

Dated: 16th Sep. 2022

CERTIFICATION FOR GREEN AUDIT

This is to certify that Eco Paryavaran Laboratories and Consultants (NABET, NABL and MoEF&CC approved for environmental management and testing services) has undertaken "Green Audit" for Central University of Himachal Pradesh (Dharamsala, Shahpur & Dehra Campus) in September 2022.

This green audit includes the enrollment of Functional Area Experts (NABET approved), testing laboratory (NABL and MoEF&CC accredited) and high end instrument/ equipment/ software (USEPA/TUV/CPCB certified).

We are thankful to the Management and Principal of the Institute for entrusting us to conduct their Green Audit.



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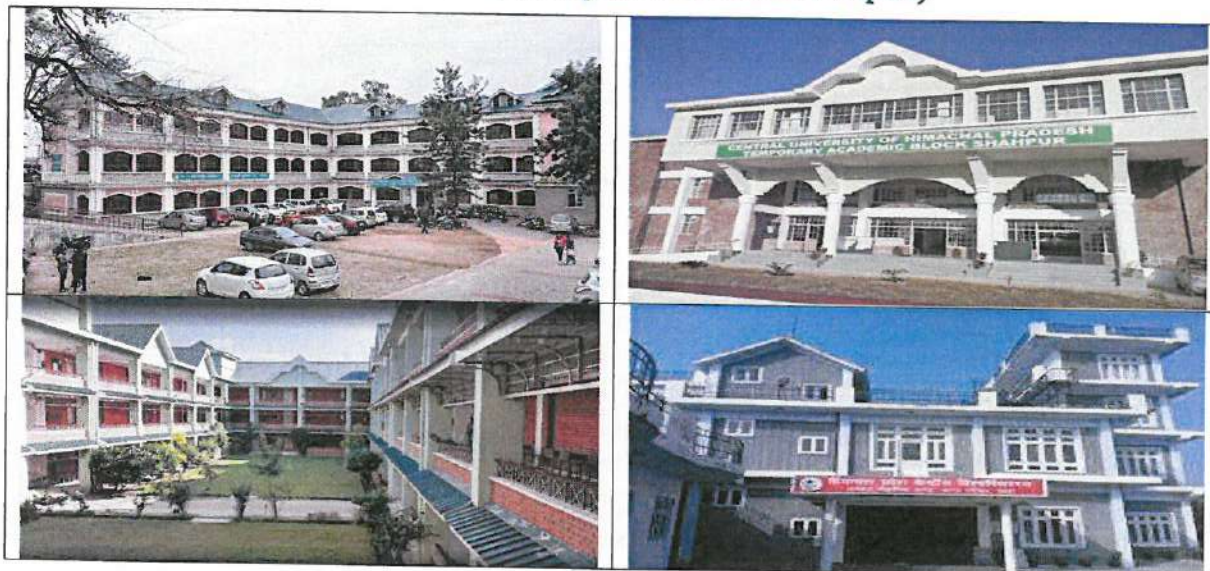
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Green Audit (Environment, Energy and Green Campus Management)
Report
for



Central University of Himachal Pradesh
(Dharamsala, Shahpur and Dehra Campus)



Prepared & Submitted By



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(September 2022)



Green Audit (Environment, Energy and Green Campus Management) Report
Central University of Himachal Pradesh
(Dharamsala, Shahpur & Dehra Campus)



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Executive Summery



Executive Summary

A Nation's growth starts from its educational institutions, where the ecology is thought as a prime factor of development associated with environment. A clean and healthy environment aids effective learning and provides a conducive learning environment. Educational institutions now a day are becoming more sensitive to environmental factors and more concepts are being introduced to make them eco-friendly.

To preserve the environment within the campus, various viewpoints are applied by the several educational institutes to solve their environmental problems such as promotion of the energy savings, recycle of waste, water reduction, water harvesting etc. The activities pursued by institutes can also create a variety of adverse environmental impacts. To protect such situation Energy Audit, Green Audit and Environment Audit are required to be conducted in these institutions. Energy Audit pave the way to save energy consequently reducing Carbon Emissions. Environmental auditing is a process whereby an organization's environmental performance is tested against its environmental policies and objectives. Green audit is defined as an official examination of the effects a institute has on the environment. It must also be under stood that Energy Audit, Green Audit and Environment Audit are inter related to each other. If you save Energy, it will save Environment. If you save trees or plant trees, it will save Environment and energy. If you clean Environment, it will save human life and save energy.

Eco campus is a concept implemented in many educational institutions, all over the world to make them sustainable because of their mass resource utilization and waste discharge in to the environment. Waste minimization plans for the educational institute are now mandatory to maintain the cleanliness of the campus. To find out the environmental performance of the educational institutions and to analyze the possible solutions for converting the educational campus as eco-campus the conduction of Green Auditing of institution is essential.

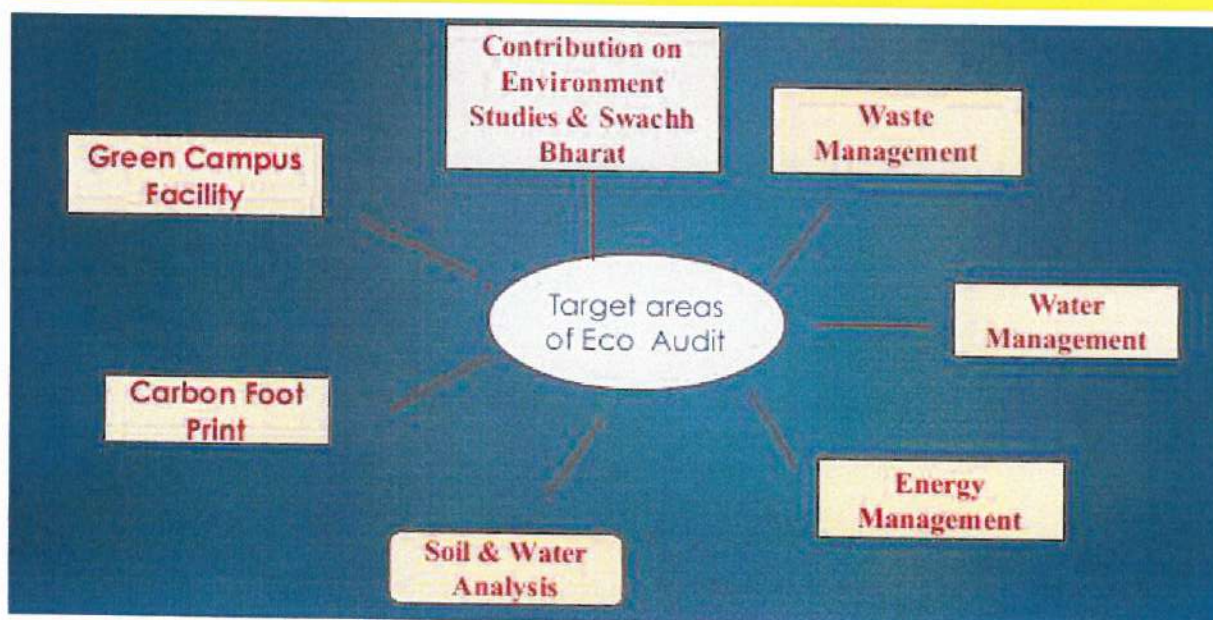
The green auditing of Central University, Himachal Pradesh enables to assess the life style, action and its impact on the environment. This is the first attempt to conduct Environment, Energy and green auditing of this campus. This audit was mainly focused on greening indicators like consumption of energy in terms of electricity and fossil fuel, quality of soil and water, vegetation, waste management practices and carbon foot print of the campus etc. Initially a questionnaire survey was conducted to know about the existing resources of the campus and resource consumption pattern of the students and staffs in the campus. In order to assess the environmental quality, the samples were collected from different locations of the university

campus and analyzed for applicable parameters. Finally, a report pertaining environmental management plan with strength, weakness and suggestion on the environmental issue of campus are documented.

Green Audit can be defined as systematic identification, quantification, recording, reporting and analysis of components of environmental diversity. The 'Green Audit' aims to analyze the environmental practices within and outside the institutional campus, which will have an impact on the eco-friendly ambience. It was initiated with the motive of inspecting the work conducted within the organizations whose exercises can cause risk to the health of inhabitants and the environment. Through Green Audit, one gets a direction as how to improve the condition of environment and there are various factors that have determined the growth of carrying out Green Audit. Green audit is assigned to the criteria 7 of NAAC, National Assessment and Accreditation Council which is a self-governing organization of India which declares the institutions as Grade A, B or C according to the scores assigned during the accreditation.

Thus it is imperative that the Central University of Himachal Pradesh evaluate its own contributions toward a sustainable future. As environmental sustainability is becoming an increasingly important issue for the nation, the role of higher educational institutions in relation to environmental sustainability is more prevalent.

Component of Audit





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About Central University of Himachal Pradesh



About Central University of Himachal Pradesh

The Prime Minister, in his address to the nation on August 15, 2007, announced the establishment of a Central University in each of the states that did not have a central university so far. Subsequently, 11th Plan provided for the establishment of 16 new Central Universities. Accordingly, the Central Universities Act 2009 (No. 25 of 2009) which received Presidential assent on 20th March 2009 provided for the establishment of Central University of Himachal Pradesh amongst others. The Central University of Himachal Pradesh is established under the Central Universities Act 2009 (No. 25 of 2009) enacted by the Parliament. The University is funded and regulated by the University Grants Commission (UGC). The University became functional with the assumption of charge by the first Vice Chancellor on 20th January 2010.

Location of the University

Headquarters of the University

The Headquarter of the University is located in Dharamshala, District Kangra, Himachal Pradesh. Dharamshala is a place with profile and is known worldwide. Serene Location, pleasant climatic condition, spiritual atmosphere of the location provides an attractive ambience conducive to academic pursuits.

Permanent Campuses

The University will have two distinct campuses located in Dharamshala and Dehra, both the Kangra District of Himachal Pradesh, as under

- **Beas Campus:** Located in Dehra, it will have such Schools/Departments/Centres as may be decided by the University and may have infrastructure for about 70 percent of the academic activities of the University.
- **Dhauladhar Campus:** Located in Dharamshala, it will have such Schools/ Departments/ Centres as may be decided by the University and may have infrastructure for about 30 percent of the academic activities of the University.

The Land for both the Campuses of the University, has already been identified and the proposal for clearance under the Forest Conservation Act (FCA), as approved by the Government of Himachal Pradesh, has a

ready been submitted to the Ministry of Environment & Forest, Government of India. Development and Construction of the Permanent Campuses shall commence as soon as the FCA Clearance is received and the land is formally transferred to the University. Temporary campuses Pending the development of its own infrastructure and permanent



campuses, the University is presently operating from its Temporary Campuses comprising the following facilities:

Camp Office

The Camp Offices, which presently serves as the Headquarter of the University is located in the Sanskriti Sadan (Writers' Home), at Dharamshala (Near International Cricket Stadium), District Kangra. The Offices of the Vice Chancellor, Registrar and Finance Officer are located in the Camp Office.

Students Support Facilities

Transport Facilities

The University has arranged transport facilities, on nominal charge, to ferry students of the University from Dharamsala and Kangra to the Temporary Academic Blocks at Shahpur & Dharamsala. Students residing in the hostels of the University are also covered by the transport facility from hostels to Temporary Academic Blocks at Shahpur & Dharamsala.

Health Care Facilities

The healthcare facilities are being provided through Government Hospitals and Government Medical College, Tanda to cater to elementary and emergency medical care of the students, faculty and staff. A regular Nurse with first-aid facilities has been stationed at Temporary Academic Block of University.

Halls of Residence

Men's Hostel: The University has hired a furnished building for Men's Hostel at Kangra. It is equipped with modern facilities having a capacity of accommodating about 110 students. The building is located in a beautiful and serene environment which is ideal for pursuing serious studies and research activities. The hostel has become functional from January 7, 2012. The facilities for both indoor and outdoor games like table tennis, badminton and volleyball, and a fully equipped gymnasium are being developed. It also has internet facility. The students run the mess of the hostel on cooperative basis having liberty to decide menu of their own choice. The University provides transport facility from hostel to Temporary Academic Blocks at Shahpur & Dharamsala. The inmates of the hostel are required to abide by the hostel rules.

Women's Hostel: The University has hired a furnished building for Women's Hostel at well-located place of Dharamsala. The facility may accommodate about 60 women students of the



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University. The University has arranged transport facility for the residents to commute between the Hostel and the Temporary Academic Blocks at Shahpur & Dharamsala.

Games & Sports Facilities

The official inauguration of the Sports Club of the Central University of Himachal Pradesh was done in November, 2012 by the Vice-Chancellor. The Sports Club is having facilities of both indoor & outdoor games including Badminton, Volleyball, Table-Tennis, Chess and Carom.



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About Green Audit



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About Green Audit

Climate change and its impact, has brought into focus the need for environmental protection as a global agenda. It has emerged as the pillar for sustainable development of the world. The UN Sustainable Development Goals (SDG's) are an important step in ensuring nation's responsiveness towards environmental protection. The Legal and the policy framework of the country have incorporated many environmental measures, involving all stakeholders in the mission. In this context, the Educational Institution has been responsible and responsive in implementing green practices, such as green plantation, Rain water harvesting structures, Solid waste management, E-Waste Management, solar powered campus, Energy conservation etc.

Green Audit can be defined as systematic identification, quantification, recording, reporting and analysis of components of environmental diversity. The 'Green Audit' aims to analyze the environmental practices within and outside the institutional campus, which will have an impact on the eco-friendly ambience. It was initiated with the motive of inspecting the work conducted within the organizations whose exercises can cause risk to the health of inhabitants and the environment.

Through Green Audit, one gets a direction as how to improve the condition of environment and there are various factors that have determined the growth of carrying out Green Audit.

Green audit is assigned to the criteria 7 of NAAC, National Assessment and Accreditation Council which is a self-governing organization of India which declares the institutions as Grade A, B or C according to the scores assigned during the accreditation.

Thus it is imperative that the Central University of Himachal Pradesh evaluate its own contributions toward a sustainable future. As environmental sustainability is becoming an increasingly important issue for the nation, the role of higher educational institutions in relation to environmental sustainability is more prevalent.

Scope and Goals of Green Audit

A clean and healthy environment aids effective learning and provides a conducive learning environment. There are various efforts around the world to address environmental education issues. Green Audit is the most efficient and ecological way to manage environmental problems. It is a kind of professional care which is the responsibility of each individual who are the part of economic, financial, social, environmental factor. It is necessary to conduct green audit in institute campus because students become aware of the green audit, its advantages to save the



planet and they become good citizen of our country. Thus Green audit becomes necessary at the institute level. Green audit can be a useful tool for a college to determine how and where they are using the most energy or water or resources; the college 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. Green auditing and the implementation of mitigation measures is a win-win situation for all the college, the learners and the planet. It can also create health consciousness and promote environmental awareness, values and ethics. It provides staff and students better understanding of Green impact on campus. Green auditing promotes financial savings through reduction of resource use. It gives an opportunity for the development of ownership, personal and social responsibility for the students and teachers.

Objectives of Green Audit

The main aim objectives of this green audit is to assess the environmental quality and the management strategies being implemented in University. The specific objectives are:

- To assess the quality of the water and soil in University
- To monitor the energy consumption pattern of the institute
- To quantify the liquid and solid waste generation and management plans in the campus.
- To assess the carbon foot print of the campus
- To assess whether the measures implemented by the University have helped to reduce the Carbon Footprint.
- To impart environment management plans of University
- Providing a database for corrective actions and future plans.
- To assess whether extracurricular activities of the Institution support the collection, recovery, reuse and recycling of solid wastes.
- To identify the gap areas and suggest recommendations to improve the Green Campus the institute.

Benefits of Green Auditing

- More efficient resource management
- To provide basis for improved sustainability
- To create a green campus



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- To enable waste management through reduction of waste generation, solid-waste and water recycling
- To create plastic free campus and evolve health consciousness among the stakeholders
- Recognize the cost saving methods through waste minimizing and managing
- Authenticate conformity with the implemented laws
- Empower the organizations to frame a better environmental performance
- Enhance the alertness for environmental guidelines and duties
- Impart environmental education through systematic environmental management approach and Improving environmental standards
- Benchmarking for environmental protection initiatives
- Financial savings through a reduction in resource use
- Development of ownership, personal and social responsibility for the Institute and its environment
- Green audit is important criteria of NAAC (National Assessment and Accreditation Council) to get the institution as Grade A, B or C according to the scores assigned during the accreditation.

Target Areas of Green Audit

Green audit forms part of a resource management process. Although they are individual events, the real value of green audit is the fact that they are carried out, at defined intervals, and their results can illustrate improvement or change over time. Eco-campus concept mainly focuses on the efficient use of energy and water; minimize waste generation or pollution and also economic efficiency.

All these indicators are assessed in the process of "Green Auditing of this educational institute". Eco-campus focuses on the reduction of contribution to emissions, procure a cost effective and secure supply of energy, encourage and enhance energy use conservation, promotes personal action, reduce the institute's energy and water consumption, reduce wastes to landfill, and integrate environmental considerations into all contracts and services considered to have significant environmental impacts. Target areas included in this green auditing are

- | | |
|----------------|------------------------------------|
| • Water, | • Environment (Outdoors & Indoors) |
| • Energy, | • Health and Safety |
| • Waste, | • Carbon footprint |
| • Green campus | |

Auditing for Water Management

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. Hence it is essential to examine the quality and usage of water in the institute.

Water auditing is conducted for the evaluation of facilities of raw water intake and determining the facilities for water treatment and reuse. The concerned auditor investigates the relevant method that can be adopted and implemented to balance the demand and supply of water.

Advantage of Water Audit

- Water audits provide decision making tools to utility managers, directors, and operators. i.e., knowing where water is being used in your system allows you to make informed decisions about investing resources such as time, labour and money.
- Water audits allow managers to efficiently reduce water losses in the system.
- Reducing water used at the source may even result in delaying or avoiding capital investments such as a new well, more treatment technology or additional water rights.
- Water audits also identify which water uses are earning revenue for the utility and which water uses are not. Thus, System personnel can increase revenue by institute ensuring all appropriate uses are being accurately measured and billed. This leads to more financial capacity in the water system, reduced cost per customer and better management of the water resource.
- Creating awareness among water users i.e., customers can see and understand that the utility is taking proactive steps to manage wasted water and save for the future.
- It is an effective educational and public relations tool for the water system.

Auditing for Energy Management

Energy conservation is an important aspect of campus sustainability which is also linked with carbon foot print of the campus. Energy auditing deals with the conservation and methods to reduce its consumption related to environmental degradation. It is therefore essential that any environmentally responsible institution examine its energy use practices.

Auditing for Waste Management

Human activities create waste, and it is the way these wastes are handled, stored, collected and disposed of, which can pose risks to the environment and to public health. Pollution from waste

is aesthetically unpleasing and results in large amounts of litter in our communities which can cause health problems. Solid waste can be divided into three categories as bio-degradable, non-biodegradable and hazardous waste. Bio-degradable wastes include food wastes, canteen waste, wastes from toilets etc. Non-biodegradable wastes include what is usually thrown away in homes and schools such as plastic, tins and glass bottles etc. Hazardous waste is waste that is likely to be a threat to health or the environment like cleaning chemicals, acids and petrol. Unscientific management of these wastes such as dumping in pits or burning them may cause harmful discharge of contaminants into soil and water supplies, and produce greenhouse gases contributing to global climate change respectively. Special attention should be given to the handling and management of hazardous waste generated in the institute. Bio-degradable waste can be effectively utilized for energy generation purposes through anaerobic digestion or can be converted to fertilizer by composting technology. Non-biodegradable waste can be utilized through recycling and reuse. Thus the minimization of solid waste is essential to a sustainable institute. The auditor diagnoses the prevailing waste disposal policies and suggests the best way to combat the problems.

Auditing for Green Campus Management

Trees play an important ecological role within the urban environment, as well as support improved public health and provide aesthetic benefits to cities. In one year, a single mature tree will absorb up to 48 pounds of carbon dioxide from the atmosphere, and release it as oxygen. The amount of oxygen released by the trees of the campus is good for the people in the campus. So while you are busy studying and working on earning those good grades, all the trees in campus are also working hard to make the air cleaner for you.

Auditing for Carbon Footprint

Burning of fossil fuels (such as petrol) has an impact on the environment through the emission of greenhouse gases into the atmosphere. The most common greenhouse gases are carbon dioxide, water vapour, methane, nitrous oxide and ozone. Of all the greenhouse gases, carbon dioxide is the most prominent greenhouse gas, comprising 402 ppm of the Earth's atmosphere. The release of carbon dioxide gas into the Earth's atmosphere through human activities is commonly known as carbon emissions. Vehicular emission is the main source of carbon emission in the campus, hence to assess the method of transportation that is practiced in the institute is important.



Methodology for Green Audit



Methodology Adopted for Green Audit

The methodology adopted for this audit has following step process comprising of

Data Collection

In preliminary data collection phase, exhaustive data collection was performed using different tools such as observation, survey communicating with responsible persons and measurements.

Following steps were taken for data collection:

- The team went to each department, centres, Library, canteen etc.
- Data about the general information was collected by observation and interview.
- The power consumption of appliances was recorded by taking an average value in some cases.

Data Analysis

Detailed analysis of data collected include calculation of energy consumption, analysis of latest electricity bill of the campus, understanding the tariff plan provided by Himachal Pradesh Electricity Board. Data related to water usages were also analyzed using appropriate methodology.

Recommendation

On the basis of results of data analysis and observations, some steps for reducing power and water consumption were recommended. Proper treatments for waste were also suggested. Use of fossil fuels has to be reduced for the sake of community health.

The above target areas particular to the institute was evaluated through questionnaire circulated among the students for data collection. Five categories of questionnaires were distributed.

Onsite Visit

Two-days site visit was conducted by the Experts of Green Audit Team of Eco Laboratory on 30th to 31st August 2022. The key focus of the visit was on assessing the status of the green cover of the Institution, their waste management practices and energy conservation strategies etc. The sample collection was carried out during the visits to assess the quality of environment. The samples air, noise, drinking water and indoor environment were taken from university campus. The sample collection, preservation, and analysis were done in the scientific manner as prescribed by the standard procedures.

Focus Group Discussion

The Focus Group discussions were held with the Club members, staff members and the management focusing various aspects of Green Audit. The discussion was focused on identifying the attitudes and awareness towards environmental issues at the institutional and local level.

Energy, waste management and Carbon foot print analysis Survey

With the help of teachers and students, the audit team has assessed the energy consumption pattern and waste generation, disposal and treatment facilities of the institute. The monitoring was conducted with a detailed questionnaire survey method.

Process for Environmental Audit



Fig.: Process adopted for Environmental Audit



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Auditing for Water Resource Management

Auditing for Water Resource Management

Water Audit Process



Fig.: Process adopted for Auditing of Water Resource Management

Source of Water

The institute is getting all required water from Jal Prabandhan Nigam Ltd. which is chargeable on monthly basis.

Baseline of Water Consumption

- In India, the design of water supply systems has been done using certain standards. Currently the standard being used is NBC, 2016. This specifies a consideration of use of the following:
- For communities with a population of between 20,000 to 100,000 @ 100 to 135 liters per head per day (Max. 135 lpcd has been considered).
- Persons working in normal working hours i.e. Staff @ 45 liters per head per day
- Visitors in the institute @ 15 liters per head per day

Population of Central University

The details of Persons coming in Day time are as per Table.

Day Time population in the Institute

Sl. No	Particulars	Nos
1	Students enrolled in University Campus	2079
2	Teaching Staff in University Campus	123
3	Non-Teaching Staff in University Campus	53
4	Daily visitors in University Campus	100
Total Daytime population		2355

The details of the residents living in Hostels (Hired buildings) outside the Campus are as per below Table.

Nos. of residents living in Hostels (Hired buildings) outside campus

Sl. No	Particulars	Nos
1	Nos. of residing Students	170
2	No of residing Staff	50
Total Residents Population		220

Thus total maximum permissible water Consumption as per Standards laid as per NBC, 2016 is given in below Table.

Total permissible water Consumption as per Standards laid as per NBC, 2016

Sl. No.	Particulars	Nos.	Maximum water consumption per Person per day (Liters)	Total Maximum water consumption Liters per Day
1	No. of Day time Population in campus	2255	45	1,01,475
2	No. of Visitors in campus	100	15	1,500
3	Nos. of residing population in hostels	220	135	29,700
Grand Total				1,32,675

An attempt was made as per NBC, 2016 to understand the demand of water supply and waste water generated.

- Actual Water Demand = 1,32,675 liters per day
- Waste Water Generation = 80% of total water consumption = 1,06,140 liters per day

The source of water requirement is municipal supply water and the wastewater generated as 1,06,140 liters per day is being discharged to municipal drainage.

The institute has no sewage treatment facility, hence recommended to install sewage and effluent treatment plants to treat the daily wastewater generated based on zero liquid discharge so that management and conservation of water resource can be done at institute level.

Rainwater Harvesting

Rainwater harvesting is the accumulation and deposition of rainwater for reuse on-site, rather than allowing it to run off. Rainwater can be collected from roofs, and in many places the water collected is redirected to a deep pit (well, shaft, or borehole), a reservoir with percolation. Its uses include water for gardens, livestock, irrigation, domestic use with proper treatment etc.

The harvested water can also be used as drinking water, longer-term storage and for other purposes such as groundwater recharge.

Rainwater harvesting provides an independent water supply during regional water restrictions and in developed countries is often used to supplement the main supply. It provides water when there is a drought, can help mitigate flooding of low-lying areas, and reduces demand on wells which may enable groundwater levels to be sustained. It also helps in the availability of potable water as rainwater is substantially free of salinity and other salts. Application of rainwater harvesting in urban water system provides a substantial benefit for both water supply and wastewater subsystems by reducing the need for clean water in water distribution system, less generated storm water in sewer system, as well as a reduction in storm water runoff polluting freshwater bodies. Supplying rainwater that has gone through preliminary filtration measures for non-potable water uses, such as toilet flushing, irrigation, and laundry, may be a significant part of a sustainable water management strategy.

Though the institute has no rainwater harvesting system adopted at any campus and hotel buildings.

Recommendations

- The institute does not have waste/ effluent water treatment plant for management of waste water generated from laboratories, canteen and laundries. Waste/effluent water goes to drains.
- The institute does not have Sewage treatment plant for management of waste water generated from bathrooms and toilets. Sewage waste goes to municipal sewerage system.
- Separate STP and ETP plants need to be installed for water resource conservation and management.
- Display boards for water conservation and don't misuse of water are lacking.
- Lacking of water consumption monitoring system in the campus.
- Automatic switching system is not installed for pump sets used for overhead tank filling.
- Lacking of flushing and dual plumbing line systems to save the water resources.
- Rain Water Harvesting System need to be installed at each Building/ Block wise.
- Water quality in terms of drinking and domestic water and effluent discharges need to be checked periodically by NABL and MoEF&CC approved laboratory.



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Auditing for Waste Management

Auditing for Waste Management

Pollution from waste is aesthetically unpleasing and results in large amounts of litter in our communities which can cause health problems. Plastic bags and discarded ropes and strings can be very dangerous to birds and other animals. This indicator addresses waste production and disposal, plastic waste, paper waste, food waste, and recycling. Solid waste can be divided into two categories: general waste and hazardous waste. General wastes include what is usually thrown away in homes and schools such as garbage, paper, tins and glass bottles. Hazardous waste is waste that is likely to be a threat to health or the environment like cleaning chemicals and petrol. Unscientific landfills may contain harmful contaminants that leach into soil and water supplies, and produce greenhouse gases contributing to global climate change. Furthermore, solid waste often includes wasted material resources that could otherwise be channeled into better service through recycling, repair, and reuse. Thus the minimization of solid waste is essential to a sustainable institute. The auditor diagnoses the prevailing waste disposal policies and suggests the best way to combat the problems. It is therefore essential that any environmentally responsible institution examine its waste processing practices.

Quantity of Waste Generated

No data could be provided by the Institute regarding the quantity of waste (Biodegradable, Non-biodegradable and E Waste) generated in the Institute.

Generation of Solid Waste

Generation of Solid Waste

Sl. No.	Particulars	Nos.	Rate of solid waste generation (kg per person per day)	Total solid waste generation (kg/day)
1	No. of Day time Population in campus	2255	0.2	451
2	No. of Visitors in campus	100	0.2	20
3	Nos. of residing population in hostels	220	0.4	88
Grand Total				559

Disposal of Solid Waste generated

(A) Biodegradable Canteen waste

It was shared by the authorities that Canteen waste is being disposed to local Cattle Keepers to feed the waste to their animals.

Leaves and others:

Leaves and other wastes are collected by Municipal council.

Authorities are advised to collect, segregate and dispose the biodegradable waste in manure pits and resulting manure can be utilized in garden and plantation areas in the institute.

(B) Non-biodegradable

This type of waste including metals, bottles, plastics, cans, broken glass wares, tins etc., are collected by Municipal council. Authorities are advised to dispose the Non-biodegradable waste to only Government authorized Venders only and keep proper accounting.

(C) E-Waste

E Waste is collected and disposed by Municipal council. Authorities are advised to dispose the E Waste to only Government authorized Venders only and keep proper accounting.

Solid Waste Management System

No specific data could be provided by the institute regarding the quantity of solid wastes generated in the campus however the solid waste is collected by Municipal council.

At Dehra campus, waste material is deposited in pits located on back side of the campus so as to get it decomposed and later it can be used as manure.





Recommendations

- Solid waste management systems established are insufficient.
- Waste bins in the class rooms, veranda, canteen and campus are inadequate.
- The institute should have proper communication with the local body for regular collection of solid waste from the campus apart from biodegradable waste.
- Bio degradable waste is to be managed in-house by use of mechanical composter and manure generated can be utilized in gardening purposes within the Institute.
- Implementation of sustainable projects to attain set environmental goals is not in place.
- Proper waste segregation and management by recycle and reuse of waste with zero discharge can be adopted to manage resources and prevent environmental degradation.



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Auditing for Environmental Management

Auditing of Environmental Management

As part of green audit of campus, we carried out the environmental monitoring of campus including Illumination and Ventilation of the class room. It was observed that Illumination and Ventilation is adequate considering natural light.

a) Outdoor Environment

Air Quality Index (AQI)

Air Quality Index (AQI) transforms complex air quality data of criteria pollutants into a single number (index value), with nomenclature and colour. AQI was launched on 17 October 2014 in India to disseminate information on air quality in an easily understandable form for the general public. AQI has six categories of air quality which are defined as Good, Satisfactory, Moderately Polluted, Poor, Very Poor and Severe. AQI is considered as 'One Number- One Colour-One Description' for the common man to judge the air quality within his vicinity. The formulation of the index was an initiative under **Swachh Bharat Mission (cleanliness Mission)**, based on the recommendations of IIT Kanpur and the Expert Group formed in this regard. The earlier measuring index in this regard was limited to three indicators, while the current measurement index had been expanded with five additional parameters. The measurement of AQI is based on following pollutants, namely

- Particulate Matter (size less than 10 μm) or (PM_{10}),
- Particulate Matter (size less than 2.5 μm) or ($\text{PM}_{2.5}$),
- Nitrogen Dioxide (NO_2),
- Sulphur Dioxide (SO_2),
- Carbon Monoxide (CO),
- Ozone (O_3) and
- Ammonia (NH_3),

AQI Index values and their associated health impacts

AQI	Associated Health Impacts
Good (0-50)	Minimal Impact
Satisfactory (51-100)	May cause minor breathing discomfort to sensitive people.
Moderately polluted (101-200)	May cause breathing discomfort to people with lung disease such as asthma, and discomfort to people with heart disease, children and older adults.
Poor (201-300)	May cause breathing discomfort to people on prolonged exposure, and discomfort to people with heart disease

Very Poor (301-400)	May cause respiratory illness to the people on prolonged exposure. Effect may be more pronounced in people with lung and heart diseases.
Severe (401-500)	May cause respiratory impact even on healthy people, and serious health impacts on people with lung/heart disease. The health impacts may be experienced even during light physical activity.

Methodology of AQI

The ambient air quality has been assessed through scientifically designed ambient air quality monitoring network. The monitoring network was designed based on the following considerations:

- Meteorological conditions
- Topography
- Likely impacts and sensitive receptors

Ambient air quality monitoring network was established as per CPCB guidelines in triangular method @120-degree orientation of three sampling locations. Ambient air quality monitoring was done on 24 hourly bases at each of identified air quality locations simultaneously for a day on 20th March 2020.

Parameters & Methods of Air Quality Monitoring

Test methods for determining Various Air Quality Parameters are described in below **Table** as

Test methods for determination of Air Quality Parameters

S. No.	Test Parameter	Test Method
1.	Particulate Matter (PM ₁₀)	IS:5182 (P-23) 2006 RA 2017
2.	Particulate Matter (PM _{2.5})	Lab SOP EL/SOP/AAQ/01
3.	Sulphur Dioxide (SO ₂)	IS:5182 (P-2) 2001 RA 2017
4.	Nitrogen Dioxide (NO ₂)	IS:5182 (P-6) 2006 RA 2017
5.	Ammonia (NH ₃)	Lab SOP EL/SOP/AAQ/02
6.	Ozone (O ₃)	IS:5182 (P-9):2006 RA 2014
7.	Carbon Monoxide (CO)	IS 5182 Part-10:1999, RA 2014

Sampling Procedure

Particulate samples for PM₁₀ were collected on Whatman glass fiber filters using respirable dust sampler (AAS 217NL, Ecotech) whereas samples for PM_{2.5} were collected on Whatman Quartz filter papers (47 mm diameter) using fine particulate sampler (AAS 127Mini, Ecotech). During sampling a laminar flow was maintained as 16.7 liters per min (1.0 m³ per hr) for PM_{2.5} and 1.13 m³ per minute for PM₁₀. The air sampling was done on 24 hourly basis at a nominal sampling height of 3 meter at each location. Gaseous sampling was done using Thermoelectrically cooled Gas sampler (AAS 109TE, Ecotech) whereas CO was collected in tedler bag for the analysis by NDIR CO Analyzer (APMA-370, Horiba) and Benzene was collected in activated carbon absorber tubes for GC analysis.

Construction of Air Quality Index (AQI)

- Based on the measured ambient air concentrations, corresponding standards and likely health impact (known as health breakpoints), a sub-index is calculated for each of the pollutants.
- A sub-index is a linear function of concentration e.g. the sub-index for PM_{2.5} will be
 - ✚ 51 at concentration 31 µg/m³,
 - ✚ 100 at concentration 60 µg/m³, and
 - ✚ 75 at concentration of 45 µg/m³
- The formula for calculating a sub-index is as follows:

Sub Index for a pollutant = Upper limit of the previous AQI category to which the pollutant's current reading would have fallen + [(current reading - upper limit of the previous reading category of the pollutant) * (width or interval of the AQI category for the current level of reading / width or interval of the current reading category of the pollutant)]

Eg. Sub-index for PM_{2.5}

If concentration is 150 µg/m³, the sub index would be = $300 + [(150 - 120) * 100 / 130] = 323$

If concentration is 45 µg/m³, the sub index would be = $30 + [(45 - 30) * 50 / 30] = 75$

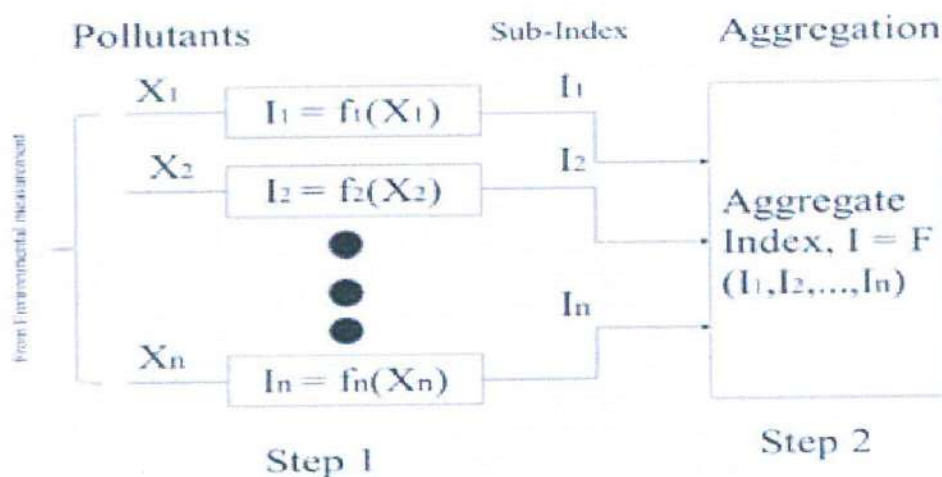


Fig. 7: Index and Sub-index of Pollutants

- Primarily two steps are involved in formulating an AQI: (i) formation of sub-indices (for each pollutant) and (ii) aggregation of sub-indices to get an overall AQI.
- Formation of sub-indices (I_1, I_2, \dots, I_n) for n pollutant variables (X_1, X_2, \dots, X_n) is carried out using sub-index functions that are based on air quality standards and health effects. Mathematically;

$$I = f(X_i), i=1, 2, \dots, n \quad [\text{Eq. 1}]$$

- Each sub-index represents a relationship between pollutant concentrations and health effect as the functional relationship between sub-index value (I_i) and pollutant concentrations (X_i).
- Aggregation of sub-indices, I_i is carried out with some mathematical function (described below) to obtain the overall index (I), referred to as AQI.

$$I = F(I_1, I_2, \dots, I_n) \quad [\text{Eq. 2}]$$

- The aggregation function usually is a summation or multiplication operation or simply a maximum operator.

Sub-indices (Step 1)

- Sub-index function represents the relationship between pollutant concentration X_i and corresponding sub index I_i . It is an attempt to reflect environmental consequences as the concentration of specific pollutant changes. It may take a variety of forms such as linear, non-linear and segmented linear. Typically, the I - X relationship is represented as follows:

$$I = aX + \beta \quad [\text{Eq. 3}]$$

Where, a = slope of the line, β = intercept at $X=0$

- The general equation for the sub-index (I_i) for a given pollutant concentration (C_p); as based on 'linear segmented principle' is calculated as:

$$I_i = \{[(I_{HI}-I_{LO})/(B_{HI}-B_{LO})]*(C_p-B_{LO})\}+I_{LO} \quad [\text{Eq. 4}]$$

Where,

B_{HI} = Breakpoint concentration greater or equal to given concentration.

B_{LO} = Breakpoint concentration smaller or equal to given concentration.

I_{HI} = AQI value corresponding to B_{HI}

I_{LO} = AQI value corresponding to B_{LO}

I_p = Pollutant concentration

Aggregation of Sub-indices (Step 2)

- Once the sub-indices are formed, they are combined or aggregated in a simple additive form or weighted additive form:

Weighted Additive Form

$$I = \text{Aggregated Index} = \sum W_i I_i \quad (\text{For } i = 1, \dots, n) \quad [\text{Eq. 5}]$$

where,

$$\sum W_i = 1$$

I_i = sub-index for pollutant i

n = number of pollutant variables

W_i = weightage of the pollutant

Root-Sum-Power Form (non-linear aggregation form)

$$I = \text{Aggregated Index} = [\sum I_i^p]^{(1/p)} \quad [\text{Eq. 6}]$$

where,

p is the positive real number >1

Root-Mean-Square Form

- $I = \text{Aggregated Index} = \{1/k (I_1^2 + I_2^2 + \dots + I_k^2)\}^{0.5}$ [Eq. 7]
- Finally; $AQI = \text{Max} (I_p)$ (where; $p = 1, 2, \dots, n$; denotes n pollutants)
- The AQI values and corresponding ambient concentrations (health breakpoints) for the identified eight pollutants are as follows:

AQI Category, Pollutants and Health Breakpoints

AQI Category (Range)	Categories for various readings of pollutant based on health breakpoints/health impacts						
	PM ₁₀	PM _{2.5}	NO ₂	O ₃	CO	SO ₂	NH ₃
	24-hr	24-hr	24-hr	8-hr	8-hr	24-hr	24-hr
Good (0-50)	0-50	0-30	0-40	0-50	0-1.0	0-40	0-200
Satisfactory (51-100)	51-100	31-60	41-80	51-100	1.1-2.0	41-80	201-400
Moderately polluted (101-200)	101-250	61-90	81-180	101-168	2.1-10	81-380	401-800
Poor (201-300)	251-350	91-120	181-280	169-208	10-17	381-800	801-1200
Very poor (301-400)	351-430	121-250	281-400	209-748*	17-34	801-1600	1200-1800
Severe (401-500)	430+	250+	400+	748+*	34+	1600+	1800+

***One hourly monitoring (for mathematical calculations only)**

Calculator for Air Quality Index (AQI)

- For manual monitoring stations, an AQI calculator is developed by CPCB wherein data can be fed manually to get AQI value.
- The excel sheet for calculating AQI, as uploaded by CPCB

Interpretation of Air Quality Index (AQI)

- The worst sub-index reflects overall AQI

For instance, if the sub index of PM_{2.5} = 75, SO₂ = 63, NO₂ = 38 then the AQI will be 75 which is the same as the value of the sub index of PM_{2.5}.

- The Sub-indices for individual pollutants at a monitoring location are calculated using
 - ✓ 24-hourly average concentration value (8-hourly in case of CO and O₃)
 - ✓ Health breakpoint concentration range (e.g. AQI at 6 am on a day will incorporate data from 6am on previous day to the current day).
 - ✓ AQI is calculated by eight pollutants however, overall AQI can be calculated with available data for minimum three pollutants out of which one should necessarily be either PM_{2.5} or PM₁₀.
 - ✓ Minimum of 16 hours' data is considered necessary for calculating sub index
 - ✓ AQI index values can vary depending on the time of the day.
 - ✓ AQI reflects the status of the worst pollutant in that city. i.e. higher reading in one city can be due to high concentration of PM whereas in some other city it may be due to SO₂.
 - ✓ If one pollutant out of eight is in the "poor" category, then AQI will be in "poor" category.

For manual monitoring stations, data were fed manually in AQI calculator developed by CPCB to get AQI value. The AQI calculation has been depicted as

Air Quality Index (AQI) Calculator

Air Quality Index (AQI) Calculator					
Date	DD-MM-YYYY	INPUT	Station	NSIT	
Pollutants	Duration	Conc. in µg/m3 (CO in mg/m3)	Sub-Index	Check	AQI
PM ₁₀	24-hr avg	85	85	1	81
PM _{2.5}	24-hr avg	45	75	1	
SO ₂	24-hr avg	11	14	1	
NO ₂	24-hr avg	22	30	1	
CO	max 8-hr	0.43	32	1	
O ₃	max 8-hr	19	19	1	
NH ₃	24-hr avg	24	6	1	
Concentrations of minimum three pollutants are required; one of them should be PM ₁₀ or PM _{2.5} . The check displays "1" when a non-zero value is entered					

Interpretation of Air Quality Index (AQI)

Air Quality Index

Indicators & Categories of Air Quality Index

Good (0-50)
Satisfactory (51-100)
Moderately polluted (101-200)
Poor (201-300)
Very Poor (301-400)
Severe (401-500)

AQI Result

Test Results of Air Quality Index

Air Quality Index	Air Quality Status
81	Satisfactory (51-100)

The Air Quality Index (AQI) is observed as 81 that indicates the ambient air quality is Satisfactory at university campus and safe for human health.

b) Indoor Environment

Indoor environment was monitored for visual comfort, thermal comfort, ventilation and noise levels in each university campus blocks.

Visual and Thermal Comfort

Visual comfort was monitored using Lux monitor and thermal comfort was monitored by Heat stress analyzer for temperature and humidity levels.



Fig.: Photographic view of Indoor Environmental Monitoring

Indoor environment in respect to visual comfort, thermal comfort, noise levels and ventilation was found to be satisfactory in each block of university campus.

Practices for Environmental Management

Department of Social Work, Central University of Himachal Pradesh, Dehra campus has created a proper framework and action plan for improving facilities at Sapt-Sindhu Parisar-II in the areas of sanitation and hygiene, waste management, vermin-compost plant at adopted villages, water management, energy conservation, plantation for green and sustainable environment and conservation of natural resources.

Dehra campus has Adopted Ten Villages Under Unnat Bharat Abhiyan with the motto

- To promote, create awareness and opportunities for Community development and Eco friendly environment.
- Empowering the rural community in terms of socio- economic, cultural transformation and Greenery contributes



The university functionaries are aware of the various environmental issues and the various green measures to be adopted in office as well as in their houses. A course on Environmental Studies is compulsory for all under graduate students. Further, university conducts plantation drives in the campus during Environment Day, 15 August and during other important events in the university. Further, university has also adopted nearby villages for environmental awareness activities, health camps and other community programmes being conducted through their participation.

Plantation drives are regular activities in the campus, and usually in all important occasions, plantation activity is taken up. The department of Social Work at Dehra campus has maintained a adopted garden at Kuru Snot Village in which different ornamental plants have been raised.



3R's (Reduce, Reuse and Recycle)

These three 'R' words are an important part of sustainable Living



Cope-up with the local villagers for Environment Management Activities

- Awareness about innovative smart agriculture and climate resilient agro technologies.
- Facilitate quality raw materials and infrastructure
- Manufacturing Eco-friendly Products



Natural Resource Management

- Constructing / Rejuvenation of Rain Water Harvesting pits and traditional water bodies.
- Activates and recharging dry bore-wells & water tables.

Establishment of Vermi-compost Units to enhance organic Farming at Snot Village



Rain water Harvesting Structure

- Demonstration on Percolation Tanks in Micro Shed for recharging underground water table.
- Maintenance of existed water bodies like Babries, Khatries and community Ponds

Environmental Conservation practices adopted at Dehra campus

- Carpooling by the faculty members to attend any meetings in Dharamsala or any other purposes.
- There has been a common culture of taking double side print outs

- Some limited communications are also done through emails. Even many meetings such as Board of Studies (BoS), Ph.D & Master's Viva-voce were allowed to be conducted through online mode, especially during the COVID period.

इतिहास विभाग द्वारा वर्ष 2021-2022 में अनेक कार्यक्रम पर्यावरण संरक्षण पर्यावरण पर जन चेतना जाग्रति, जल संरक्षण स्वच्छता आदि के लिए आयोजित किये गये है एवं पर्यावरण के प्रति जागरूकता बनाये रखने के लिए विभाग के संकाय सदस्य एवं छात्र-छात्राओं ने जागरूकता अभियान के साथ निम्नलिखित कदम उठाये

1. विश्वविद्यालय परिसर एवं ग्राम सनोट (पोस्ट-देहरा) में वृक्षारोपण कार्यक्रम किया गया जिसमे
 - I. 13 पेड़ (2-अवला, 2-नीम, 2-पीपल, 1-शीसम एवं 3 आम, 1- तुलसी, 2 अलोएवेरा) लगाये गये | ये सभी वृक्ष औषधी के रूप में भी कार्य करते है |
 - II. सजावटी पौधो के रूप में एरिका पाम, पाइन प्लांट, मनी प्लांट के पोधे लगाये गये|
 - III. बागवानी के रूप में 5 पेड़ (गुलाव, गेदा, केल, अशोक आदि के) लगाये गये है |
2. विभाग की ओर से पर्यावरण जागरूकता हेतु रंगोली कार्यक्रम का आयोजन किया गया।
3. विभाग की ओर से जल संरक्षक एवं स्वच्छता बनाये रखने के लिए जागरूकता अभियान देहरा क्षेत्र के झुग्गी झोपडी एरिया में चलाया गया |
4. विभाग के संकाय सदस्य किसी प्रकार की सिंगल यूज प्लास्टिक का प्रयोग नहीं करते है |
5. विभाग में 6 संकाय सदस्य , 22 शोधार्थी एवं 70 छात्र-छात्राये है जो 3 कार एवं 8 मोटर साईकिल का प्रयोग करते है विभाग के छात्र सार्वजनिक हिमाचल प्रदेश बस के माध्यम से एवं पैदल विश्वविद्यालय परिसर आते है
6. परिषर में विभाग की भौगोलिक स्थिति सूर्य प्रकाश के समुख होने के कारण प्रकाश के लिए किसी प्रकार के विजली उपकरण का प्रयोग अति आवश्यक होने पर ही करते है | जिससे बिजली बचाव के रूप में विभाग अपना योगदान देता है।
7. भू एवं जल संरक्षण हेतु झीलों के आस पास पेड़ लगाए गए |
8. विभाग के छात्रों ने पर्यावरण के उपर जन जागरण हेतु रेली व मार्च का आयोजन किया |





*Green Audit (Environment, Energy and Green Campus Management) Report
Central University of Himachal Pradesh
(Dharamsala, Shahpur & Dehra Campus)*



Auditing for Health and Safety

Auditing for Health and Safety

a) Fire Safety



Fig.: Fire Safety Measures in UNIVERSITY

Fire safety appliances were in place in some departments/Sections however few departments/Sections / floors lacking these systems. However, few of them were outdated which need to be refill freshly on immediate basis.

It is recommended to install fire safety measures at each departments/Sections floor wise and building wise. The institute has adopted fire safety measures which has been verified by Directorate of Fire Services Himachal Pradesh as per verification report enclosed.

b) Health Safety



Fig. Health Safety Measures in UNIVERSITY Campus

Health safety measures were reported in place as per requirements in each building/block wise in respect to safe and potable drinking water supply with RO systems. Drinking water sample was tested for the purpose of portability and suitability of water quality. The available water quality was found to be safe for domestic and human consumption. Health community center is operational in campus for primary health checkups and treatments in case of any medical emergency or medical requirements.

c) Traffic & Parking Area



Fig. Management of Traffic in CUvCampus

The campus has lacking designated parking area in place that are not sufficient to manage daily traffic fleet in the campus due to non-availability of concerned space, a common problem in hilly areas. Vehicles were kept here and there on main roads in front of each department that causes nuisance and accidental risks to students, staff and visitors coming to the campus.

Designated parking areas as multistory or multi-parking to be provided to manage daily traffic movement and to avoid nuisance and accidental risks in the campus.

Sanitation, hygiene & meditation under Ribbon club

- Dehra campus organized awareness programmes for better sanitation practices like using the toilet, hand washing, health & hygiene awareness and garbage disposal etc
- Conducted surveys and door-to-door meetings to drive behavioral change with respect to sanitation behaviour
- Created awareness about the benefits of Yoga in our precious life.

Water Conservation Sensitization Programme

A sensitization programme was organized by the of Department of Sociology and Social Anthropology under 'Swatch Bharat Abhiyan' on 1st Sept. 2019. The Programme aimed at creating awareness among the students of Government School Lanjhani, at village Lanjani, Dharamshala (HP), regarding the need to conserve water and prevent its contamination by human beings. In the programme a skit was performed by students of Department of Sociology and Social Anthropology to portray the difficulties faced on shortage of drinking water, followed by rural-urban clashes and inter-community clashes over water sources and their utilizations. During the sensitization programme, the poems were also recited by the students and they also shared their lived experiences regarded water fetching and conservation. Students of school enthusiastically attended and participated in the programme and took oath to save and conserve water at their personal fronts in their lives.







Green Audit (Environment, Energy and Green Campus Management) Report
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(Dharamsala, Shahpur & Dehra Campus)



Auditing for Green Campus Management

Auditing for Green Campus Management

Unfortunately, biodiversity is facing serious threats from habitat loss, pollution, over consumption and invasive species. Species are disappearing at an alarming rate and each loss affects nature's delicate balance and our quality of life. Without this variability in the living world, ecological systems and functions would break down, with detrimental consequences for all forms of life, including human beings. Newly planted and existing trees decrease the amount of carbon dioxide in the atmosphere. Trees play an important ecological role within the urban environment, as well as support improved public health and provide aesthetic benefits to cities. In one year, a single mature tree will absorb up to 48 pounds of carbon dioxide from the atmosphere, and release it as oxygen. The amount of oxygen that a single tree produces is enough to provide one day's supply of oxygen for people. So while you are busy studying and working on earning those good grades, all the trees on campus are also working hard to make the air cleaner for us. Trees on our campus impact our mental health as well; studies have shown that trees greatly reduce stress, which a huge deal is considering many students are under some amount of stress. The University is nestled amidst tall and lush green trees as Deodars, Oats, Pines and Rhododendrons.



Outdoor Plantation



Indoor Plantation



Medicinal use of Plantation



Fruit Plantation

List of plantation to be managed at Dehra campus

- | | |
|----------------------------|----------------------------------|
| 1. तुलसी श्याम (02) | 18. लोंगाट (2) |
| 2. तुलसी राम (01) | 19. निम्बू (5) |
| 3. चन्दन (1) | 20. केले (10) |
| 4. जामुन (2) | 21. तुडा (1) |
| 5. बिल (1) | 22. पीपल (1) |
| 6. भेड़ा (1) | 23. अशोका वृक्ष (3) |
| 7. आहड़ (3) | 24. सिल्वररॉक (5) |
| 8. आमला (2) | 25. मौसमी सब्जियाँ प्रत्येक सीजन |
| 9. अमरुद (3) | 26. शीशम (1) |
| 10. आम (5) | 27. डॉगफ्लोवर (1) |
| 11. नीलकंठी (1) | 28. गुलाब (2) |
| 12. सागवान (2) | 29. खेर (5) |
| 13. गन्दला कड़ी पत्ता (10) | 30. बसुन्ति (1) |
| 14. संतरा (5) | 31. इलायची (1) |
| 15. मौसमी (5) | 32. रातरानी (1) |
| 16. दालचीनी (1) | 33. अम्ब्रेलाट्री (1) |
| 17. नीम (3) | 34. शहतूत (5) |

Tree plantation program at Dehra Campus



Tree plantation and distribution program organized by Dehra Campus

Activities for Greenery

A few activities were planned and implemented based on the 3R's Reduce, Reuse and Recycle.

- To fulfil the Institution's responsibility towards reducing carbon footprint. Use both side paper for prints and contribute to environmental protection.
- The Department of Social Work promote Environmental Consciousness and Responsibility among students.
- To implement green practices consistently and effectively towards creating a sustainable at Sapt Sindhu Dehra Parisar-II at CUHP.
- To monitor and evaluate the Green practices, towards building a sustainable campus
- To generate innovative green practices, promoting the spirit of eco-innovation among students and scholars specially at adopted villages.
- Interaction with selected Panchayat, representatives, Anganwadi & ASHA workers for Reduce-Reduce



Green belt with sufficient tree cover is managed by the campus but following short coming were observed for effectiveness of the management of plant biodiversity in the campus as

- Tagging on plants with nomenclature (Botanical / general name and species) is lacking for effective plant management practices.
- Plant counting and numbering record is not managed for the effective plant management program at campus.

Medicinal plants at Dehra Campus

The plants play a critical role in the development of human cultures around the whole world. Consequently, the use of medicinal plants is well encouraged around the Dehra campus of Central University of Himachal Pradesh. Consequently, one can see lots of medicinal plants here. Few Medicinal Plants below are mentioned below

1. shyam Tulsi तुलसीश्याम (*Ocimum Tenuiflorum*) (02)
2. Ram Tulsi तुलसीराम (*Ocimum Gratissimum*) (01)
3. Chandan चन्दन (*Santalum Album*) (1)
4. jamun जामुन (*Syzygium Cumini*) (2)
5. बिल/बिल्व, बेल (*Aegle Marmelos*) (1)
6. भेड़ा/बहेड़ा (*Terminalia Bellirica*) (1)
7. आहड़ (*Leptadenia Pyrotechnica*) (3)
8. आमला(आमला) *Phyllanthus Emblica*
9. गन्दलाकड़ीपत्ता(*Murraya koenigii*) (10)
10. दालचीनी Dalchini (*Cinnamomum verum*) (1)
11. नीम Neem (*Azadirachta indica*)
12. निम्बू (*Citrus limon*)(5)
13. तुड़ा (1)
14. खेर (*Senegalia catechu*) (5)
15. बसुन्ति (1)

16. इलायची (Elettaria Cardamomum) (1)

17. शहतूत (Morus Alba)(5)

Ornamental plants at Dehra Campus

1. नीलकंठी (Anagallis Arvensis) (1)
2. सागवान(Tectona Grandis) (2)
3. अशोकावृक्ष ((Saraca Asoca) (3)
4. सिल्वररॉक (Grevillea Robusta) (5)
5. शीशम(Dalbergia Sissoo) (1)
6. डॉगफ्लोवर(Dalbergia Sissoo) (1)
7. गुलाब (Rosa Centifolia)(2)
8. रातरानी (Cestrum Nocturnum) (1)
9. अम्ब्रेलाट्री (Schefflera Actinophylla) (1)

House Keeping

Being the part of Swatchha Bharat Abhiyan, the Central University of Himachal Pradesh, Dehra Campus ensures neat and clean environment. Consequently, buildings are kept clean and sanitized on regular basis on all working days.

Recommendations

- All trees in the campus should be named scientifically and numbered with track record
- Make tagging on all plants with nomenclature (Botanical / general name and species) and manage the plant counting and numbering records
- Create automatic drip irrigation system during summer holidays
- Beautify the institute building with maximum use of oxygen generating indoor plants
- Encouraging students and conducting competitions among departments for making the campus green.



*Green Audit (Environment, Energy and Green Campus Management) Report
Central University of Himachal Pradesh
(Dharamsala, Shahpur & Dehra Campus)*



Auditing for Energy Management



Auditing for Energy Management

Energy is one of the major inputs for the economic development of any country. The fundamental goal of energy management is to produce goods and provide services with the least cost and least environmental effect. Also it can be said as “the strategy of adjusting and optimizing energy, using system and procedure so as to reduce energy requirements per unit of output while holding constant or reducing total costs of producing the output from these systems”. The energy audit is key to a systematic approach for decision making in the area of energy management. It attempts to balance the total energy inputs with its use, and serve to identify all the energy streams in a facility.

a) Electrical Energy

Energy resources utilized by all the departments, support services and the administrative buildings in all three campuses of Central University include electricity. Major use of the energy is at office, canteen, hostel and laboratories, for lighting, transportation, cooking and workshop instruments. Electricity is supplied to all three campuses by Himachal Pradesh State Electricity Board. No alternate source of energy as solar and others have not been adopted so far by the institute.

The study encompassed the examination of the existing pattern of energy use in the university campus and identification of areas where energy & monetary savings could be achieved by employingsuitable techno-economic measures.

This report gives the details of observations of the team along with appropriate recommendations and supporting calculations. We hope that the findings of the team will supplement the efforts of the management in bringing the energy consumption of the office to the lowest possible level.

Note: This report is based on the present operating status of the office. The recommendations are based on various operational parameters examined by the team and the information supplied to the team by the management of Central University of Himachal Pradesh.

Assignment was conducted and the following areas have been covered in the study.

- | | |
|-------------------------|--------------------------|
| 1. Electricity Bill | 4. Lights |
| 2. Distribution Network | 5. Air Conditioning Load |
| 3. DG Sets | 6. Solar Power etc. |

The summary of the observations and recommendations evolved out of the energy management study of the university campus building is given below: -

- The Running Maximum Demand (kVA) of the university campus varies from 216 KW to 250KW. The running maximum Demand depends on power factor which also varies from 0.7 to 0.92 and the average monthly P.F. has been calculated and considered as 0.8. Details of the Power Factor is given in the report.
- It is advisable to reduce the sanctioned load of 265 kW with the HPSEBL. This will be helpful in reducing the fixed cost of electricity bills per year as shown under para 1.2 'Sanctioned Demand'. For precaution, a Demand controller can be installed which will help in keeping the maximum running demand within the limit. The payback period will be around 1 month.
- The average monthly power factor is 0.8 which is not good. If the power factor improves to 0.99 or unity, then it will further reduce the fixed cost per year as shown under para 1.3 'Power Factor'. The payback period will be around 2 months.
- Lux level in the classroom was found less. It is advisable to put some more tubes there for better light intensity.

The summary at a glance of the observations and the return on investment has been tabulated below.

Summary of Anticipated Annual Recurring Savings

S.No	Description of the Items	Quantity	Wattages	Total Load
1	Ceiling Fans	250	70	17500
2	Exhaust fans	25	70	1750
3	2x 11-watt CFLs	100	22	2200
4	Air Conditioners hot and cold	40	2000	80000
5	1 x 36 watt Tube Sets	150	36	5400
6	Computer load/laptops	163	350	57050
7	Water coolers	02	2000	4000
8	Heaters	20	1000	20000
Total working Load				187900 Watts (188KW)
Add 15% labs Equipment loads				216KW

Connected load of Shahpur Campus

S.No	Description of the Items	Quantity	Wattages	Total Load
1	Ceiling Fans	103	70	7210
2	Exhaust fans	31	70	2170
3	Single tube lights	116	20	2320
4	Double tube lights	34	40	1360
5	CFL Round light	44	18	792
6	Square Lights	6	10	60
7	Bulk Head	19	9	171
8	Mirror Lights	02	9	18
9	Computer(approx.)	100	350	35000
10	Water cooler	02	2000	4000
11	Heaters	40	1000	40000
TOTAL Working LOAD				93101 Watts
Approximate Working LOAD In KW				93kW

Connected load of the CUHP Dhauladhar, Parisar-II (Dharamshala)

S. No	Description of the Items	Quantity	Wattages	Total Load
1	Ceiling Fans	45	70	3150
2	Exhaust fans	4	70	280
3	Single tube lights	100	36	3600
4	Computer Units	45	350	15750
5	Water Cooler	1	2000	2000
6	Heaters	25	1000	25000
7	AC Units	4	2000	8000
Total Load				57780 Watts
TOAL LOAD In KW				57.78 kW

Connected load of the VC Secretariat

S.NO	Description of the Items	Quantity	Wattages(W)	Connected Load
1	Tube lights	30	20	600 W
2	Fans	14	70	980 W
3	A.C's	10	2500	25000 W
4	Heater	10	2000	20000 W
5	Photocopier	03	1000	3000 W
6	LED ceiling lights	19	15	285 W
7	Exhaust Fans	11	70	770 W
8	Computer System	22	350	7700 W
Load in Watts				58335 W
Total Load in k Watts				58 kW

Connected load of the Dehra Parisar 1

S.NO	Description of the Items	Quantity	Wattages(W)	Connected Load
1	Tube lights	40	20	800 W
2	Fans	31	70	2170 W
3	A.C's	00	2500	00
4	Heater single rod	25	1000	25000 W
5	Photocopier	01	1000	1000W
6	LED ceiling lights	00	15	00W
7	Exhaust Fans	04	70	280 W
8	Computer System	30	350	10500 W
Load in Watts				39750W
Total Load in k Watts				39.7 kW



Status of Energy Consumption by University Campus

General

Central University of Himachal Pradesh Dharamsala and it is established in the year 2010, imparting higher education in the field of Arts & Commerce. It is located in the heart of the capital of Himachal Pradesh.

The University campus admits students from all social milieus and empowers them through intensive mentoring and counselling to face the challenges of life and become responsible and sensitized citizens of the country. CUHP provides a caring and nurturing environment where students come into their own, blossoming into confident young women ready to face the world.

Energy Sources

Electricity is the major energy source of the university campus. Electricity is supplied by HPSEBL, Himachal Pradesh. Diesel oil is being used in the DG sets for in-house generation of electricity during a powercut.

Energy Consumption

For each university campus, the applicable HPSEBL electrical tariff is in two part i.e. a fixed cost (Demand Charges) and unit (kWh) rate. The average monthly unit consumption of the university campus is 13810 kVAh and the average monthly electricity bill amount is around Rs. 442400/- (Aug. 2021 to Aug. 2022). The average monthly unit cost would be around Rs. 19.10/kVAh.

DG Sets

There is one DG set of capacity 82.5 kVA installed in the university campus. There is hardly any power cut so the running hour of DG set is very less or negligible.

Air Conditioning

In the university campus, there are package units of 50 Nos. of 2 TR split units Air-conditioners to maintain a comfortable temperature in the office/ classrooms etc.

Electrical Supply & Billings

Electrical Supply

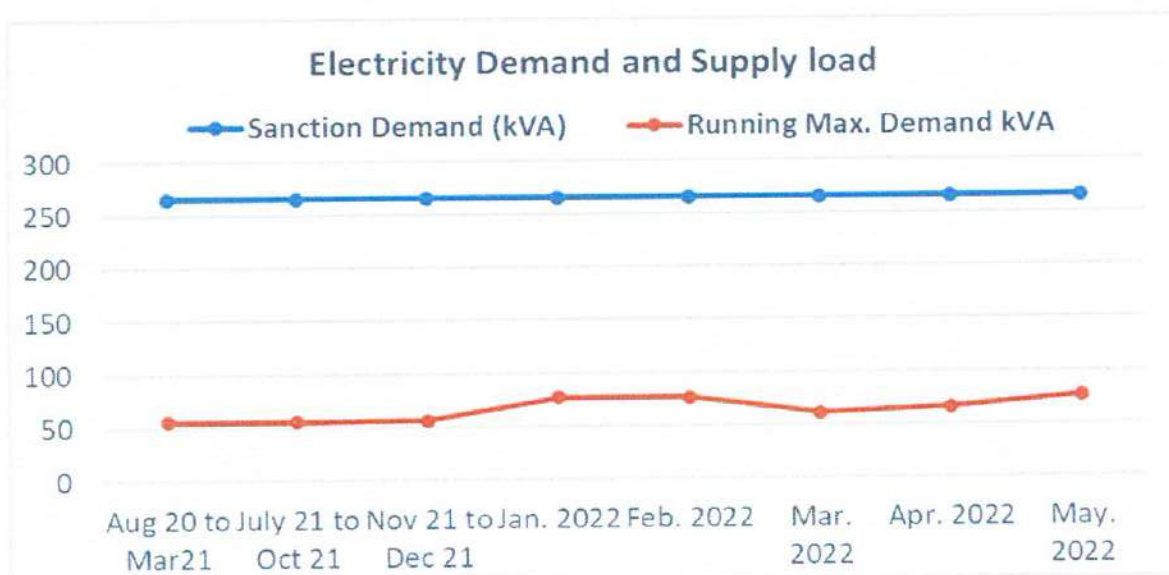
The university campus is getting electrical supplies from HPESBL, Dharamsala. There is one energy meter installed at each of premises.

Sanctioned Demand

The sanctioned demand for the unit is 265.5 KVA from HPESBL, Dharamsala. The sanctioned demand kVA varies every month because of changes of power factor in every month. The recorded running maximum demand of the university campus from the electricity bill is given below:

Months	Sanction Demand (kVA)	Running Max. Demand kVA	Bill Cost (Rs.)	Difference (S.D. - R.M.D.)
Aug 20 to Mar21	265.5	55.4	749611.25	210.1
July 21 to Oct 21	265.5	55.4	32713.35	210.1
Nov 21 to Dec 21	265.5	56	458616	209.5
Jan. 2022	265.5	76.6	442400	188.9
Feb. 2022	265.5	76	57750	189.5
Mar. 2022	265.5	60.6	95889	204.9
Apr. 2022	265.5	65.6	59750	199.9
May. 2022	265.5	76	128850	189.5

Presentation of Electricity Demand and Supply load





The difference between Sanctioned Demand and running maximum Demand (R.D.) varies between 188.9 kVA (151kW) to 210.1 kVA (168kW). It is advisable to reduce the sanctioned Load from 265.5 kW to 170 kW. Running Max. Demand is 76 kVA (61kW), Running Max. Demand should be 100kW. This will yield an annual saving on the electricity bill.

Since the supply is in LT connection. The transformer belongs to the university campus as told by the concerned officer. Then it is advisable to change the electrical supply from LT to HT supply i.e. 11 kV. This will reduce the energy charge by 3% per month which will be a good saving per year. (As per the electrical tariff, Rebate of 3% on the Energy Charges for supply at 11kV).

For the purpose of precaution, a maximum Demand Controller (DC) can be installed at the main LT panel to avoid the maximum demand penalty. In case of the running maximum demand increases, the demand controller will switch off some non-essential load like Air-conditioning load etc. and simultaneously it will also give an alarm for further action.

Use of Electricity during Peak Hour and Off-Peak Hour

The applicable electricity tariff is not based on the timing of the day and may not be applicable in case of domestic LT/ HT type connection. This will also helpful in maintaining the demand graph. It is recommended to avoid the use of electrical gadgets for Heaters, cleaning, watering etc. during peak hours. This type of work should be operational during the off-peak hour.

Testing procedure for capacitor

Good healthy capacitors should deliver 1.3 times amperage in all the three phases compared to its rating in kVAR. Thus, a 10 kVAR capacitor should deliver about 13 amps in each of the three phases. Due to development of internal faults, the capacitors get derated/ damaged in the course of time. A capacitor derated to less than 75% of its rating should be replaced. On the other hand, if there is considerable unbalance between the phases, that can be indication of possible damage of the capacitor and may be removed immediately.

Distribution Network

There is a main electrical panel installed near the DG Set. All the distribution cables are going from the main panel to all the buildings, submersible pump, street light etc. Sub panels are also installed in the buildings. There is a tapping on each floor rising from the main.

During the study, it was observed that the conductor size is good according to ampere load. No any conductor was found over heated or its insulation burnt. Adequate size of conductor is going

to feed the utility area. So, distribution losses are within the limit.

DG SETS

There is a DG set available in the university campus of capacity 82.5 kVA for in house generation of electricity. As the power supply is very good in the area so the running hour of DG set is very less.

It is advisable to put an energy meter on each DG set to conduct the efficiency of DG set. This way, the operator could also note down the unit generation and oil consumed. The operator may record the operating parameters of the sets in the following manner in future.

Start Time	Off Time	Diesel consumption	Unit Generated	Loading			KW Loading	Voltage	KVAh/ lit.
				R	Y	B	R	Y	B

The mechanical details like temperature, lube oil etc. should be in addition to the above. From the above data, the management may calculate the office power supply generated by the DG set in an hour and total diesel consumption. The offices generated per litre of diesel consumed can hence be calculated on an hourly basis. Thereafter, the monthly figures can be calculated in the similar fashion.

It may be noted that the efficiency of the DG set depends largely on the operating load factor. The maximum efficiency of the DG set is available at about 80-85% load factor.

Lights, Air-condition & Solar PV

Lighting

The total lighting (luminary) load of the university campus is about 8 kW which includes Fluorescent tubes 36w/ 40w, LED lights 12w/ 36w etc. LED lights is good from energy efficiency point of view.

LED tube lights are also available in the market, which is also good from energy efficiency point of view. Whenever 36/40w tube gets fuse (not in warranty period) then it could be replaced by 18w/ 9w LED tube. There are 20 Nos. of street lights which are working on solar power with battery. These lights are switched ON in the night with the help of timer.

During study, tube lights were ON in the class room and it was observed that lux level was good (240 – 320) in the class room near to window and low levels (120 – 200) near the entrance door and wall side areas. It is advisable to increase some tube lights in the class room for better lux value.

Air Conditioning Load

In the Unit/ university campus, there are package unit of 50 Nos. of 2 TR split units Air-conditioners to maintain comfort temperature in the Auditorium/ office etc. Package units are installed mainly for the Auditorium.

As the study being done in monsoon season, the Energy efficiency assessment could not be done for the ACs. However, it was observed that some split ACs fitted in the office carries 5 star, which is good from energy efficiency point of view. It is recommended that whenever new split/window ACs are being installed, it should be 5 star rated. Filters of package units were also checked during study which was found clean.

Energy Consumption in star rated split ACs for offices

S. No.	Type of Ac	Rated TR	Star	KW
1	Split	1.5	*	1.91 - 2.1
2	Split	1.5	**	1.75 - 1.9
3	Split	1.5	***	1.65 - 1.74
4	Split	1.5	****	1.55 - 1.64
5	Split	1.5	*****	1.45 - 1.54

It is recommended to use Star rated window ACs which consume power similar to the split AC for each office. Proper cleaning of ACs are very important for its output performance. At least, once in two months cleaning of ACs filter is recommended during the season.

Solar Power Generation

There is a Solar Photovoltaic (SPV) unit for Power Generation with capacity of 48 kW. The SPV is connected with the LT supply with some relay/sensor which keeps sense of electrical supply. When there is an electrical supply, the SPV will generate electricity. As the electrical supply goes off, the SPV will not generate any electricity. SPV will also not generate electricity when there is the electrical supply of DG set.

The best use of SPV is to put all lighting, ceiling fan and exhaust fans load etc. on it. Some intelligent relay/ sensor need to install for better management. The energy meter should also be calibrated by third party once in a year or two years. This way, the SPV will continue supply even there is utility supply available or not and it will also help in saving a substantial amount in the electricity bill. It was also observed that electrical data like daily/ weekly/ monthly units generated by SPV are not recorded in the register or in soft copy.

The SPV system should be installed along with Net metering system. For this, there is a proper format in the concerned HSEB office to install Net metering. Benefits of net metering is given below:

Advantage of Net Metering

Financial benefit for the system owner

Since the system owner is charged for the net energy consumed from the utility grid, the owner gets financial benefits. e.g. If energy generation < energy consumed: owner pays just for the net amount. If energy generation > energy consumed: the owner gets credit for excess generation.

Avoid the use of batteries

In a grid connected solar pv system, any excess energy generated can be fed back to local utility grid and can be taken back at later stage when required. Thus, there is no need to store the surplus energy in batteries for later use, thus, avoiding the heavy costs of batteries. Also, since batteries are eliminated, the maintenance costs of the system also reduce to a great extent. Batteries may be required only when there are frequent power fluctuations/outages.

Produce more today, use it tomorrow

If there is a surplus of power generation than the consumption, the surplus can be fed into grid system and if consumption increases, it can be taken from the grid.

General Energy Conservation Tips

Electricity

- Schedule your operations to maintain a high load factor
- Minimize maximum demand by tripping loads through a demand controller
- Use standby electric generation equipment for on-peak high load periods.
- Correct power factor to at least 0.99 under rated load conditions.

- Set transformer taps to optimum settings.
- Shut off unnecessary computers, printers, and copiers at night.

Motors

- Properly size to the load for optimum efficiency. (High efficiency motors offer of 4 - 5% higher efficiency than standard motors)
- Check alignment.
- Provide proper ventilation (For every 10°C increase in motor operating temperature over recommended peak, the motor life is estimated to be halved)
- Check for under-voltage and over-voltage conditions.
- Balance the three-phase power supply. (An Imbalanced voltage can reduce 3 - 5% in motor input power)
- Demand efficiency restoration after motor rewinding.

Fans

- Use smooth, well-rounded air inlet cones for fan air intakes.
- Avoid poor flow distribution at the fan inlet.
- Minimize fan inlet and outlet obstructions.
- Clean screens, filters and fan blades regularly.
- Use aerofoil shaped fan blades.
- Minimize fan speed.
- Use low-slip or flat belts.
- Check belt tension regularly.
- Eliminate variable pitch pulleys.
- Use variable speed drives for large variable fan loads.
- Use energy-efficient motors for continuous or near-continuous operation
- Eliminate leaks in ductwork.
- Minimize bends in ductwork



- Turn fans off when not needed.

Blowers

- Use smooth, well-rounded air inlet ducts or cones for air intakes.
- Minimize blower inlet and outlet obstructions.
- Clean screens and filters regularly.
- Minimize blower speed.
- Use low-slip or no-slip belts.
- Check belt tension regularly.
- Eliminate variable pitch pulleys.
- Use variable speed drives for large variable blower loads.
- Use energy-efficient motors for continuous or near-continuous operation.
- Eliminate ductwork leaks.
- Turn blowers off when they are not needed.

Pumps

- Operate pumping near best efficiency point.
- Modify pumping to minimize throttling.
- Adapt to wide load variation with variable speed drives or sequenced control of smaller offices.
- add an auto-start for on-line spare or add a booster pump in the problem area.
- Use booster pumps for small loads requiring higher pressures.
- Increase fluid temperature differentials to reduce pumping rates.
- Repair seals and packing to minimize water waste.
- Balance the system to minimize flows and reduce pump power requirements.
- Use siphon effect to advantage: don't waste pumping head with a free-fall (gravity) return.



Chillers

- Increase the chilled water temperature set point if possible.
- Use the lowest temperature condenser water available that the chiller can handle. (Reducing condensing temperature by 5.5°C, results in a 20 - 25% decrease in compressor power consumption).
- Increase the evaporator temperature (5.5°C increase in evaporator temperature reduces compressor power consumption by 20 - 25%)
- Clean heat exchangers when fouled. (1 mm scale build-up on condenser tubes can increase energy consumption by 40%).
- Optimize the flow rates of condenser water and refrigerated water.
- Use water-cooled rather than air-cooled chiller condensers.
- Use energy-efficient motors for continuous or near-continuous operation.
- Specify appropriate fouling factors for condensers.
- Do not overcharge oil.
- Install a control system to coordinate multiple chillers.
- Study part-load characteristics and cycling costs to determine the most-efficient mode for operating multiple chillers.
- Run the chillers with the lowest operating costs to serve base load.
- Avoid over sizing - match the connected load.
- Isolate off-line chillers and cooling towers.
- Establish a chillers efficiency-maintenance program. Start with an energy audit and follow-up, then make a chillers efficiency-maintenance program a part of your continuous energy management program.

HVAC (Heating / Ventilation / Air Conditioning)

- Tune up the HVAC control system.
- Consider installing a building automation system (BAS) or energy management system (EMS) or restoring an out-of-service one.



- Balance the system to minimize flows and reduce blower/fan/pump power requirements.
- Eliminate or reduce reheat whenever possible.
- Use appropriate HVAC thermostat setback.
- Use building thermal lag to minimize HVAC equipment operating time.
- In winter during unoccupied periods, allow temperatures to fall as low as possible without freezing water lines or damaging stored materials.
- In summer during unoccupied periods, allow temperatures to rise as high as possible without damaging stored materials.
- Improve control and utilization of outside air.
- Use air-to-air heat exchangers to reduce energy requirements for heating and cooling of outside air.
- Reduce HVAC system operating hours (e.g. -- night, weekend).
- Optimize ventilation.
- Ventilate only when necessary. To allow some areas to be shut down when unoccupied, install dedicated HVAC systems on continuous loads (e.g. computer rooms).
- Provide dedicated outside air supply to kitchens, cleaning rooms, combustion equipment, etc. to avoid excessive exhausting of conditioned air.
- Use evaporative cooling in dry climates.
- Clean HVAC office coils periodically and comb mashed fins.
- Upgrade filter banks to reduce pressure drop and thus lower fan power requirements.
- Check HVAC filters on a schedule (at least monthly) and clean/change if appropriate.
- Check pneumatic controls air compressors for proper operation, cycling, and maintenance.
- Isolate air-conditioned loading dock areas and cool storage areas using high- speed doors or clear PVC strip curtains.
- Install ceiling fans to minimize thermal stratification in high-bay areas.



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- Relocate air diffusers to optimum heights in areas with high ceilings.
- Consider reducing ceiling heights.
- Eliminate obstructions in front of radiators, baseboard heaters, etc.
- Check reflectors on infrared heaters for cleanliness and proper beam direction.
- Use professionally-designed industrial ventilation hoods for dust and vapor control.
- Use local infrared heat for personnel rather than heating the entire area.
- Use spot cooling and heating (e.g. -- use ceiling fans for personnel rather than cooling the entire area).
- Purchase only high-efficiency models for HVAC offices.
- Put HVAC window offices on timer control.
- Don't oversize cooling offices. (Oversized offices will "short cycle" which results in poor humidity control.)
- Install multi-fueling capability and run with the cheapest fuel available at the time.
- Consider dedicated make-up air for exhaust hoods. (Why exhaust the air conditioning or heat if you don't need to?)
- Minimize HVAC fan speeds.
- Consider desiccant drying of outside air to reduce cooling requirements in humid climates.
- Seal leaky HVAC ductwork.
- Seal all leaks around coils.
- Repair loose or damaged flexible connections (including those under air handling offices).
- Eliminate simultaneous heating and cooling during seasonal transition periods.
- Zone HVAC air and water systems to minimize energy use.
- Inspect, clean, lubricate, and adjust damper blades and linkages.
- Establish an HVAC efficiency-maintenance program. Start with an energy audit and follow-up, then make an HVAC efficiency-maintenance program a part of your continuous

energy management program.

Lighting

- Reduce excessive illumination levels to standard levels using switching; de-lamping, etc. (Know the electrical effects before doing de-lamping.)
- Aggressively control lighting with clock timers, delay timers, photocells, and/or occupancy sensors.
- Install efficient alternatives to incandescent lighting, mercury vapour lighting, etc. Efficiency (lumens/watt) of various technologies range from best to worst approximately as follows: low pressure sodium, high-pressure sodium, metal halide, fluorescent, mercury vapour, incandescent.
- Select ballasts and lamps carefully with high power factor and long-term efficiency in mind.
- Upgrade obsolete fluorescent systems to Compact fluorescents and electronic ballasts
- Consider lowering the fixtures to enable using less of them.
- Consider day lighting and sky lights, etc.
- Consider painting the walls a lighter colour and using less lighting fixtures or lower wattages.
- Use task lighting and reduce background illumination.
- Re-evaluate exterior lighting strategy, type, and control. Control it aggressively.
- Change exit signs from incandescent to LED.

DG sets

- Optimize loading
- Use waste heat to generate steam/hot water /power an absorption chiller or preheat process or utility feeds.
- Use jacket and head cooling water for process needs
- Clean air filters regularly
- Insulate exhaust pipes to reduce DG set room temperatures

- Use cheaper heavy fuel oil for capacities more than 1MW

Buildings

- Seal exterior cracks / openings / gaps with caulk, gasketing, weather stripping etc.
- Consider new thermal doors, thermal windows, roofing insulation, etc.
- Install windbreaks near exterior doors.
- Replace single-pane glass with insulating glass.
- Consider covering some window and skylight areas with insulated wall panels inside the building.
- If visibility is not required but light is required, consider replacing exterior windows with insulated glass block.
- Consider tinted glass, reflective glass, coatings, awnings, overhangs, draperies, blinds, and shades for sunlit exterior windows.
- Use landscaping to advantage.
- Add vestibules or revolving doors to primary exterior personnel doors.
- Consider automatic doors, air curtains, strip doors, etc. at high-traffic passages between conditioned and non-conditioned spaces. Use self-closing doors if possible.
- Use intermediate doors in stairways and vertical passages to minimize building stack effect.
- Use dock seals at shipping and receiving doors.
- Bring cleaning personnel in during the working day or as soon after as possible to minimize lighting and HVAC costs.

Water & Wastewater

- Recycle water, particularly for uses with less-critical quality requirements.
- Recycle water, especially if sewer costs are based on water consumption.
- Balance closed systems to minimize flows and reduce pump power requirements.
- Use the least expensive type of water that will satisfy the requirement.
- Fix water leaks.



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- Test for underground water leaks. (It's easy to do over a holiday shutdown.)
- Check water overflow pipes for proper operating level.
- Automate blow down to minimize it.
- Provide proper tools for wash down -- especially self-closing nozzles.
- Install efficient irrigation system.
- Reduce flows at water sampling stations.
- Eliminate continuous overflow at water tanks.
- Promptly repair leaking toilets and faucets.
- Use water restrictors on faucets, showers, etc.
- Use self-closing type faucets in restrooms.
- Use the lowest possible hot water temperature.
- Do not use a heating system hot water boiler to provide service hot water during the cooling season -- install a smaller, more-efficient system for the cooling season service hot water.
- If water must be heated electrically, consider accumulation in a large insulated storage tank to minimize heating at on-peak electric rates.
- Use multiple, distributed, small water heaters to minimize thermal losses in large piping systems.
- Use freeze protection valves rather than manual bleeding of lines.
- Consider leased and mobile water treatment systems, especially for deionized water.
- Seal sumps to prevent see page inward from necessitating extra sump pump operation.
- Install pre-treatment to reduce TOC and BOD surcharges.
- Verify the water meter readings. (You'd be amazed how long a meter reading can be estimated after the meter breaks or the meter pit fills with water!)
- Verify the sewer flows if the sewer bills are based on them



Miscellaneous

- Meter any unmetered utilities to know about the normal efficient use. Track down causes of deviations.
- Shut down spare, idling, or unneeded equipment.
- Make sure that all of the utilities to redundant areas are turned off including utilities like compressed air and cooling water.
- Install automatic control to efficiently coordinate multiple air compressors, chillers, cooling tower cells, boilers, etc.
- Renegotiate utilities contracts to reflect current loads and variations.
- Consider buying utilities from neighbours, particularly to handle peaks.
- Leased space often has low-bid inefficient equipment. Consider upgrades if your lease will continue for several more years.
- Adjust fluid temperatures within acceptable limits to minimize undesirable heat transfer in long pipelines.
- Minimize use of flow bypasses and minimize bypass flow rates.
- Provide restriction orifices in purges (nitrogen, steam, etc.).
- Eliminate unnecessary flow measurement orifices.
- Consider alternatives to high-pressure drops across valves.
- Turn off winter heat tracing that is on in summer.

b) Fuel Energy

The fuel energy audit determines the approximate use of petrol or diesel by the vehicles inside the university. It also includes the efforts taken by the university to conserve the fuel. The conventional source of fuel for the vehicle is petrol and diesel. Most of students, teaching and non-teaching staff of university use public transport and university arranged buses. So, the data regarding fuel utilization for students, teaching and non-teaching staff of university have not been calculated in the study.

c) Alternate and Green Source of Energy

No alternate or green source of energy as solar and others have not been adopted so far by the institute.

Recommendations for Energy Management

- The communication process for awareness in relation to energy conservation is found inadequate.
- Objectives for reducing energy, water and fuel consumption are meager.
- Older generation and non-energy efficient electrical appliances as fans, tube lights can be phase out by replacing with new energy efficient ones.
- Regular monitoring of equipments and immediate rectification of any problems.
- Employment of more solar panels and other renewable energy sources.
- Conduct more save energy awareness programs for students and staff.
- Replace all computers with LED monitors.
- Observe a power saving day every year.
- Automatic power switch off systems may be introduced.
- Installation solar power stations and adoption of green energy resources for conservation of energy with sustainable development and reduce carbon footprints.
- Isolate the leech Loads from power when not in use.
- Recommend the centralized HVAC system instead of individual room heater and AC.
- Replace the all faulty appliances located in the building.
- Remove the faulty light holders, bulbs and live wires from DB box and open area.
- Establish energy efficient and conservation steering committee to take with energy efficiency initiative and management within the building.
- Renovate or improve the lighting control, i.e. add the LED light as per lighting calculation/IS standard.
- Use the solar street lights.
- Prepare the POWER CONTROL ROOM to centralized the power system.
- Proper earth mat, & Lighting earthen arrangement for buildings.



*Green Audit (Environment, Energy and Green Campus Management) Report
Central University of Himachal Pradesh
(Dharamsala, Shahpur & Dehra Campus)*



Auditing for Carbon Footprint

Auditing for Carbon Footprint

Commutation of stakeholders has an impact on the environment through the emission of greenhouse gases into the atmosphere consequent to burning of fossil fuels (such as petrol and diesel vehicles). The most common greenhouse gases are carbon dioxide, water vapour, methane, nitrous oxide and ozone. Of all the greenhouse gases, carbon dioxide is the most prominent greenhouse gas, comprising 402 ppm of the Earth's atmosphere. The release of carbon dioxide gas into the Earth's atmosphere through human activities is commonly known as carbon emissions.

An important aspect of doing an audit is to be able to measure your impact so that we can determine better ways to manage the impact. In addition to the water, waste, energy and biodiversity audits we can also determine what our carbon footprint is, based on the amount of carbon emissions created. One aspect is to consider the distance and method traveled between home and college every day. It undertakes the measure of bulk of carbon dioxide equivalents exhaled by the organization through which the carbon accounting is done. It is necessary to know how much the organization is contributing towards sustainable development. It is therefore essential that any environmentally responsible institution examine its carbon footprint.

The numbers of vehicles in Dehra Campus for Staffs are 10 and for Students are approximately 10. Mostly students & staff is encouraged to use public transport (Buses)

Reducing the Carbon Footprints

- Installation of solar panels or solar energy generation devices should be enhanced to reduce the electricity footprint of the campus. Terrace of each building can be utilized to produce electricity from tiltable solar modules.
- The food waste generated from university hostel mess, guest house, canteens and staff quarters should be converted into the biogas which can be further utilized for hostel kitchens.
- The solar battery operated vehicles should be used on the campus to overcome the vehicle footprint.
- The Green computing or E-work is helping the organization to reduce footprint very effectively.
- The solar energy based street lamps on campus will reduce carbon footprint.



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- The awareness should be made among the faculty, students and other employees regarding Clean Development Mechanism (CDM) to reduce the consumption of electricity and natural resources.
- Establish a system of carpooling among the staff to reduce the number of four wheelers coming to the university.
- Introduce university bus services to the students and staff.
- Encourage students and staff to use cycles.
- Establish a more efficient cooking system to save gas.
- Discourage the staff and students using vehicles in university campus.
- As an outcome effort can be made to reduce carbon foot prints by using electrical vehicles in the campus, and green computing in the administration and examination.
- University can follow No Vehicle Day on one day in a week to save fuel consumption.
- Various awareness programmes will be helpful to motivate all the staff members for optimized sustainable use of available resources.



Evaluation of Audit Findings



Evaluation of Audit Findings

Major Audit Observations in General

- There is no Green policy/Environmental policy statement indicating the commitment of the institute towards its environmental performance.
- Gardens inside the university premises are found well maintained.
- Use of notice boards and signs are inadequate to reduce over exploitation of natural resources.
- Programs on green initiatives have to be increased.
- Environmental education programs have to be strengthened.
- Adoption of Rain water harvesting and solar power generation systems
- Establish a purchase policy for environmental friendly materials
- Students and staff can be permitted to solve local environmental problems
- Renovation of cooking system in the canteen to save gas

Water Audit

- The institute does not have waste water treatment for waste water generated from laboratories, canteen, hostel kitchen, toilets, bathrooms and office rooms.
- The waste water should be suitably treated, controlled and used for gardening.
- Display boards against the misuse of water use are lacking.
- Lacking of water consumption monitoring system in the campus.
- Automatic switching system is not installed for pump sets used for overhead tank filling.
- Lacking of flushing and dual plumbing line systems to save the water resources.
- Separate STP and ETP plants need to be installed for water resource management.
- Rain Water Harvesting System need to be installed at each Building/ Block wise.
- Quality of water in terms of fresh water supply and domestic and effluent discharges need to check periodically by NABL and MoEF&CC approved laboratory.

Waste Audit

- Solid waste management systems established are insufficient.
- Bio degradable waste may be used for non-conventional Energy Generation or Steam Generation for cooking food/Washing cloths etc.
- The institute should have proper communication with the local body for regular collection of solid waste from the campus.

- Implementation of sustainable projects to attain set environmental goals is not in place.
- Waste bins in the class rooms, veranda, canteen and campus are inadequate.
- Bio gas plant should be installed
- Proper composting systems are lacking.
- Mechanical composting system can be adopted to reduce the load of waste generation.
- Green chemistry labs are not introduced.

Energy Audit

- The communication process for awareness in relation to energy conservation is found inadequate.
- Objectives for reducing energy, water and fuel consumption are meager.
- Old generation and non-energy efficient electrical appliances as fans, tube lights can be phase out by replacing with new energy efficient ones in each block/ building.
- Regular monitoring of equipments and immediate rectification of any problems with monitoring records.
- Employment of solar panels and other renewable energy sources.
- Conduct more save energy awareness programs for students and staff.
- Replace computers and TVs with LED monitors.
- Observe a power saving day every year.
- Automatic power switch off systems may be introduced.

Green Campus Audit

- Nomenclature and number plates on trees and tracking record on plantation is lacking.
- Registry for flora and fauna on the campus is lacking.
- Nomenclature, track record and uses of herbs cultivated in the medicinal garden are not displayed.
- Adopting Routine Green Practices for clean and green environment.
- Celebration of World Environment Day, Ozone Day, Earth Day with huge plantation and environmental awareness campaigns.

Carbon Footprints

- Initiative for carbon accounting is lacking in the institute
- Adequate common transportation facilities should be provided by the institute.
- Encourage students to use cycles.



Green Audit (Environment, Energy and Green Campus Management) Report
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General Recommendations

General Recommendations

Water

- Manual water Taps should be replaced with Auto closed water Taps
- Treatment systems for sewage and effluent waste water based on Zero Liquid Discharge (ZLD) to reduce undue pressure on municipal system and to manage water resources and their conservation.
- Drip irrigation for gardens and vegetable cultivation can be initiated.
- Establish water treatment systems to recycle drain water
- Awareness programs on water conservation to be conducted.
- Install display boards to control over exploitation of water.

Waste

- A model solid waste treatment system and Bio Digester or Bio Manure plant to be established to reduce undue pressure on municipal system and to manage and convert wastes into valuable resources.
- Practice of waste segregation to be strengthened.
- Establish a plastic free campus and use of paper plates and cups in place of Plastic for all functions in the institute.

Green Campus

- Create automatic drip irrigation system during summer holidays.
- Not just celebrating environment day but making it a daily habit.
- Beautify the institute building with maximum use of oxygen generating indoor plants
- Encouraging students not just through words, but through action for making the campus green
- Conducting competitions among departments for making students more interested in making the campus green.
- All trees in the campus should be named scientifically.

Energy

- Isolate the leech Loads from power when not in use.
- Recommend the centralized HVAC system. Instead of Individual Room Heater and AC.
- Remove the Faulty Appliances Located in the building.



- Installation of solar power stations and adoption of green energy resources for conservation of energy with sustainable development and reduce carbon footprints.
- Remove the faulty light holders and bulbs or remove the live wires from DB box and open area.
- Establish Energy Efficiency and Conservation steering committee to take with energy efficiency initiative and management within the building.
- Renovate or Improve the Lighting control, i.e add the LED light as per lighting calculation/IS standard.
- Repair the Solar Street Lights.
- Prepare the POWER CONTROL ROOM to centralized the power system.
- Proper earth mat, & Lighting earthing arrangement for buildings.

Tips for Energy Conservation

Lighting System

- One of the best energy-saving devices is the light switch. Turn off lights when not required.
- Many automatic devices can help in saving energy used in lighting. Consider employing infrared sensors, motion sensors, automatic timers, dimmers and solar cells wherever applicable, to switch on/off lighting circuits.
- As far as possible use task lighting, which focuses light where it's needed. A reading lamp, for example, lights only reading material rather than the whole room.
- Dirty tube lights and bulbs reflect less light and can absorb 50 percent of the light; dust your tube lights and lamps regularly.
- Fluorescent tube lights and CFLs convert electricity to visible light up to 5 times more efficiently than ordinary bulbs and thus save about 70% of electricity for the same lighting levels.
- Ninety percent of the energy consumed by an ordinary bulb (incandescent lamp) is given off as heat rather than visible light.
- Replace your electricity-guzzling ordinary bulbs (incandescent lamps) with more efficient types. Compact fluorescent lamps (CFLs) use up to 75 percent less electricity than incandescent lamps.
- A 15-watt compact fluorescent bulb produces the same amount of light as a 60watt incandescent bulb.

Room Air Conditioners

- Use ceiling or table fan as first line of defense against summer heat. Ceiling fans, for instance, cost about 30 paise an hour to operate - much less than air conditioners (Rs.10.00 per hour).
- You can reduce air-conditioning energy use by as much as 40 percent by shading your home's windows and walls. Plant trees and shrubs to keep the day's hottest sun off the house.
- One will use 3 to 5 percent less energy for each degree air conditioner is set above 22°C (71.5°F), so set the thermostat of room air conditioner at 25°C (77°F) to provide the most comfort at the least cost.
- Using room, ceiling or room fans allows you to set the thermostat higher because the air movement will cool the
- A good air conditioner will cool and dehumidify a room in about 30 minutes, so use a timer and leave the unit off for some time.
- Keep doors to air-conditioned rooms closed as often as possible.
- Clean the air-conditioner filter every month. A dirty air filter reduces airflow and may damage the unit. Clean filters enable the unit to cool down quickly and use less energy.
- If room air conditioner is older and needs repair, it's likely to be very inefficient. It may work out cheaper on life cycle costing to buy a new energy-efficient air conditioner.

Pumps

- Operate pumping near best efficiency point.
- Modify pumping to minimize throttling.
- Adapt to wide load variation with variable speed drives or sequenced control of smaller units.
- Stop running both pumps -- add an auto-start for an on-line spare or add a booster pump in the problem area.
- Use booster pumps for small loads requiring higher pressures.
- Increase fluid temperature differentials to reduce pumping rates.
- Repair seals and packing to minimize water waste.
- Balance the system to minimize flows and reduce pump power requirements
- Use siphon effect to advantage: don't waste pumping head with a free-fall (gravity) return

Tips for ecofriendly activities can be adopted in campus

- Planting and caring of trees in and around the campus.
- Timely disposal of wastes from the campus.
- Campus is to be declared as plastic free.
- Management has to adopt green protocol.
- Distribution of medicinal plant saplings among students.

Adoption of Environmental Education Policy

The following environmental education program may be implemented in the institute before the next green auditing

- Training programs in solid waste management, liquid waste management, setting up of medicinal plant nursery, water management, vegetable cultivation, paddy cultivation, tree planting, energy management, landscape management, pollution monitoring methods, and rain water harvesting methods.
- Increase the number of display boards on environmental awareness such as – save water, save electricity, no wastage of food/water, no smoking, switch off light and fan after use, plastic free campus etc.
- Activate the environmental clubs
- Set up model rainwater harvesting system, rainwater pits, vegetable garden, medicinal plant garden, paddy fields etc. for providing proper training to the students.
- Conduct exhibition of recyclable waste products
- Implement chemical treatment system for waste water from the laboratories.

Awareness on Carbon Consumption

Students and Staff members may be made totally aware of pollution caused by use of vehicles.

The carbon consumption awareness programs on carbon emission at individual as well as social level will help to avoid air and noise pollution in the campus due to vehicles.

Reducing the Carbon Footprints

- Installation of solar panels or solar energy generation devices should be enhanced to reduce the electricity footprint of the campus. Terrace of each building can be utilized to produce electricity from tiltable solar modules.

- The food waste generated from university hostel mess, guest house, canteens and staff quarters should be converted into the biogas which can be further utilized for hostel kitchens.
- The solar battery operated vehicles should be used on the campus to overcome the vehicle footprint.
- The Green computing or E-work is helping the organization to reduce footprint very effectively.
- The solar energy based street lamps on campus will reduce carbon footprint.
- The awareness should be made among the faculty, students and other employees regarding Clean Development Mechanism (CDM) to reduce the consumption of electricity and natural resources.



Fig. Basic and Fundamental Components of environmental sustainability



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Key Findings and Recommendations

Key Findings and Recommendations

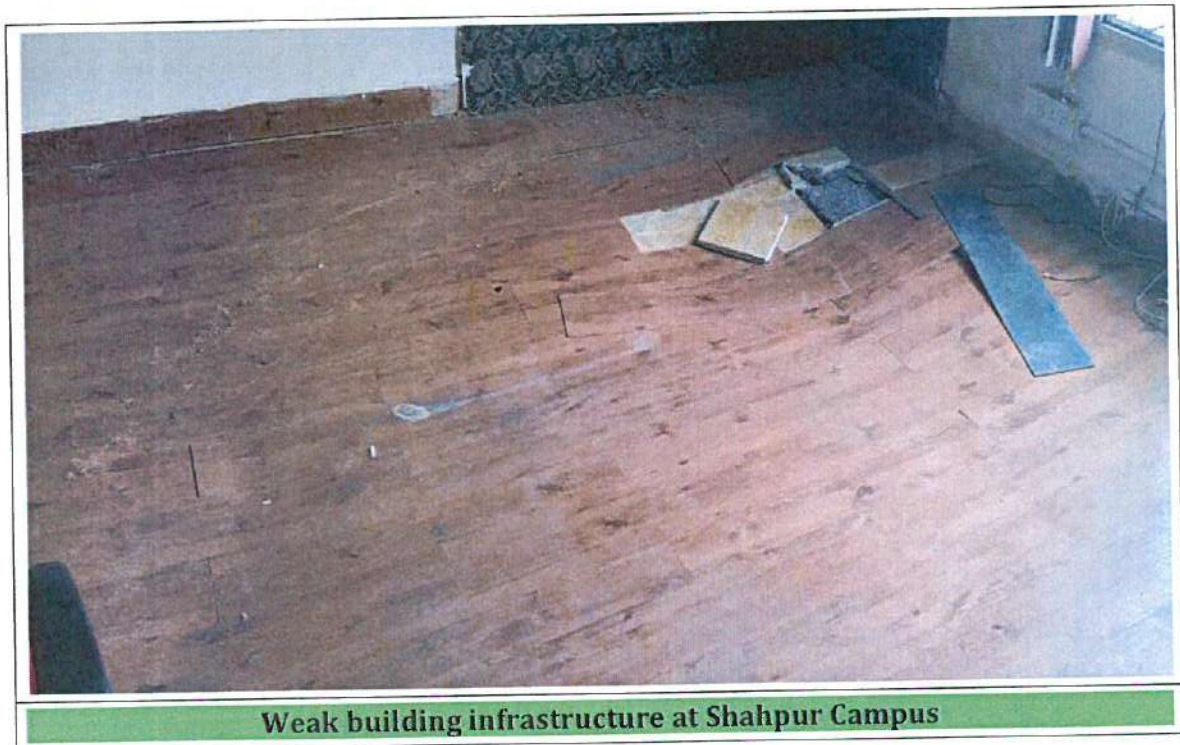
Following are some of the key recommendation for improving campus environment:

- An environmental policy document has to be prepared with the goal and objectives of clean and green environment, zero waste generation and adoption of green energy by the university.
- The university should develop internal procedures to ensure its compliances with environmental legislation and responsibility should be fixed to carry out it in practice.
- The solid waste should be reused or recycled at maximum possible places. The biodegradable waste should be properly utilized for manure preparation or biogas generation.
- Waste water treatment plant (STP & ETP) need to established under zero liquid discharge policy of the institute.
- Adoption of green energy sources as solar power need to be established.
- Installation of sensor based electrification items like fans, lights, etc. can save electricity.
- Installation of rain water harvesting system to every terrace of building will be useful in conserve the water resources.
- Science laboratories large amount of water goes waste during the process of making distilled water; the system should have developed to reuse this water for other purposes. The solar distillation unit be installed at the earliest.
- Frequent visits should be conducted to ensure that the generated waste is monitored (measured, recorded and disposal) and the information should be made available to administration regularly.
- Adoption of E-vehicle for transportation to reduce carbon footprints and for clean, green and safe environment.
- Reduction in unnecessary Maximum Demand Load and Sanctioned Load for cost effectiveness and financial savings.
- Testing of environmental samples as air quality, drinking water, Noise levels, DG emissions and waste water/ effluents on quarterly basis by NABL and MoEF&CC approved laboratory to assess the quality of existing environment and compliance with regulatory and legal norms.

Unstable and weak building infrastructure at Shahpur Campus

Building infrastructure at Shahpur Campus has become weak/ lean due to water seepage as a result of poor and faulty drainage system. The building has large cracks in floor and walls and floor has sunken up to one feet at many places. The building is no longer safe which can causes sever risks to human life, hence recommended not to be used and totally rejected with immediate effect.





Weak building infrastructure at Shahpur Campus

Recommendation for Shahpur campus building

- The building is no longer safe and can cause severe risks to human life, hence recommended not to be used with immediate effect.
- It needs structural survey to be conducted by Govt. authorized agency and reconstruction and lay down the foundation as per suggestions of agency.



Green Audit (Environment, Energy and Green Campus Management) Report
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Preparation of Action Plan

Preparation of Action Plan

There should be Committee formation for energy Audit, Green Audit and Environmental Audit involving Faculties and Students. Policies referring to institute's management and approach's towards the use of resources need to be considered. The institute should have a green policy and environmental policy for its sustainable development. The environmental policy formulated by the management of the institute should be implemented meticulously. The institute should have a policy on awareness raising or training programs (for ground staff or kitchen staff for example) and institute also should have a procurement policy (the Institute's policy for purchasing materials).

Green Audits are exercises which generate considerable quantities of valuable management information. The time and effort and cost involved in this exercise is often considerable and in order to be able to justify this expenditure, it is important to ensure that the findings and recommendations of the audit are considered at the correct level within the organization and that action plans and implementation programs result from the findings. Audit follow up is part of the wider process of continuous improvement. Without follow-up, the audit becomes an isolated event which soon becomes forgotten in the pressures of organizational priorities and the passing of time.

Exit Meeting

The exit meeting was conducted jointly by experts of Eco Laboratories and team members of University. It was a mechanism to provide the management and staff a broad feedback on the preliminary findings of the audit team before completing the audited report. The exit meeting was held in the college on 31st August 2022. Clarification on certain information gathered was sought by the audit team from the management and staff of the college.



Fig. Team of Experts during Green Audit of University



Draft Audit Report

The information gathered by the audit team was consolidated as a draft audit report. This draft report was then circulated to the audit team and those directly concerned with the audit to check the report for accuracy. The draft green audit report was also discussed in the exit meeting.

Final Audit Report

The final audit report is the corrected final document which contains the findings and recommendations of the audit. It will also form one of the bases of future audits because the information it contains informs some of the tests and analyses that need to be performed in the future. Final Audit Report was submitted to the Principal / Director of the University.

Follow Up and Action Plans

Green audits form a part of an on-going process. Innovative green initiatives have to be designed and implemented every year to make the institute environmentally sustainable. Follow up programs of green auditing recommendations should be done meticulously before next audit.

Next Audit

In order to promote continuous improvement, it is recommended to conduct the next green auditing during the year 2024.

Transparency of Green Audit Report

Green audit report is one of the useful means of demonstrating an organization's commitment to openness and transparency. If an organization believes it has nothing to hide from its stakeholders, then it should feel confident enough to make its green audit reports freely available to those who request them. As a basic rule, green audit reports should be made available to all stakeholders.



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About Eco Group (Consultant)



ABOUT ECO GROUP

Eco Group is North India's reputed environmental organization Headquartered in Mohali (Chandigarh) that offers consultancy and environmental-related turnkey solutions for overall pollution abatement and sustainable development. We are a professional engineering firm with National level consultancy approved by QCI/ NABET and Environmental and Mechanical testing laboratory approved by MoEF&CC, NABL (ISO/IEC 17025:2017) and state boards.

Eco Group, established in 1998 has designed, engineered and executed more than 1,000 installations of Water, Domestic Sewage and Industrial Effluent Treatment Plants. With the help of our state-of-the-art technologies and apt infrastructure, we are proud to maintain an impeccable quality record, owing to our customer satisfaction levels. These treatment plants operate with the help of trained staff, including Sewage Treatment Plants (STPs), Effluent Treatment Plants (ETPs), Reverse Osmosis Plants (ROs), etc. In the last 20 years, we have undertaken several projects successfully and have created sustainable solutions to environmental issues.

Eco Group has two major business divisions as Eco Paryavaran Engineers & Consultants Pvt. Ltd. and Eco Paryavaran Laboratories & Consultants Pvt. Ltd. The former caters to consultancy and providing engineering solutions for environmental pollution whereas the latter pertains to the analytical and consultancy services in the field of lab testing and environmental studies. Eco Paryavaran is North India's leading supplier of pollution control equipment with world-class infrastructure.

Eco Paryavaran Laboratories is NABL (National Accreditation Board for Testing and Calibration Laboratories) accredited for ISO/IEC 17025:2017, approved by Ministry of Environment, Forest and Climate Change (MoEF&CC) & State Pollution Control Board (SPCBs) in the field of air, noise, wastes, water/wastewater and microbiological testing. Eco Paryavaran Laboratories & Consultants Pvt. Ltd. is also Government approved (ISO 9001:2015, ISO 14001:2015 and ISO 45001:2018) and National Accreditation Board for Education and Training (NABET).

Special Facility of Eco Group for Environmental Testing & Management

Onsite Environmental Testing

Mobile Testing Laboratory



Flue Gas Emissions from Stack/ Source/ Duct

Flue Gas Analyzer – HORIBA PG350 (Japan), MRU Optima 7 (Germany) and Testo (India)



Aerosol Dust in Ambient/ Indoor/ Work zone Environment

(TSI Side Pak™ AM520i Real Time Aerosol Sampler for PM₁₀, PM_{5.0}, PM_{2.5}, PM_{1.0} and PM_{0.8} - DPM), Intrinsically Safe



VOCs & Toxic Gases in Ambient/ Indoor/ Work zone Environment

Real Time VOC/Toxic Gas Meter (PID) - TIGER Pho Check, Ion Science, UK, Intrinsically Safe



Validation of Indoor Environment in Hospitals/ Operation Theaters

As per ISO 14664 standard, services are delivered as Air Change/ Ventilation Rate, Air Velocity at filtration unit, Pressure Differential, Validation of HEPA Filters by DOP /POA testing, Temp. and Humidity



Noise & Vibration Monitoring

Sound level meters and octave brands



Noise Dose Monitoring in Work Zone Environment

Noise Dosimeter – SVANTEK SV104IS, Intrinsically Safe



Calibration of Online CEMS (Emission/ Effluent)

Calibration for Particulate Matter (Emissions) & pH, BOD, COD, TSS (Effluents)



Milk Powder Emission Loss Monitoring in Dairy Industry

Quantification of Milk Powder Emission Loss form Milk Dryers/ Fugitive Emissions/ General Leakage



Carbon Monoxide (CO) in Ambient/ Indoor/ Work zone Environment

Real Time NDIR CO Monitor - Horiba APMA-370



Industrial Hygiene & Occupational Health and Safety Study in Workzone Environment

Industrial Hygiene, Ventilation Rate, Heat Stress, Health and Safety Study as per OSHA/ NIOSH/ Indian Factories Act, 1948









Biohazard Testing

Air Quality Testing for Bacteria. Yeast & Mould Count



Team of Experts for the Study

S. No.	Name of Expert	Role of Expert	ID of Expert
1.	Dr. Sandeep Garg (Ph. D. & ME in Env. Sc., BE in Civil)	Managing Director <ul style="list-style-type: none"> ▪ NABL approved authorized signatory ▪ MoEF&CC approved govt. analyst ▪ NABET approved EIA Coordinator & Functional Area Expert ▪ Chairman IWE & Ex-Advisor, GMADA 	
2.	Dr. Rai Singh (Ph. D. & M. Sc. Env. Sc. P.G. Diploma in Industrial Safety, Health & Env.)	Dy. General Manager (Technical & Environment) <ul style="list-style-type: none"> ▪ MoEF&CC approved Govt. Analyst; ▪ NABL approved authorized signatory ▪ NABET approved Environmental Expert ▪ Worked in CPCB (2001-12) as Research Scientist 	
4.	Dr. Simranjit Kaur (M.Sc. & M.Phil.; Ph.D. in Solid Waste Management)	Deputy General Manager – EMS & Biological Lab Quality Manager – Analytical Division <ul style="list-style-type: none"> ▪ NABL Technical Assessor, ▪ NABL approved authorized signatory ▪ MoEF&CC approved govt. analyst ▪ NABET approved EIA Coordinator & Functional Area Expert 	
5.	Dr. Ajay Kumar	Chief Technical Officer Quality Manager <ul style="list-style-type: none"> ▪ NABL approved authorized signatory 	
6.	Mr. Maninder Preet Singh (Diploma in Electrical & Electronics)	Manager (Projects)	
7.	Mr. Umesh Kumar (M. Tech – Nanotech)	Technical Manager & Sr. Laboratory Analyst (Environment & Chemical) NABL approved authorized signatory	





Green Audit (Environment, Energy and Green Campus Management) Report
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(Dharamsala, Shahpur & Dehra Campus)



Approvals of Eco Laboratory

Approvals of Eco Laboratory

NABET ACCREDITATION CERTIFICATE

Quality Council of India

National Accreditation Board for Education & Training

Certificate of Accreditation

Eco Laboratories and Consultants Pvt Ltd, Mohali


E 207, Phase VIII B, Sector 74, Industrial Area, SAS Nagar, Mohali

The organization is accredited as Category-A under the QCI-NABET Scheme for Accreditation of EIA Consultant Organization, Version 3: for preparing EIA-EMP reports in the following Sectors –

S. No	Sector Description	Sector (as per)		Cat.
		NABET	MoEFCC	
1	Mining of minerals- opencast only	1	1 (b)	A
2	Metallurgical industries	8	3 (a)	B
3	Cement plants	9	3 (b)	A
4	Synthetic organic chemicals industry (dyes & dye intermediates; bulk drugs and intermediates excluding drug formulations; synthetic rubbers; basic organic chemicals, other synthetic organic chemicals and chemical intermediates)	21	5 (f)	A
5	Distilleries	22	5 (g)	A
6	Sugar Industry	25	5 (j)	B
7	Industrial estates/ parks/ complexes/ Areas, export processing zones (EPZs), Special economic zones (SEZs), Biotech parks, Leather complexes	31	7 (c)	A
8	Common Effluent Treatment Plants (CETPs)	36	7 (h)	B
9	Building and construction projects	38	8 (a)	B
10	Townships and Area development projects	39	8 (b)	B

Note: Names of approved EIA Coordinators and Functional Area Experts are mentioned in RA AC minutes dated July 02, 2021 posted on QCI-NABET website.

The Accreditation shall remain in force subject to continued compliance to the terms and conditions mentioned in QCI-NABET's letter of accreditation bearing no. QCI/NABET/ENV/ACO/21/1936 dated Sept 10, 2021. The accreditation needs to be renewed before the expiry date by Eco Laboratories and Consultants Pvt Ltd, Mohali following due process of assessment.



Sr. Director, NABET
Dated: Sept 10, 2021

Certificate No.
NABET/EIA/2023/RA 0211

Valid up to
Dec 17, 2023

For the updated List of Accredited EIA Consultant Organizations with approved Sectors please refer to QCI-NABET website.

NABL ACCREDITATION CERTIFICATE



National Accreditation Board for
Testing and Calibration Laboratories

CERTIFICATE OF ACCREDITATION

ECO LABORATORIES AND CONSULTANTS PVT. LTD.

has been assessed and accredited in accordance with the standard

ISO/IEC 17025:2017

**"General Requirements for the Competence of Testing &
Calibration Laboratories"**

for its facilities at

ECO GROUP, ECO BHAWAN, E-207, INDUSTRIAL AREA, PHASE VIII-B, (SECTOR 74), MOHALL, PUNJAB,
INDIA

in the field of

TESTING

Certificate Number: TC-7477

Issue Date: 01/06/2021

Valid Until: 31/05/2023

This certificate remains valid for the Scope of Accreditation as specified in the annexure subject to continued satisfactory compliance to the above standard & the relevant requirements of NABL.
(To see the scope of accreditation of this laboratory, you may also visit NABL website www.nabl-india.org)

Name of Legal Identity : ECO LABORATORIES AND CONSULTANTS PVT. LTD.

Signed for and on behalf of NABL



N. Venkateswaran
Chief Executive Officer

MOEF&CC ACCREDITATION CERTIFICATE

रजिस्ट्रार नं० डी० एल०-33004/99

REGD. NO. D. L.-33004/99



भारत का राजपत्र
The Gazette of India

असाधारण
EXTRAORDINARY

भाग II—खण्ड 3—उप-खण्ड (ii)
PART II—Section 3—Sub-section (ii)

प्राधिकार से प्रकाशित
PUBLISHED BY AUTHORITY

नं. 758] नई दिल्ली, बुधवार, कार्तिकी 28, 2018/फाल्गुन 9, 1939
No. 758] NEW DELHI, WEDNESDAY, FEBRUARY 28, 2018/PHALGUNA 9, 1939

पर्यावरण, वन और जलवायु परिवर्तन मंत्रालय

वर्षा सूचना

नई दिल्ली, 26 फरवरी, 2018

NOTIFICATION

New Delhi, the 26th February, 2018

S.O. 857(E).—In exercise of the powers conferred by clause (b) of sub-section (1) of section 12 and section 13 of the Environment (Protection) Act, 1986 (29 of 1986), read with rule 10 of the Environment (Protection) Rules, 1986, the Central Government hereby makes the following further amendments in the notification of the Government of India in the erstwhile Ministry of Environment and Forests, number S.O. 1174(E), dated the 18th July, 2007, namely: -

In the Table appended to the said notification, -

(i) for serial numbers 1,17,24,26,30,39,41,45,81,86,87,93,94,95,96 and 100 the entries relating thereto, the following serial numbers and entries shall be substituted, namely: -

S.No.	Name of the Laboratory	Name of the Govt. Analyst	Recognition with effect from and valid up to
(1)	(2)	(3)	(4)
~1	M/s Mantec Consultants Pvt. Ltd. D-36, Sector-VI, Noida-201301, Uttar Pradesh	(i) Mr. Gaj Nand Mallick (ii) Dr. Vivek Dwivedi (iii) Mr. Sumit Verma	26.02.2018 to 25.02.2023
17	M/s Idma Laboratories Limited	(i) Mr. Ankush Aggarwal	26.02.2018

[भाग II-खण्ड 3(ii)]

भाग का समर्थन : असाधारण

5

	391, Industrial Area, Phase-I, Panchkula-160019, Haryana	(i) Mr. Niranjana Dev Behl (ii) Dr. Rajendra Kumar Jain	to 25.02.2023
24	M/s Neweon Consultants & Laboratories Pvt. Ltd. 8 th K.M. Stone, Delhi Meerut Road, Morla (Opp. Manan Dham Mandir), Ghaziabad-201003, Uttar Pradesh	(i) Mr. Pankaj Gupta (ii) Mr. Amit Kumar Singh (iii) Mr. Intekhab Khan	26.02.2018 to 25.02.2023
26	M/s Klean Laboratories & Research Pvt. Ltd. 402, Parushottam Plaza, Opp. Baner Telephone Exchange, Baner Road, Pune-411045, Maharashtra	(i) Mr. Vishwas Waman Kale (ii) Mr. Sanjay Kamalakar Mardikar (iii) Ms. Manjusha Gaikwad	26.02.2018 to 25.02.2023
30	M/s Lawn Enviro Associates, "Lawn House" #184-C, Vengal Rao Nagar, Hyderabad-500038, Telangana	(i) Mr. Devireddy Nagarajuna Reddy (ii) Ms. Chevula Anuradha (iii) Ms. Vangani Pallavi	26.02.2018 to 25.02.2023
39	M/s Team Test House. (A Unit of Team Institute of Science & Technology Pvt. Ltd.) G-1-584, RIICO Industrial Area, Sitapura, Jaipur-302022, Rajasthan	(i) Mrs. Kavita Mathur (ii) Mr. Kedar Nath Mukhopadhyay (iii) Mr. Rajesh Maheshwari	26.02.2018 to 25.02.2023
41	M/s Envirochem Research & Test Labs Pvt. Ltd. HIG-79, Sector-E, Aliganj, Lucknow-226024, Uttar Pradesh	(i) Dr. Madan Mohan Agarwal (ii) Sh. Vivek Kumar Gupta (iii) Mrs. Saroj Singh	26.02.2018 to 25.02.2023
45	M/s Mineral Engineering Services 25/XXV, Club Road, Bellary-583103, Karnataka	(i) Mr. M. Sachin Raju (ii) Mr. M.R. Durga Prasad (iii) Mr. A.D. Yashwanth Arun Murthy	26.02.2018 to 25.02.2023
81	M/s Advanced Environmental Testing and Research Lab Pvt. Ltd. 63/1, Kailash Vihar, Near ITO, City Center-II, Gwalior-474011, Madhya Pradesh	(i) Mr. Rajesh Jain (ii) Dr. Dinesh Kumar Uchchariya (iii) Mr. Arvind Kumar Sharma	26.02.2018 to 25.02.2023
86	M/s Care Labs Plot No. 1, 3 rd Floor, Sai Sadan Complex, Shiva Ganga Colony, L.B. Nagar, Hyderabad-500074, Telangana	(i) Mr. K. Srinivasa Rao (ii) Ms. Gouthami Gangula (iii) Ms. P. Mamatha	26.02.2018 to 25.02.2023
87	M/s Green Circle Inc. Green Empire, Anupashpan Habitat Centre, Nr. Yash Complex, Above Axis Bank Ltd., Gori Main Road, Vadodra-390021, Gujarat	(i) Mr. Pradeep Joshi (ii) Mr. Ram Raghav (iii) Ms. Shital Jashvantsinh Pamar	26.02.2018 to 25.02.2023
93	M/s Eco Laboratories & Consultants Pvt. Ltd. E-207, Industrial Area, Phase- VIII B, Sector-74, Mohali-160071, Punjab	(i) Mr. Saandeep Garg (ii) Ms. Simranjit Kaur (iii) Dr. Deepika Thakur	26.02.2018 to 25.02.2023
94	M/s Hubert Enviro Care Systems Pvt. Ltd. No. 18, 92 nd Street, Ashok Nagar, Chennai-600083, Tamil Nadu	(i) Dr. J.R. Moses (ii) Dr. Rajkumar Samuel (iii) Mr. A.K. Natarajan	26.02.2018 to 25.02.2023
95	M/s Nawal Analytical Laboratories Plot No. 100, New SIDCO Industrial Estate, Sri Nagar, Hosur-535109, Tamil Nadu	(i) Mr. D. Balakrishnan (ii) Ms. S. Elanathi (iii) Mr. K.E. Krishnamoorthy	26.02.2018 to 25.02.2023

 **Approved**

ISO 9001: 2015 Certificate

Certificate of Registration

This is to Certify that
Quality Management System of

ECO PARYAVARAN ENGINEERS & CONSULTANTS PRIVATE LIMITED

E-204 & 205, INDUSTRIAL AREA, PHASE VIII B (SECTOR-74),
MOHALI-160071, PUNJAB, INDIA.

has been assessed and found to conform to the requirements of

ISO 9001:2015

for the following scope :

DESIGNING, MANUFACTURING, SUPPLY AND COMMISSIONING OF
POLLUTION CONTROL EQUIPMENTS.

Certificate No	: 22IQJH70	Issuance Date	: 21/04/2022
Initial Registration Date	: 21/04/2022		
Date of Expiry	: 20/04/2025		
1st Surve. Due	: 21/03/2023	2nd Surve. Due	: 21/03/2024



Director



ACCREDITED
Management Systems
Certification Body
MSCB-119



AQC MIDDLE EAST LLC

Head Office: Office No. 02, Ground Floor, Sharjah Media City, Sharjah, UAE. e-mail : info@aqcmiddle.com

Key Location: A-60, Sector - 2, Noida, Uttar Pradesh, 201301, India.

Validity of the Certificate is subject to successful completion of surveillance audits on or before of due date. (In case surveillance audit is not allowed to be conducted, this certificate shall be suspended/withdrawn)

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This is to Certify that
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**ECO PARYAVARAN LABORATORIES &
CONSULTANTS PRIVATE LIMITED**

E-207, INDUSTRIAL AREA, PHASE VIII B (SECTOR-74), MOHALI-160071,
PUNJAB, INDIA.

has been assessed and found to conform to the requirements of

ISO 14001:2015

for the following scope :

TESTING SERVICES IN BIOLOGICAL, CHEMICAL AND MECHANICAL
CATEGORIES & EIA CONSULTANTS FOR PREPARING EIA/EMP REPORTS.

Certificate No	: 22IEJS76	Issuance Date	: 21/04/2022
Initial Registration Date	: 21/04/2022		
Date of Expiry	: 20/04/2025		
1st Surve. Due	: 21/03/2023	2nd Surve. Due	: 21/03/2024



Director



AQC MIDDLE EAST LLC

Head Office: Office No. 02, Ground Floor, Sharjah Media City, Sharjah, UAE. e-mail: info@aqcmiddleeast.com,
Key Location: A-60, Sector - 2, Noida, Uttar Pradesh, 201301, India.

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ISO 45001: 2018 Certificate

Certificate of Registration

This is to Certify that
Occupational Health & Safety Management System of

**ECO PARYAVARAN LABORATORIES &
CONSULTANTS PRIVATE LIMITED**

E-207, INDUSTRIAL AREA, PHASE VIII B (SECTOR-74), MOHALI-160071,
PUNJAB, INDIA.

has been assessed and found to conform to the requirements of

ISO 45001:2018

for the following scope :

TESTING SERVICES IN BIOLOGICAL, CHEMICAL AND MECHANICAL
CATEGORIES & EIA CONSULTANTS FOR PREPARING EIA/EMP REPORTS

Certificate No	: 22IOJA85		
Initial Registration Date	: 21/04/2022	Issuance Date	: 21/04/2022
Date of Expiry	: 20/04/2025		
1st Surve. Due	: 21/03/2023	2nd Surve. Due	: 21/03/2024

Director



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AQC MIDDLE EAST LLC

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Key Location: A-60, Sector - 2, Noida, Uttar Pradesh, 201301, India.

**Validity of the Certificate is subject to successful completion of surveillance audit on or before of due date. (In case surveillance audit is not allowed to be conducted, this certificate shall be suspended automatically).*

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*Green Audit (Environment, Energy and Green Campus Management) Report
Central University of Himachal Pradesh
(Dharamsala, Shahpur & Dehra Campus)*



Acknowledgement



*Green Audit (Environment, Energy and Green Campus Management) Report
Central University of Himachal Pradesh
(Dharamsala, Shahpur & Dehra Campus)*



Acknowledgement

Eco Paryavaran Laboratories and Consultants are thankful to the Management and the Principal/Director of Central University, Himachal Pradesh for entrusting processes of Green auditing with us.

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For Eco Paryavaran Laboratories and Consultants

Dr. Rai Singh
(Authorized Signatory)

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***** *End of Report* *****

