.	Sr.	Species	No.
39	Callistemon citrinus	2	139	Parkia biglobosa	3
40	Calophyllum inophyllum	1	140	Passiflora edulis	1
41	Canna	2	141	Peltophorum pterocarpum	391
42	Careya arborea	2	142	Pentatropis microphylla	1
43	Carica papaya	9	143	Petunia	2
44	Caryota urens	11	144	Phoenix dactilifera	14
45	Cascabela thevetia	101	145	Phoenix sylvestris	1
46	Cassia auriculata	1	146	Phyllanthus emblica	3
47	Cassia fistula	12	147	Phyllanthus reticulatus	1
48	Cassia senna	7	148	Pimenta aromatica	1
49	Casuarina equisetifolia	87	149	Pithecellobium dulce	3
50	Catharanthus roseus	1	150	Plumbago europaea	4
51	Ceiba pentandra	1	151	Plumeria alba	107
52	Ceratonia siliqua	2	152	Polyalthia longifolia	143
53	Cerecus cactaceae	7	153	Polyscias	2
54	Chrysopogon zizanioides	1	154	Pongomia pinnata	9
55	Cicca acida	1	155	Premna integrifolia	3
56	Cissus quadrangularis	2	156	Prosopis sineria	33
57	Coccus nucitera	259	157	Prunus amygdalus	20
58	Combretum ovalifolium	1	158	Psidium guajava	23
59	Conocarpus erectus	41	159	Psoralea corylifolia	1
60	Cordia dichotoma	1	160	Pterocarpus marsupium	3
61	Cordia mixa	46	161	Punica granatum	2
62	Crinum asiaticum	3	162	Ravenella palm	36
63	Cyssus comosum	2	163	Rivina humilis	5
64	Daemia extensa	1	164	Roystonea regia	8
65	Dalbergia latifolia	4	165	Ruelia tuberosa	2
66	Delonix regia	887	166	Russelia juncea	1
67	Dendrocalamus bambtus	30	167	Salvadora persica	3
68	Dendrocalamus strictus	2	168	Santalum album	8
69	Diospyros kaki	1	169	Saraca asoca	9
70	Dregea volubilis	3	170	Semecarpus anacardium	2
71	Elaeis guineensis	3	171	Bryonia laciniosa	1
72	Elletaria cardamomum	1	172	Simarouba glauca	2
73	Embellica officinalis	1	173	Sterculia foetida	1
74	Epiphyllum	2	174	Sterculia urens	5
75	Erythrina variegata	3	175	Swietenia mahagoni	2
76	Eucalyptus glabrus	352	176	Syzigium cumini	19

Sr.	Species	No.	Sr.	Species	No.
77	Euphorbia lactea	1	177	Tababua rosea	4
78	Euphorbia tirucalli	1	178	Tababuya sp	52
79	Ficus benghalensis	34	179	Tabebuia rosea	5
80	Ficus benjamina	1	180	Tabermaemontana coriaraia	8
81	Ficus elastica	2	181	Tamarindus indica	15
82	Ficus hispida	1	182	Tamarix gallica	3
83	Ficus religiosa	35	183	Tamarix indicus	28
84	Ficus sp	56	184	Tectona grandis	1
85	Gerbera	3	185	Terminalia arjuna	33
86	Gmelina arborea	8	186	Terminalia bellirica	2
87	Gmelina hystrix	3	187	Terminalia catappa	3
88	Guaiacum officinale	1	188	Terminalia chebula	2
89	Gymnosporia montana	2	189	Thespesia populnea	8
90	Hedychium spicatum	1	190	Thuja standishii	6
91	Helicteris isora	4	191	Tinospora cordifolia	1
92	Hemidesmus indicus	1	192	Tradescantia	1
93	Heterophragma quadriloculare	2	193	Tylophora indica	2
94	Hibiscus	283	194	Vernonia elaeagnifolia	4
95	Holoptelea integrifolia	2	195	Vitex negundo	2
96	Hyphaene dichotoma	5	196	Vitex trifolia	1
97	Ixora coccinia	15	197	Wedelia urticifolia	3
98	Ixora pavetta	3	198	Withania somnifera	2
99	Jacquinia arborea	1	199	Wrightia tinctoria	1
100	Jasminum officinale	4	200	Zingiber officinale	2
			201	Zizyphus manritiana	9
Total plants - 4740 Nos					

Following are the details of various bio-diversity within VNSGU Campus

Mammals

Sr.	Family	Scientific Name	Common name
1	Sciuridae	Funsmbulus pennantii	The Northern palm squirrel
2	Herpestidae	Herpestes edwardsii	Indian gray mangoose
3	Pteropodidae	Pteropus giganteus	Indian flying foxes
4	Canidae	Canis familiaris	Domestic dog
5	Felidae	Felis domestica	Domestic cat

Fishes

Sr.	Scientific Name	Common name
1	Poecillia reticulata	Guppy

Amphibians

Sr.	Family	Scientific Name	Common name
1	Bufonidae	Dattaphrynus melanosticus	Common Asian Toad
2	Bufonidae	Dattaphrynus scaber	Schneider's Dwarf Toad
3	Bufonidae	Dattaphrynus stomaticus	Indian Marbled Toad
4	Dicroglossidae	Minervarya syhadrensis	Long-legged cricket frog
5	Dicroglossidae	Fejervarya limnocharis	Indian cricket frog
6	Dicroglossidae	Hoplobatrachus tigerinus	Indian bullfrog
7	Microhylidae	Microhyla ornate	Ornate narrow mouthed frog

Snakes

Sr.	Family	Scientific Name	Common name
1	Elapidae	Naja	Indian Cobra
2	Elapidae	Bungarus caeruleus	Common Krait
3	Viperidae	Daboia russelli	Russell's Viper
4	Viperidae	Echis carinatus	Saw scaled viper
5	Colubridae	Ptyas mucosa	Indian rat snake
6	Colubridae	Coelognathus Helena	Trinket
7	Colubridae	Coronella brachyura	Indian smooth snake
8	Colubridae	Lycodon aulicus	Common wolf snake
9	Colubridae	Oligodon arnensis	Common kukri
10	Colubridae	Ahaetulla nasuta	Common vine snake
11	Typhlopidae	Indotyphlops braminus	Brahminy blind snake
12	Erycidae	Eryx conicus	Common sand boa
13	Natricidae	Xenochrophis piscator	Checkered keelback
14	Natricidae	Macropisthodon plumbicolor	Green keelback

Lizards and Geckos

Sr.	Family	Scientific Name	Common name
1	Agamidae	Calotes versicolour	Oriental Garden Lizard
2	Gekkonidae	Hemidactylus brookii	Brook's House gecko
3	Gekkonidae	Hemidactylus falviviridis	Northern House gecko
4	Gekkonidae	Hemidactylus frenatus	Southern House gecko
5	Lygosomidae	Lygosoma guentheri	Gunther's supple skink
6	Lygosomidae	Lygosoma albopunctata	White spotted supple skink
7	Lygosomidae	Eutropis carinata	Common skink
8	Lygosomidae	Eutropis macularia	Bronze skink

Turtles

Sr.	Family	Scientific Name	Common name
1	Trionychidae	Lisseymys punctata	Common flap-shelled turtle

Birds

Sr	Order	Family	Common Name	Scientific Name
1	Accipitriformes	Accipitridae	Black Kite	Milvus migrans
2			Oriental Honey Buzzard	Pernis ptilorhynchus
3			Shikra	Accipiter badius
4	Caprimulgiformes	Apopidae	Little Swift	Apas affinis
5	Charadriiformes	Charadriidae	Red-wattled Lapwing	Vanellus indicus
6		Scolopacidae	Green Sandpiper	Tringa ochropus
7	Columbiformes	Columbidae	Common rock Pigeon	Columba livia
8			Spotted Dove	Spilopelia chinesis
9	Coraciiformes	Alcedinidae	White-throated Kingfisher	Halcyon smyrnensis
10		Meropidae	Green bee eater	Merops orientalis
11			Blue tailed bee eater	Merops philippinus
12	Cuculiformes	Cuculidae	Asian koel	Eudynamys scolopaceus
13			Greater Coucal	Centropus sinesis
14	Galliformes	Phasianidae	Indian Peafowl	Pavo cristatus
15	Gruiformes	Rallidae	White breasted waterhen	Amaurornis phoenicurus
16	Passeriformes	Acrocephalidae	Blyth's reed Warbler	Acrocephalus dumetorum
17			Syke's Warbler	Iduna rama
18		Cisticolidae	Ashy Prinia	Prinia socialis
19			Common tailor bird	Orthotomus sutorius
20			Plain Prinia	Prinia inornata
21		Corvidae	House Crow	Corvus splendens
22			Jungle Crow	Corvus macrorhynchos
23		Dicaidae	Pale-billed Flowerpeacker	Dicaeum erythrorhynchos
24		Dicruridae	Black Drongo	Dicrurus acrocercus
25		Estrildidae	Scaly-breasted Munia	Lonchura punctulata
26		Hirudinidae	Red rumped Swallow	Cecropis daurica
27		Laniidae	Long-tailed shrike	Lanius schach
28		Muscicapidae	Indian Robin	Saxicoloides fulicatus
29			Oriental magpie Robin	Copsycus saularis
30			Red-breasted flycatcher	Ficedula parva
31		Monarchidae	Indian paradise flycatcher	Tersiphone paradisi
32		Nectariniidae	Purple-rumped Sunbird	Leptocoma zeylonica
33			Purple Sunbird	Cinnyris asiaticus
34		Oriolidae	Indian golden Oriole	Oriolus
35		Pycnonotidae	Red vented Bulbul	Pycnonotus cafer
36			Red whiskered bulbul	Pycnonotus jokosus
37		Sturnidae	Bank Myna	Acridotheres ginginianus
38			Common Myna	Acridotheres tristis
39			Rosy Starling	Pastor roseus
40	Pelecaniformes	Ardeidae	Cattle Egret	Bubulcus ibis
41			Intermediate Egret	Ardeaintermedia
42			Indian pond Heron	Ardeola grayii
43			Little Egret	Egretta garzetta

44	Piciformes	Megalamidae	Coppersmith Barbet	Psilopogon hemacephalus
45	Psittaciformes	Psittacidae	Alexandrine Parakeet	Psittacula eupatria
46			Rose-ringed Parakeet	Psittacula crameri
47	Suliformes	Phalacrocoracidae	Little cormorant	Microcarbo niger
48	Bucerotiformes	Upupidae	Common Hoopoe	Upupa epops

Butterfly

Sr.	Family	Scientific Name	Common name
1	Lycaenidae	Common Pierrot	Castalius rosimon
2	Lycaenidae	Forget Me Not	Catochrysops strabo
3	Lycaenidae	Plains Cupid	Chilades pandava
4	Nymphalidae	Common Castor	Ariadne merione
5	Nymphalidae	Common Evening Brown	Melanitis leda
6	Nymphalidae	Common Indian Crow	Euploea core
7	Nymphalidae	Danaid Eggfly	Hypolimnas misippus
8	Nymphalidae	Great Eggfly	Hypolimnas bolina
9	Nymphalidae	Common Leopard	Phalanta phalantha
10	Nymphalidae	Plain Tiger	Danaus chrysippus
11	Nymphalidae	Striped Tiger	Danaus genutia
12	Nymphalidae	Blue Tiger	Tirumala limniace
13	Nymphalidae	Tawny Coster	Acraea violae
14	Pieridae	Common Emigrant	Catopsillia pomono
15	Pieridae	Common Grass Yellow	Eurema hecabe
16	Pieridae	Common Gull	Cepora nerissa
17	Pieridae	Mottled Emigrant	Catopsillia pyranthe
18	Pieridae	One-spot Grass Yellow	Eurema andersoni
19	Pieridae	Common Jezebel	Delias eucharis
20	Pieridae	Common Jay	Graphium doson

Beetles

Sr.	Scientific Name	Common name
1	Mango tree borer	Batocera sp.
2	Blister beetle	Meloidae Family
3	Jewel beetle	Buprestidae family
4	Longicorn beetle	Olenecampus bilobus
5	Lady bug	Coccinellidae Family

Mollusca

Sr.	Scientific Name	Common name
1	Round back slug	Arionoidae
2	Asian apple snail	Pila
3	Hammerheaded slug	Geoplanidae

Microscopic Organisms

No.	Scientific name
1	Keratella
2	Diaptomous
3	Daphnia
4	Moina
5	Nauplius
6	Tendipes
7	Rhabdolaimus
8	Ploeosoma
9	Brachionus kestei
10	Lepadella vanden
11	Paramecium

Ants

Sr.	Scientific Name	Common name
1	Carpenter Ant	Camponotus compressus
2	Velvet sugar Ant	Camponotusrufoglaucus
3	Smooth harvester ant	Messor sp.
4	silky shield ant	Meranoplus bicolor
5	Cocktail ant	Crematogester sp.
6	Asian Weaver Ant	Oecophylla smaragdina
7	Pharaoh ant	Monomorium sp.

Spiders

Sr.	Scientific Name	Common name
1	Lycosa sp.	Wolf spider
2	Telamonia dimidiate	Two striped jumping spider
3	Hyllus semicupreus	Heavy bodied jumper
4	Rhene sp.	Heavy bodied jumper
5	Thomisus sp.	Crab spider
6	Tetragnatha sp.	Long jawed spider
7	Plexippus paykulii	Housefly catcher
8	Neoscona sp.	Garden orb weaver spider
9	Cyrtophora sp.	Tent web spider
10	Argyrodes sp.	Dewdrop spider
11	Oxyopes sp.	Lynx spider
12	Olios sp.	Golden huntsman
13	Olios millet	Green Huntsman

Dragonflies and Damsel flies

Sr.	Scientific Name	Common name
1	Coromandel marsh dart	Ceriagrion coromandelium
2	Marsh blue tail	Ischnura senegalensis
3	Scarlet marsh hawk	Aethriamanta brevipennis
4	Green Marsh hawk	Orthetrum sabina
5	Banded pennant	

Moths

Sr.	Scientific Name	Common name
1	Owlet moth	Spirama retorta

Other Insects

Sr.	Scientific Name	Common name
1	Green lacewing	Chrysopidae
2	Long legged fly	Austrosciapus connexus
3	House fly	Musca sp.
4	Drain fly- Bathroom moth	Clogmia albipunctata
5	Soldier fly	Sargus sp.
6	Anthomyia fly	Anthomyia sp.
7	Hover fly	Syrphidae family
8	Sarcophage- Flesh fly	Sarcophaga sp.
9	Drosophila	Drosophila melanogaster
10	Leaf hopper	Cicadellidae
11	Grass hopper	Melanoplus
12	Tree hopper	Membracidae
13	Katydid	Katydid
14	Giant Centipede	Scolopendra
15	Long flange Millipede	Asiomorpha
16	Red cotton bug	Dysdercus
17	Tiger Crane fly	Nephrotoma
18	Honey bee	Apis cerana india
19	Indian stingless bee	Tetragonula
20	Blue banded bees	Zonamegilla
21	Common trig	Trigonidium sp.
22	Green stink bug	Chinavia sp.
23	Giant water nug	Lethocerus indicus
24	Assisan bug	Reduviidae
25	Water strider	Gerroidae
26	Cotton stainer bugs	Dysdercus cingulatus
27	Oliender aphids	Aphis nerii
28	Rough stink bug	Brochymena sp.
29	Palm weevil	Rhynchophorous sp.

HEALTH & SAFETY MANAGEMENT:

Apart from good ventilation, natural daylighting for the occupants, VNSGU also committed to provide good infrastructure for all the occupants and includes but not limited to:

1. Drinking water
2. Sanitation facilities
3. Health center
4. Nursing facilities
5. Regular medical checkups
6. COVID 19 – ICMR approved testing facility
7. Hygienic Food (Canteen facility)
8. Good housekeeping

However, following observations are made and can be considered for better health management at VNSGU.

Indoor Air Quality (IAQ) refers to the air quality within and around buildings and structures, as it relates to the health and comfort of building occupants. Some common indoor pollutants are listed as below:

- Molds and other allergens – This may arise from water seeping into the building envelope or skin, plumbing leaks, condensation due to improper ventilation, or from ground moisture penetrating a building part.
- Carbon monoxide – Sources of carbon monoxide are incomplete combustion of flammable materials including vehicular activities.
- Volatile organic compounds – VOCs are emitted by paints and lacquers, paint strippers, pesticides, office equipment such as copiers and printers, correction fluids and carbonless copy paper, graphics and craft materials including glues and adhesives, permanent markers, and photographic solutions etc.
- Carbon dioxide – Due to human respiration
- Particulate matter – Due to construction and maintenance activities as well as dusty ambient conditions.

Major observations under indoor air quality is as below:

1. Ventilation is achieved by fans in the university and air conditioners in some places.
2. Heating Ventilation and Air Conditioning (HVAC) system is not installed.
3. Smoke detectors are partially provided in the university.
4. Exhaust fans are only provided in washrooms and chemistry lab.
5. No indoor plants were observed in the entire university. Indoor plants can be plotted not only for the aesthetic appearance but also for health benefits.

6. Green belts are constructed in open areas.
7. IAQ awareness signage's can be displayed for sources & causes of indoor air pollution in the university for making people aware of indoor air pollution and their health impacts.
8. A systematic approach towards health and safety management can be implemented in accordance with ISO 45001:2018 with inclusions of following aspects.
    a) Ergonomics
    b) First Aid
    c) Hazard Identification and Reporting
    d) Hazardous Waste Management
    e) Emergency Response
    f) Designated Substances
    g) Workplace Harassment and Violence
    h) Working Alone
    i) Health and Safety Awards
    j) Work Refusal
    k) Safe Working in Laboratory
    l) Stores Management
    m) Ventilation Systems
    n) Fire Safety
    o) Electrical Safety
    p) Safe Material Handling
    q) Laboratory Health & Safety
    r) Personal Protective Equipment

RENEWABLE ENERGY USE:

VNSGU believes that resources which can be replenished should be used such as rain, sunlight, wind, etc. These resources are more advantageous as they cause least pollution and hence, installed various systems to some extent to contribute to the global demand of sustainability. Measures related to daylighting, natural ventilation and rainwater is already discussed in previous chapters and information related to use of solar energy is given below.

Following are the installations which utilizes solar energy.

Sr	Location	Capacity, LPH
1	Vindhyanchal Hostel	1000
2	Sahyadhri Hostel	1000
3	Sentrunjay Hostel	1000
4	Girnar Hostel	1000
5	Satpuda Hostel	1000
6	Tapi Hostel	1000
7	Narmada Hostel	1000
8	Ambica Hostel	1000
9	Purna Hostel	1000
10	Saraswati Hostel	1000
11	Kaveri Hostel	1000
12	International Boys Hostel	1000
	Total	12000

Installed Solar Water Heater Systems

Sr	Location	Capacity, kW
1	Law Building	40
2	Computer Science Building	60
3	HRD Building 1	35
4	HRD Building 2	
5	Assessment Building	35
6	SSIC Building	15
7	Biotech Building	25
A	Sub Total	210
B	DBIM Building	58
C	Architecture	90
	Total	358

Installed Solar Panels Systems

Month	Consumer No 10206	Consumer No 11663	Consumer No 11639	Total
Aug-20	595			595
Sep-20	4	642	4870.5	5516.5
Oct-20	122	378	5985.9	6485.9
Nov-20	1260	1096	7118.7	9474.7
Dec-20	1040	580	4184.4	5804.4
Jan-21	829	1243	0	2072
Feb-21	308	1025	0	1333
Mar-21	0	408	0	408
Apr-21	8	956	0	964
May-21	4	754	0.9	758.9
Jun-21	560	820	0	1380
Jul-21	144	498	0.6	642.6
Total	4874	8400	22161	35435

Reported Solar Generation, kWh

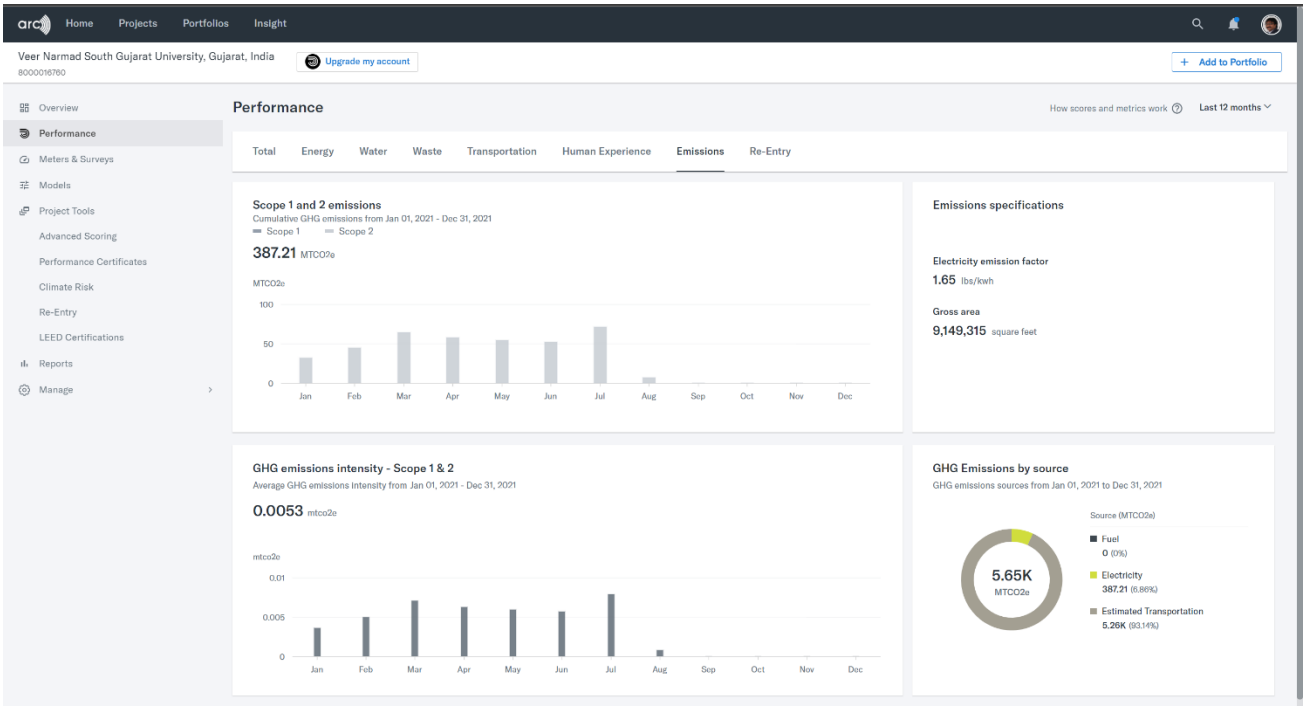
Average Global Horizontal Irradiation (GHI) in GUJARAT state is 2026 W/sqm. 1kWp solar rooftop plant will generate on an average over the year 4.53 kWh of electricity per day (considering 5.5 sunshine hours). Hence, estimated electricity generation from 358 kWp solar rooftop is 1621.74 kWh of electricity per day equivalent to 591935 kWh of electricity per year.

Following are the observations related to renewable energy.

1. Reported electricity generation is 35435 kWh against standard generation of 591935 kWh for the period of Aug-20 to Jul-21 as per DGVCL's electricity bills and corresponds to just 6.0% of designed/rated generation.
2. VNSGU can optimize the performance of installed solar rooftop in accordance with applicable design conditions.
    a. Proper operation and maintenance needs to be performed
    b. Daily records of generation to be maintained and analyzed with design conditions
3. VNSGU can install more rooftop system to be become carbon neutral, however, energy performance improvement steps are also to be implemented.

CARBON ACCOUNTING:

VNSGU monitors their carbon footprint through "ARC Skoru" platform from USGBC (United States Green Building Council). The registration number of the project is "8000016760" and covers GHG emissions as per Scope 1 and Scope 2 requirements. It is observed that, reported GHG emission for the period of Jan-2021 to Dec-2021 is 387.21 MTCO2e and 5.65K MTCO2e by source. Following are the screenshot for the same details.



OPPORTUNITIES FOR IMPROVEMENT:

Based on various observations under different categories, opportunities for improvements are summarized as below.

1. There is a scope of improvement on energy performance at VNSGU at least 20% of total energy consumption and at least 30% of total energy bill values. Following are the major findings.
    a. Power factor improvement
    b. Contract demand management
    c. Solar system performance enhancement
    d. Detailed energy audit (level 3) to be conducted in accordance with ISO 50002:2014.
    e. Implementation of ISO 50001:2018 – Energy Management System
    f. Additional metering to track energy consumption at various buildings and major energy consuming utilities.
    g. Awareness improvement on energy perceptions and related management systems.
    h. Implementation of best technologies for lighting, air conditioning and water pumping.
    i. Metering analysis to be adopted.
2. Scope of water performance improvement at VNSGU is at least 30% of total water consumption. Following are the major findings.
    a. Additional metering to track water consumption at various buildings and major water consuming utilities.
    b. Awareness improvement on water perceptions and related management systems.
    c. Implementation of best technologies for water use like water efficient plumbing fixtures.
    d. Metering analysis to be adopted.
    e. Optimization of rain water harvesting system
    f. Implementation of sewage treatment and reuse of treated sewage for gardening
3. Following are the findings for waste management improvement at VNSGU.
    a. Awareness improvement on waste perceptions and related management systems.
    b. Implementation of best technologies for effective waste management like ARC Skoru, LEED guidelines.
    c. Metering analysis to be adopted.
    d. Waste accounting for different category of waste generated at site.
        i. Paper and Cardboard Waste
        ii. Plastic Waste
        iii. Organic Waste (food)
        iv. Organic Waste (Plantations)
        v. Batteries
        vi. Glass

vii. Metal – Aluminum Cans, Foils etc.
viii. Furniture and facility alteration
ix. Lamps
x. E-Waste

e. Implementation of 3R's techniques (Reduce, Reuse and Recycle)
f. Implementation of waste collection and sorting at source.
g. Implementation of detailed waste management plan
h. Implementation of bio-gas plant from organic waste (food and plantation)

4. Following are the findings for health and safety management at VNSGU.
    a. Awareness improvement on health and safety perceptions and related management systems.
    b. Implementation of best technologies for effective waste management like ISO 45001:2018.
    c. Do not dispose off paper waste by burning it within campus.
    d. Update first-aid kits located at various places with latest guidelines.
    e. Detailed electrical and life safety audit to be conducted in accordance with NBC 2016, NFPA requirements.
5. Other findings for additional benefits at VNSGU
    a. Continue data entry at "ARC Skoru" platform to monitor carbon footprint.
    b. Display of various performance indicators of sustainability to the interested parties.
    c. Communication of efforts made and results achieved at VNSGU to promote sustainability.
    d. Conduct awareness programs on various topics of sustainability among administration and academic staff to improve knowledge on best practices and best technologies.
    e. Implement sustainable purchasing practices to ensure appropriate and effective performance of products and services.

CONCLUSION:

The green audit study of the university has identified various energy, water & cost saving opportunities as well as opportunities from improvement in environmental, safety and health areas which are discussed in the report. The summary of recommendations is given in "opportunities for improvement" section and annexure 1. It is estimated that by implementing suggested measures; the university can reduce its energy and freshwater consumption with payback period <1 year and improve on safety, health and waste management.

ANNEXURE 1: Green Audit Checklist

Daylighting and Ventilation:

Sr	Design Feature	Status	Remarks (If Any)
1	Broad door opening	✓	
2	Clerestories (High windows)	✓	
3	Rectangular building so that sunlight can reach all areas	✓	
4	Double or triple glazing on windows/ Sun protecting film on windows	✗	
5	Enough illumination from natural light	✓	
6	Light coloured fabric curtain or blind for window covering	😐	Can be improved
7	Operable/ openable windows	✓	
8	Use of glass as facilitator of natural light	✓	
9	High ceiling	✓	
10	Wide corridors	✓	
11	Use of exhaust fans	✓	Exhaust fans are provided in washrooms and chemistry lab.

Indoor Air Quality Management:

Sr	Design Feature	Status	Remarks (If Any)
1	Installation of Airconditioning Systems	✓	Installed at required places.
2	Monitoring of Airconditioning Systems	✗	
3	Maintenance of Airconditioning Systems	😐	Can be optimized and improved
4	Installation smoke detectors	✗	This will be useful from safety point of view.
5	Indoor air quality monitoring	✗	
6	Indoor Air Quality (IAQ) awareness programs	✗	

Water Efficiency and Wastewater Management:

Sr	Design Feature	Status	Remarks (If Any)
1	Aerators to water taps	✘	
2	Automatic toilet faucets	✘	
3	Dual flush toilet with cistern	✘	
4	Efficient plumbing system from maintenance & operation point	✘	
5	Use of low flow/ flow control water equipment or gadget	✘	
6	Water free urinals (No flush urinals/Zero flush urinals/Water less urinals/air based flushing system these save water used in toilet)	✘	
7	Drip irrigation (This refers to plant watering system)	✘	
8	Water distribution diagram/water network/Water balance diagram	✘	This would be useful for monitoring & reducing water consumption.
9	Sewage treatment plant for treated sewage recycle	✘	This will be useful for recycling water after treatment.
10	Rainwater harvesting	✓	Can be Improved
11	Display of signboards at appropriate places for water conservation	✘	
12	Use of bore-well water in the toilet for flushing	✘	We should discourage use of ground water

Energy Efficiency and Onsite Energy Generation System:

Sr	Design Feature	Status	Remarks (If Any)
1	Use of natural day light	✓	
2	Use of energy efficient equipment	✘	
3	Use of energy saving bulbs (LED lights)	😐	Can be optimized and improved
4	On-site energy generation	✓	Can be optimized and improved
5	Photocell occupancy sensor for automatic light control	😐	Can be optimized and improved
6	Regular maintenance of electrical system	✓	
7	Computerized monitoring of electrical system	✘	
8	Solar panel	✓	Can be optimized and improved
9	Display of signboards at appropriate places for energy conservation	✘	

Temperature and Acoustic Control:

Sr	Design Feature	Status	Remarks (If Any)
1	Use of daylight design (Building is constructed in such a way that diffused sunlight allows light but not the heat)	✓	
2	Special walls for temperature control and noise barrier (Thick/ Double/ Composite/ Acoustic control)	✗	
3	Earth air tunnel (cools air in summer and heat it in winter)	✗	
4	Roof with reflective glass	✗	
5	Use of cool roofing material during construction (mineral wool, rock wool, vermiculite, foams, expanded polystyrene, extruded polystyrene etc.)	✗	
6	Use of insulation material (e.g. autoclaved aerated blocks, hollow blocks etc.	✗	
7	Use of water bodies/fountain	✗	
8	Use of landscaping as sound barrier	✓	

Operation & Maintenance:

Sr	Design Feature	Status	Remarks (If Any)
1	Easy access to the main entrance of the building	✓	
2	Provision of Lift/Elevators	✓	
3	Ramp/ stairs with handrails on at least one side	✓	
4	Restrooms (toilets) in common areas	✓	
5	Uniformity in floor level	✓	
6	Follow standard procedures for commissioning of electrical/ plumbing system	✗	
7	Regular maintenance of building	✓	
8	Use of safer cleaning solutions	✗	
9	Preferred car park spaces for especially abled	✗	
10	Visual warning signage in common and exterior areas for safety	✗	
11	Availability of wheel chair	✗	

Waste Management:

Sr	Design Feature	Status	Remarks (If Any)
1	Segregation of dry and wet waste	✘	
2	Use of coloured bins with code to collect garbage	✘	
3	Setting up recycling area/ composing area	✘	
4	Avoid use of paper by going digital (Paper)	✘	
5	Printing on both sides of paper	✓	
6	Reuse of printed paper/ envelops for other applications	✘	
7	Donation of books to store or other library	✓	
8	Donation of weeded books to needy students	✘	
9	Donation of computers to NGOs to refurbish and give it to needy schools/people	😐	Can be optimized and improved
10	Creation of specified junctions for collection of E-waste(E-waste)	✘	
11	Implementation of any recycling project or program	✘	
12	Purchase of electronic products from company's which have after sales service for the disposal of product with take back policy	✘	
13	Reusing waste to produce new sustainable products	✘	
14	Hand over to the organization or recycler who knows proper disposal system	✘	

Environment Audit:

Sr	Design Feature	Status	Remarks (If Any)
1	Energy audit (includes energy consumption, thermal emission, visual comfort)	😐	Can be optimized and improved
2	Fire, Electrical and Life Safety audit	✘	
3	Water and waste audit (includes water quality, solid waste generation, solid waste disposal process)	✘	
4	Indoor Air Quality Audit	✘	

Green Program:

Sr	Design Feature	Status	Remarks (If Any)
1	Green education to improve environmental awareness	😐	Can be optimized and improved
2	Outreach relationships with local groups interested in environmental concern and satisfy their information needs	😐	Can be optimized and improved
3	Reduce, Reuse and recycle the products such as books, electronic appliances etc. (e.g. At the time of de-selection and disposal of library material)	✓	
4	Digitization of majority of processes	✓	
5	E-archiving	😐	Can be optimized and improved
6	E-resources: E books, Online Journals, membership of consortium	✓	
7	Subscription to databases	✓	
8	Contribute library information on sustainability resources to a university publication, blog or website	✓	
9	Selection of material content of which informs and assesses green practices (green computing, energy conservation etc.)	😐	Can be optimized and improved
10	Use of eco-friendly reading material	✘	
11	Creation of "Green Team" in the institution	✘	
12	Recycling beyond paper i.e. Plastic, e-waste	✘	
13	Disseminating expert advice about sustainability to other colleges to make their own college greener	✓	
14	E Publishing reviews of new green resources in the newsletter or news	✓	

----------END OF REPORT----------