Karmveer Vitthal Ramji Shinde Shikshan Sanstha's

Shivraj College of Arts, Commerce &

D. S. Kadam Science College, Gadhinglaj.

Estd-1964, Affiliated to Shivaji University, Kolhapur, NAAC "B" Grade

|| सेवा परमो धर्म ||

Energy Audit

(2021-22)

Introduction

a. **Environment Audit for Environmental Protection:**

- Environment Audit is a process of systematic identification, quantification, recording, reporting and analysis of components of environmental diversity of various establishments. It aims to analyze environmental practices within and outside of the concerned sites, which will have an impact on the eco-friendly ambience. The purpose of Environment auditing is to assess periodically the compliance of completed or on-going activities with the requirements of legislation, measures proposed in environmental policies, environmental management systems and environmental schemes or the provisions of standards and contracts.

b. **Benefits of Environment Audit:**

- Ensuring legislative compliance.
- Reducing environmental impacts.
- Reducing waste, water and energy costs.
- To safeguard the environment and natural resources.
- Empower the organization to frame a better environmental performance.
- It portrays good image of institution through its clean and Environment campus.
- Finally, it will help to built positive impression for the upcoming NAAC visit.

c. **NAAC criteria VII Environmental Consciousness :**

Environment Audit is assigned to the criterion VII of NAAC. National Assessment and Accreditation Council which is a self-governing organization that declares the institutions as Grade A, Grade B or Grade C according to the scores assigned at the time of accreditation of the institution. The intention of Environment Audit is to upgrade the environmental condition in and around the institution. It is performed by considering some environmental parameters like water and wastewater management, energy conservation, waste management, air monitoring, etc. for making the institution more eco-friendly.

Students are the major strength of any academic institution. Practicing Environment actions in any educational institution will inculcate the good habit of caring nature in students. Many environmental activities like plantation and nurturing saplings and trees, cleanliness drives, bird watching camp, no vehicle day, rain water harvesting visits to ecologically important places through Environment clubs will make the student a good citizen of country.

Need of 'Energy and Environmental Audit' is a management tool which comprises systematic assessment of the different components of the ecosystem in which the establishments have been made. It is the process of identifying and determining whether the institution's practices are eco-friendly and sustainable. With modernization, use of resources and chemicals have increased which have negatively impacted the environment creating an imbalance in nature. This is now a great matter of concern. Environment and Environmental audit is a way to ensure that such negative impacts on the campus environment, due to the development and other activities, are kept at a minimum. Realising the importance of Environment and Environmental audit, the Internal Quality Assurance Cell (IQAC) of the College has constituted a team to work towards such environment-related assessments on the Campus. An Eco-Friendly College agenda for Assam Don Bosco College is its road map for building and operating a healthy and self-renewing vibrant Campus community. With an idea to create an environment where youth can be educated to live a sustainable life in harmony with nature, the College has formulated the eco-friendly policy with the following objectives:

- Creating a collaborative effort among the College fraternity in fostering an eco-friendly learning and working environment.

- Ensuring the sustenance of biodiversity by maintenance of the natural environment in addition to conservation, restoration, and remediation of existing land and water.

. - Managing waste generated in the Campus through proper disposal and treatment.

- Commitment to sustainable management of land through agroforestry and kitchen gardening for meeting the food requirements in the Campus.

- Raising awareness of real-world issues affecting the rural communities living adjacent to the College Campus and working towards addressing these issues in partnership with the communities through teaching, research and extension activities.

- Encouraging students to participate in outreach education programmes as a part of Service Learning.

- Protecting, monitoring, and conserving flora and fauna of the Campus and preservation of their natural habitat.

- Identifying existing invasive species to reduce their negative impact on the indigenous flora and fauna.

- Involving local communities in the custodianship of natural resources and utilizing local resources for infrastructure construction purposes.

- The Environment and Environmental audit report consists of five components- Land, Energy, Air, Waste and Water.

❖ Objectives: The major objectives of the Environment Auditing are:

1. To document the land use patterns in the Campus
2. To estimate the energy requirements of the Campus
3. To estimate the water quality of the Campus
4. To inventories the biodiversity of the Campus
5. To document the waste disposal system of the Campus

d. ABOUT KARMVEER VITTAL RAMJI SHINDE SANSTHA'S

In the year 1974 Shivraj College was handed over to Karmveer Vitthal Ramaji Shinde Shikshan Sanstha, Gadhinglaj. Hon. Shri. Balasaheb alias R. S. Mane, the President of Karmveer Vitthal Ramaji Shinde Shikshan Sanstha, Gadhinglaj gave the dynamic leadership to this institute. He tried his best to fulfill the educational needs of the students of this area by introducing the faculty of Science both at Junior and Senior College level. Shri. D. S. Kadam then Vice-president donated Rs. Two Lac to meet the expenses of the faculty of Science.

Hon. Shri. Balasaheb alias R. S. Mane, Shri. D. S. Kadam concentrated on the construction of new buildings. The foundation stone of the new building was laid at the hands of Hon. Yashavantrao Chavan and Hon. Vasantdada Patil the then Chief Minister of Maharashtra.

e. Shivraj College of Arts, Commerce & D. S. Kadam Science College, Gadhinglaj, Kolhapur

I am grateful to the representative of Chhatrapati Shivaji Maharaj and the work of Karmveer Vitthal Ramji Shinde and keeping the representative reflection of the progress of the 'shivraj' that has passed from the year 1964 to the Golden Jubilee. Our Shivraj has made an impression of our independence in the educational, social, cultural and sports fields. Today, this college is known as an ideal and perfect college. The leadership of the shaikshnik movement in rural areas has been able to get thousands of students from self-sufficiency, self-control and self-government and have continuously kept the lamp of knowledge in their life. Art, sports literature, commerce, science, electronics, computers, science and technology are all in full swing. Now they are transformed into 'Shivraj Vidhya Sankul'. Many such students come enthusiastically for knowledge and knowledge, with the degree of happiness, along with the degree of happiness, the stubbornness of life is realized.

In June, 1964, the then MP of Kolhapur, Late V.T.Patil gave a generous response to this college established by Dr. S.S.Ghali. In June 1974, this college was transferred to the Karamvir Vitthal Ramji Shinde Education Society from Tararani College. In view of the requirement of the Department in the year 1982 in the month of july, the branches started.Under the guidance of MP Late Balasaheb Mane and Late D.S.Kadam the college flourished. Then chairmanship was offered to, Prof. Kisanrao Kurade. The college has made huge strides under their studious and skilled leadership. Their dreams have got a tangible look. Today B.B.A.,B.C.A.,B.C.S.,B.Sc(Comp.),M.Sc(Comp.),B.Sc.Micro Biology,M.B.A, along with the traditional education of B.A, B.Com, B.Sc., M.A., M.Com, M.Sc., Chemistry. These business curriculum have been started. An independent department has been started for this. All the departments of the college are progressing and the best results are in the cost. Our students are shining due to quality of the College .The academic year 2015-2016 art department and 2016-17 science department have secured the first position in the 'Shivaji College Quality Scholarship' scheme in Municipal section. N.S.S., N.C.C., Fine Arts Forum, Various Wangmi Mandals, Seminars, Camps, Trips, Studies, Various Competitions, Fraternity, 70634 Library of Library, Science Department Laboratory, 250 Computer Labs etc. The children develop children's overall development. There is no doubt that this college will continue to be progress as a proportion of the 'Parmo dharma' of the organization .We heartily Welcome you to this college. We wish you luck for moulding your personality in this college.

The college is located in rural and hilly area of Kolhapur district. The college meet the needs of students belonging to main stream of the society. It has tried to enrich the aspiration of the students belonging to educationally backward region of Kolhapur.

The main goals of our institution are to transmit education at grass root level and to build up all round personality of a student.

Vision

- Giving higher education to the students and preparing them to build strong India based on reasoning, conscience, compassion and philanthropy.

Mission

- Our mission is to provide quality education to the students of Gadhinglaj, Ajara, Chandgad Tahsils and Maharashtra, Karnataka, Goa-Kokan border areas to change their minds with newly advanced Socio-Economic knowledge and technology.

Goal

- To promote professional education to the rural students in the field of Humanities, Commerce, Science and Technology
- To motivate and to encourage research activities among the teachers and students for upliftment of the society.
- To maintain discipline, decorum and nationality in the students.
- To create awareness regarding environmental conservation.

OBJECTIVES

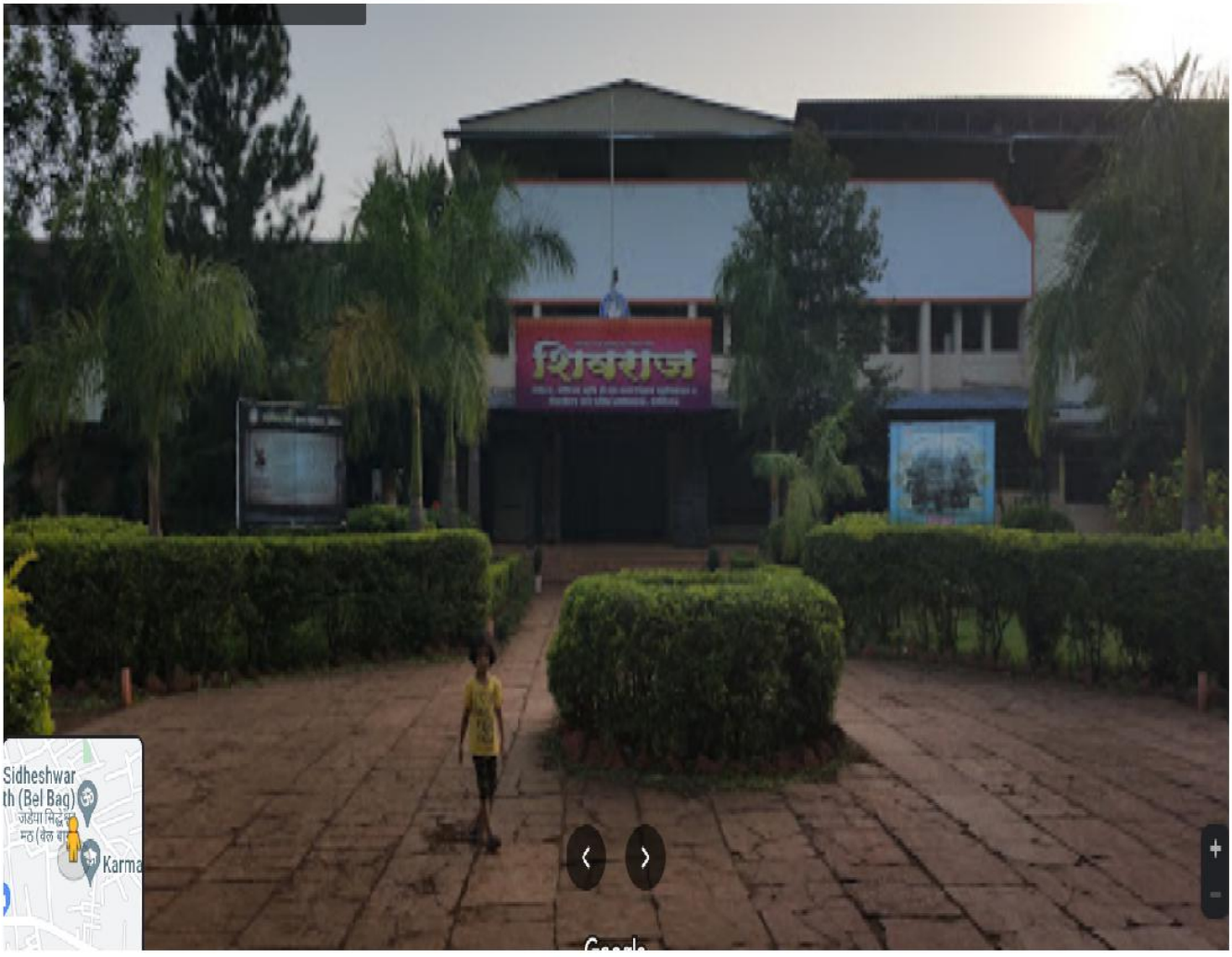
- To create awareness about standards of education and to develop self-respect in the personality of students.
- In the wake of growing needs of e-governance to expose the students to the new technologies and trends so as to prepare them to face the challenge at global level.
- To undertake faculty development programmers to enhance the academic quality of the institute.
- To start professional's courses based on computer technology to prepare our products for the growing demands of job market.

Infrastructure Shivraj College of Arts, Commerce & D. S. Kadam Science College, Gadhinglaj, Kolhapur

Institution, consist of Ground floor and G+2 buildings, is situated at Gadhinglaj with necessary infrastructure for the departments of all the faculties. A proper care is taken to provide basic amenities for the students & the staff members. The facilities are as follows….

- **Classroom:** 8 spacious classrooms with necessary furniture & blackboards in all buildings of the college.
- **Library:** The library of the college is big stored independent building with qualified staff and more than 17 thousand books.
- **Laboratory:** 14 spacious laboratories with Computers with Battery backup, Printer, Scanner, LCD projectors & equipment's & furniture etc.
- **Demo Room:** 7 spacious demo rooms with proper infrastructure.
- **Administrative Office:** The spacious LAN computerized administrative office with 19 cabins and modern technology & with necessary facilities.
- **Open Air Theatre:** An open air theatre of 4000 sq. ft. with paving blocks & stage is used for the big functions.
- **Covered Auditorium:** 2400 sq. ft. Covered Auditorium with a proper sitting capacity.
- **Conference Hall:** Independent conference hall with necessary facilities for different activities of the departments.
- **Study Room**: In the library building one study room for students & one study room for boys & girls students. Both the study rooms are spacious & necessary furniture & facilities, drinking water, toilet etc.
- **Reading Room:** 2 study rooms, 1 for PG and 1 for UG.
- **Ladies room: 1** **BoysRoom: 1**
- **Museum:** Developed 3 number of museums for study.
- **Animal House:** 1 animal house is developed by pharmacology department as per requirement.

- **Canteen:** One canteen in the campus providing tea & snacks with the size of 2000 sq. ft.
- **Hostel:** Boys and Girls' hostel with facility of rooms with beds, canteen, T.V., Study Room with newspapers. With proper capacity as per requirement.
- **Toilets:** Total number of toilets are 67 including college, office, hostels, etc.
- **Botanical Garden:** We have developed 11500 sq. ft. garden for trees & plants with many types of species.



Methodology

The college has conducted Environment Audit in the year 2018-19, on a yearly basis. The audit was carried out in three phases.

a. Questionnaire survey:

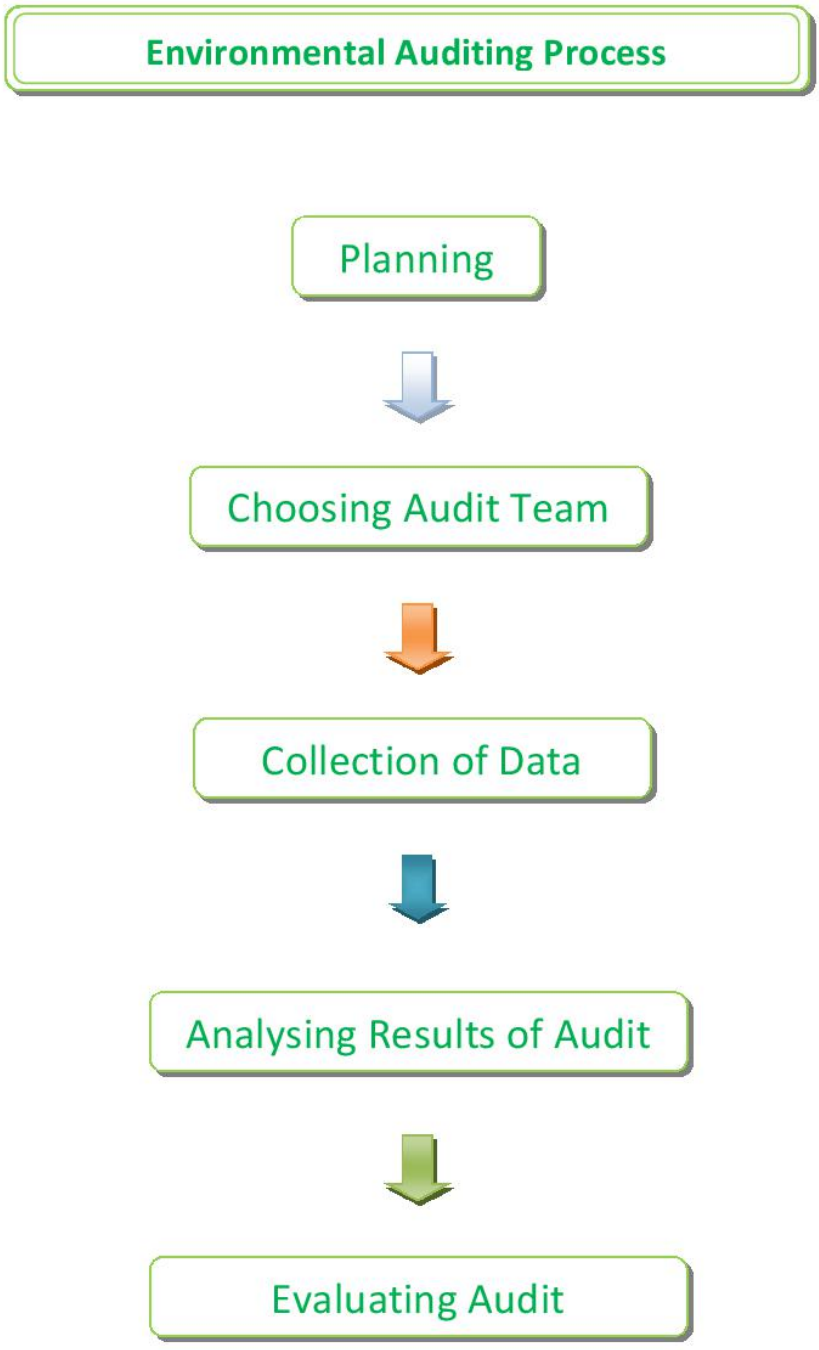
It includes administrative issues associated with the planning of audit, selecting the personnel for the audit team, preparing the audit protocol used by organization, obtaining background information, etc. The scope of the audit was defined at this step. It was decided that the information related to Water and Wastewater management, Energy conservation, green belt, Carbon inventory, Solid waste management, Hazardous waste management, Air and noise quality status, activities of nature club, etc. should be gathered for the audit purpose. For collecting data related to these different areas, specific questionnaires were prepared.

b. Onsite visit and observations:

The data related to above mentioned areas was collected by visiting each and every facility of college campus. The questionnaires were filled up according to the present situation. Photographic documentation was also done with the help of sophisticated camera.

c. Data analysis:

After collection of secondary data, the reviews related to each environmental factor were taken by the Environment audit team. The data was tabulated, analysed and graphs were prepared using computer. Depending upon the observations and data collected, interpretations were made. The lacunas and good practices were documented. The Environmental Management Plan (EMP) was prepared for the next academic year in order to have better environmental sensitization. Finally, all the information was compiled in the form of Environment Audit Report.


Environmental Auditing Process
Planning
Choosing Audit Team
Collection of Data
Analysing Results of Audit
Evaluating Audit

Overview of Environment Audit

Shivraj College of Arts, Commerce & D. S. Kadam Science College, Gadhinglaj, Kolhapuris situated in Maharashtra at **16°22'89289"N**and **74°34'51064"E**, in the Kolhapur District and it is at altitude of 700 fts above mean sea level.

Satellite image of Shivraj College of Arts, Commerce & D. S. Kadam Science College, Gadhinglaj, Kolhapur Campus

Source: Google Earth

a) Entrance

b) College Main Building

c) Parking

d) Library

e) Lecture Building

f) Botanical Garden

g) Sanstha Office

h) Labs

In its effort towards creating an eco-friendly campus, the college encourages its Faculty and Students to engage in conserving the Campus environment, its flora and fauna, through activities that include individual and collaborative study, conservation practices, activities and initiatives of the Eco Club.

Solar Water Heating System

Solar water heating system is a device that helps in heating water by using the energy from the SUN. This energy is totally free. Solar energy (sun rays) is used for heating water. Water is easily heated to a temperature of 60-80o C. Solar water heater of Solar water heaters (SWHs) of 100-300 liters capacity are suited for domestic use. Larger systems can be used in restaurants, canteens, guest houses, hotels, hospitals etc. A 100 litres capacity SWH can replace an electric geyser for residential use and may save approximately 1500 units of electricity annually. The use of 1000 SWHs of 100 litres capacity each can contribute to a peak load saving of approximately 1 MW. A SWH of 100 litres capacity can prevent emission of 1.5 tons of carbon dioxide per year.

Working Of a Solar Water Heater

The Sun's rays fall on the collector panel (a component of solar water heating system). A black absorbing surface (absorber) inside the collectors absorbs solar radiation and transfers the heat energy to water flowing through it. Heated water is collected in a tank which is insulated to prevent heat loss. Circulation of water from the tank through the collectors and back to the tank continues automatically due to thermo siphon system. Based on the collector system, solar water heaters can be of two types: A solar water heater consists of a collector to collect solar energy and an insulated storage tank to store hot water. The stored hot water can be used later any time.

Main Components Of Solar Water Heating System

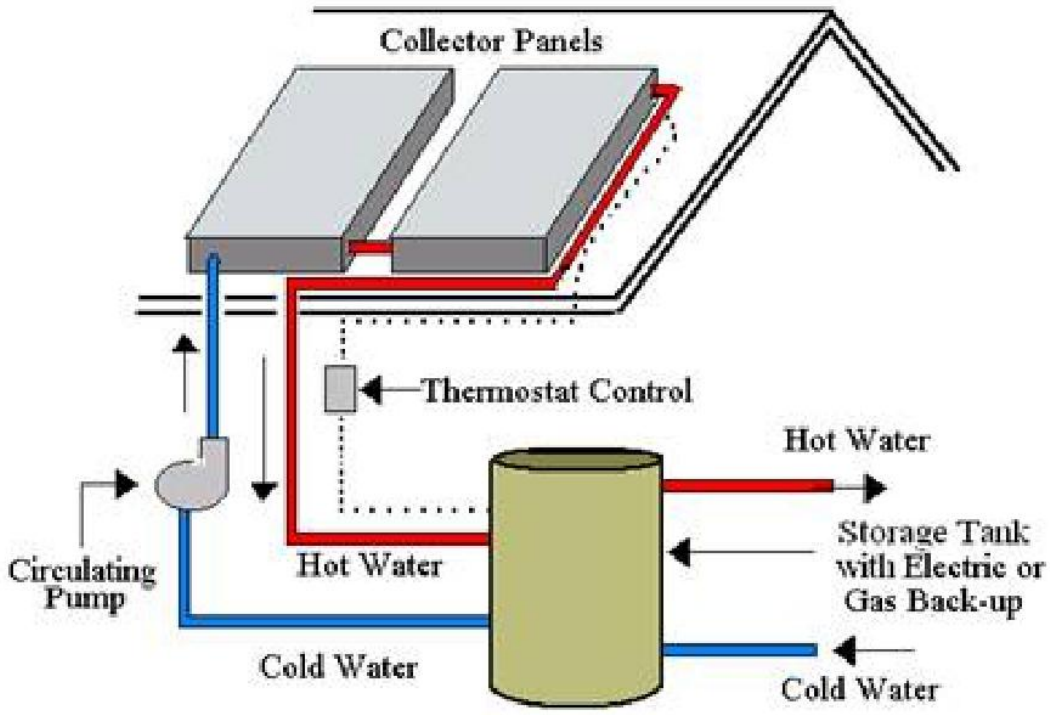
Main components of solar water heater system are

- Solar Collector(to collect solar energy)
- Insulated tank (to store hot water)
- Supporting stand
- Connecting pipes and instrumentation etc.

Applications of Solar Water Heater

- Water heating is one of the most cost-effective uses of solar energy. Every year, several thousands of new solar water heaters are installed worldwide. Solar water heaters can be used for Homes, Community Centers, Hospitals, Nursing homes, Hotels, Restaurants, Dairy plants, Swimming Pools, Canteens, Ashrams, Hostels, Industry etc. Use of solar water heater can curtail electricity or fuel bills considerably.

- Usage of solar water heater for any application where steam is produced using a boiler or steam generator can save 70-80% of electricity or fuel bills. A residence can save 70-80% on electricity or fuel bills by replacing its conventional water heater with a solar water heating system. Solar water heaters are known to have the fastest repayment of investment in 2 to 4 years depending upon use and fuel replaced.



Active Solar Water Heating System

The solar is installed on institution building of hostels with capacity of 5000 litres/day.

c. Total Electric Energy Audit :

An electricity audit is simply an audit or calculation of how much electricity you are using in your home and of where that electricity is going.

An energy audit is an analysis of a facility, indicating how and where that facility can reduce energy consumption and save energy costs. Its insight to energy efficiency and conservation can lead to significant savings on the company's utility.

Importance of Electric energy Audit:

- The audit will not only inform you of opportunities but provide you with financial analysis. This will enable prioritization based on financial benefit and return on investment.
- Provide you with solid, easy to understand technical information regarding the proposed energy conservation measures.
- A good quality audit will analyze your historical energy use and find potential issues using statistical methods.
- Provide you with emissions analysis to help you understand the benefits of your decisions from an environmental standpoint.
- Understand where energy is used and which areas are worth focusing on the most (energy hogs).
- Provide you with benchmark information to help you understand your energy use performance compared to others in your field and area.

Electricity and energy audit:

This indicator addresses energy consumption, energy sources, energy monitoring, lighting, appliances, natural gas and vehicles. Energy use is clearly an important aspect of campus sustainability and thus requires no explanation for its inclusion in the assessment. However, many may not realize how much influence the higher education sector has in the larger energy market. Energy sources utilized by all the departments and common facility centres include electricity, liquid petroleum and LPG. Major use of energy is in Science Department, office, canteen, and laboratories for lighting, transportation, cooking and laboratory work. Energy consumption by energy consuming in college is **1360.86 KwH/Week.** Due to lack of adequate ventilation and natural light in rainy season some part of infrastructure more consumption of electricity at air and light appliances in the college is increased. Hence, survey of adequate ventilation and natural light of infrastructure is essential. Also high consumption of electricity

is observed at office in duration of admission and examination. In science department like Physics, Chemistry, Mathematics, Botany and Zoology electricity was shut downed after occupancy time is one of greening practices for energy conservation. Audit shows major non-teaching staff is nearer to campus for resident and mass number of students are come from nearby villages of Gadhinlaj hence consumption in fuel is less. As our college is situated in rural area very less number of students are using vehicles, 50 % of staff using four wheelers is high in number. Study shows about 1.5% students were use two wheeler, 9.92% students come to the college by walking, 0.90 % student are using bicycle and, 3.05% students were lifted by their parents to college, 84.57 % are using state transportation vehicles and no any student make use of public transportation like bus.

Staff members who lived out campus are using the vehicles in sharing for daily transportation. Study tours, collection tours, visits are followed by college which gives the message of importance of walking which is very good green practice. Consumption of LPG for education or practical purpose is very less. The LPG connection in name of the college and LPG is handled by departments of Chemistry. For heating purpose at the time of practical, no leakages and off mode regulators are seen at time of verification.

Total Energy usage per week in KwH = 1360.86

Total lightning usage per week in KwH = 249.89

From total lightning regular light usage = 108.08 KwH/week

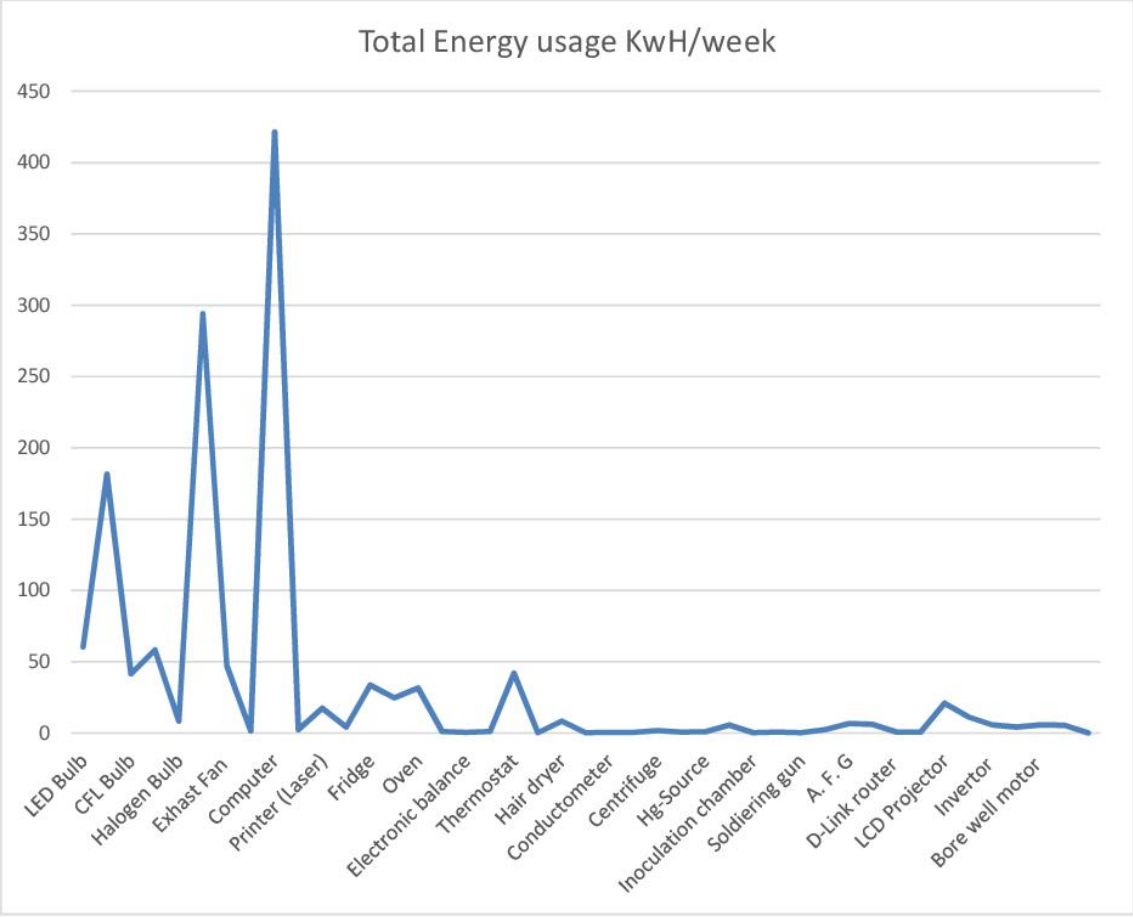
From total lightning LED light usage = 141.81 KwH/week

That is percentage of LED light usage against regular light per week is 56.75%

Electricity Usage Survey calculations chart of Shivraj college, Gadhinglaj as follows :

Type	Quantity	Watts	Total Watts	Hours per day	Energy per day	KWH/week
LED Bulb	**77**	14	1078	8	8624	**60.368**
LED Tube Lights	**180**	18	3240	8	25920	**181.44**
CFL Bulb	**37**	20	740	8	5920	**41.44**
Tube Lights	**52**	40	2080	4	8320	**58.24**
Halogen Bulb	**2**	150	300	4	1200	**8.4**
Ceiling fan	**140**	75	10500	4	42000	**294**
Exhast Fan	**14**	60	840	8	6720	**47.04**
Wall Fan	**1**	50	50	4	200	**1.4**
Computer	**172**	175	30100	2	60200	**421.4**
Printer (inkjet)	**4**	40	160	2	320	**2.24**
Printer (Laser)	**5**	250	1250	2	2500	**17.5**
Printer (All in one)	**2**	300	600	1	600	**4.2**
Fridge	**2**	150	300	16	4800	**33.6**
Freezer	**1**	220	220	16	3520	**24.64**
Oven	**3**	1500	4500	1	4500	**31.5**
Furnace	**1**	300	300	0.5	150	**1.05**
Electronic balance	**4**	15	60	1	60	**0.42**
Vacuum pump	**2**	80	160	1	160	**1.12**
Thermostat	**2**	3000	6000	1	6000	**42**
Colorimeter	**2**	20	40	1	40	**0.28**
Hair dryer	**1**	1200	1200	1	1200	**8.4**
pH Meter	**2**	10	20	2	40	**0.28**
Conductometer	**3**	10	30	2	60	**0.42**
Potentiometer	**3**	12	36	2	72	**0.504**
Centrifuge	**1**	120	120	2	240	**1.68**
Na-Source	**1**	80	80	1	80	**0.56**
Hg-Source	**1**	55	55	2	110	**0.77**
Freq Gen	**10**	40	400	2	800	**5.6**
Inoculation chamber	**1**	20	20	1	20	**0.14**
Dimmer stat	**2**	20	40	2	80	**0.56**
Soldiering gun	**3**	25	75	0.5	37.5	**0.2625**
DC power supply	**8**	10	80	4	320	**2.24**
A. F. G	**6**	40	240	4	960	**6.72**
C C TV	**6**	6	36	24	864	**6.048**

D-Link router	**2**	6	12	8	96	**0.672**
Home Theater	**1**	90	90	1	90	**0.63**
LCD Projector	**5**	300	1500	2	3000	**21**
Zerox Machine	**2**	800	1600	1	1600	**11.2**
Invertor	**1**	400	400	2	800	**5.6**
Charging Points	**121**	2.5	302.5	2	605	**4.235**
Bore well motor	**1**	800	800	1	800	**5.6**
Back Up	**1**	390	390	2	780	**5.46**
	Total Energy usage per week in KwH					**1360.8595**



Graphical representation of Total Energy usage KwH/week

Solar System for Electricity:

Solar power is pollution free and causes no greenhouse gases to be emitted after installation. Reduced dependence on foreign oil and fossil fuels. Renewable clean power that is available every day of the year, even cloudy days produce some power.

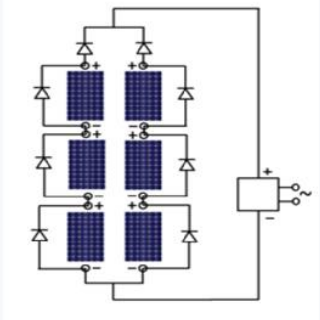
Theory and construction

Photovoltaic modules use light energy (photons) from the Sun to generate electricity through the photovoltaic effect. Most modules use wafer-based crystalline silicon cells or thin-film cells. The structural (load carrying) member of a module can be either the top layer or the back layer. Cells must be protected from mechanical damage and moisture. Most modules are rigid, but semi-flexible ones based on thin-film cells are also available. The cells are usually connected electrically in series, one to another to the desired voltage, and then in parallel to increase current. The power (in watts) of the module is the mathematical product of the voltage (in volts) and the current (in amperes) of the module. The manufacturing specifications on solar panels are obtained under standard condition, which is not the real operating condition the solar panels are exposed to on the installation site.

A PV junction box is attached to the back of the solar panel and functions as its output interface. External connections for most photovoltaic modules use MC4 connectors to facilitate easy weatherproof connections to the rest of the system. A USB power interface can also be used.

Solar panels also use metal frames consisting of racking components, brackets, reflector shapes, and troughs to better support the panel structure.

Module interconnection



A connection example, a blocking diode is placed in series with each module string, whereas bypass diodes are placed in parallel with modules.

Module electrical connections are made with conducting wires that take the current off the modules and are sized according to the current rating and fault conditions.

Panels are typically connected in series of one or more panels to form strings to achieve a desired output voltage, and strings can be connected in parallel to provide the desired current capability (amperes) of the PV system.

Blocking and bypass diodes may be incorporated within the module or used externally, to deal with partial array shading, to maximize output. For series connections, bypass diodes are placed in parallel with modules to allow current to bypass shaded modules which would be high resistance. For paralleled connections, a blocking diode may be placed in series with each module's string to prevent shaded strings' internal impedance from short circuiting other strings.

Concentrator

Some special solar PV modules include concentrators in which light is focused by lenses or mirrors onto smaller cells. This enables the use of cells with a high cost per unit area (such as gallium arsenide) in a cost-effective way.

Inverters

In general with solar panels, if not enough current is taken from PVs, then power isn't maximised. If too much current is taken then the voltage collapses. The optimum current draw depends on the amount of sunlight striking the panel. Solar panel capacity is specified by the MPP (maximum power point) value of solar panels in full sunlight.

Solar inverters convert the DC power to AC power by performing the process of maximum power point tracking (MPPT): solar inverter samples the output Power (I-V curve) from the solar cell and applies the proper resistance (load) to solar cells to obtain maximum power.

MPP (Maximum power point) of the solar panel consists of MPP voltage (V mpp) and MPP current (I mpp): it is a capacity of the solar panel and the higher value can make higher MPP.

Solar panels are wired to inverters in parallel or series (a 'string'). In string connections the voltages of the modules add, but the current is determined by the lowest performing panel. This is known as the "Christmas light effect". In parallel connections the voltages must be the same to work, but currents

add. Arrays are connected up to meet the voltage requirements of the inverters and to not greatly exceed the current limits.

Micro-inverters work independently to enable each panel to contribute its maximum possible output for a given amount of sunlight, but can be more expensive.

Efficiency

Each module is rated by its DC output power under standard test conditions (STC) and hence the on field output power might vary. Power typically ranges from 100 to 365 Watts (W). The efficiency of a module determines the area of a module given the same rated output – an 8% efficient 230 W module will have twice the area of a 16% efficient 230 W module. Some commercially available solar modules exceed 24% efficiency. Currently, the best achieved sunlight conversion rate (solar module efficiency) is around 21.5% in new commercial products typically lower than the efficiencies of their cells in isolation. The most efficient mass-produced solar modules[disputed – discuss] have power density values of up to 175 W/m2 (16.22 W/ft2).

Scientists from Spectro lab, a subsidiary of Boeing, have reported development of multi-junction solar cells with an efficiency of more than 40%, a new world record for solar photovoltaic cells. The Spectro lab scientists also predict that concentrator solar cells could achieve efficiencies of more than 45% or even 50% in the future, with theoretical efficiencies being about 58% in cells with more than three junctions.

Capacity factor of solar panels is limited primarily by geographic latitude and varies significantly depending on cloud cover, dust, day length and other factors.

Technology

Most solar modules are currently produced from crystalline silicon (c-Si) solar cells made of multicrystalline and monocrystalline silicon. In 2013, crystalline silicon accounted for more than 90 percent of worldwide PV production, while the rest of the overall market is made up of thin-film technologies using cadmium telluride, CIGS and amorphous silicon.

Emerging, third generation solar technologies use advanced thin-film cells. They produce a relatively high-efficiency conversion for a lower cost compared with other solar technologies. Also, high-cost, high-efficiency, and close-packed rectangular multi-junction (MJ) cells are usually used in solar

panels on spacecraft, as they offer the highest ratio of generated power per kilogram lifted into space. MJ-cells are compound semiconductors and made of gallium arsenide (GaAs) and other semiconductor materials. Another emerging PV technology using MJ-cells is concentrator photovoltaics (CPV).

Thin film

In rigid thin-film modules, the cell and the module are manufactured on the same production line. The cell is created on a glass substrate or superstrate, and the electrical connections are created in situ, a so-called "monolithic integration." The substrate or superstrate is laminated with an encapsulant to a front or back sheet, usually another sheet of glass. The main cell technologies in this category are CdTe, or a-Si, or a-Si+uc-Si tandem, or CIGS (or variant). Amorphous silicon has a sunlight conversion rate of 6–12%.[citation needed]

Flexible thin film cells and modules are created on the same production line by depositing the photoactive layer and other necessary layers on a flexible substrate. If the substrate is an insulator (e.g. polyester or polyimide film) then monolithic integration can be used. If it is a conductor then another technique for electrical connection must be used. The cells are assembled into modules by laminating them to a transparent colourless fluoro polymer on the front side (typically ETFE or FEP) and a polymer suitable for bonding to the final substrate on the other side.

The solar is installed on institution building with capacity of 500 kw, and right now only used for single building using only 300 to 350 units per day. Whatever available balance will be reversed to MSEB.

Solar Panel

CONCLUSION

The SSP Nature Solutions Environment consultant Pvt. Ltd., Kolhapur has conducted a Environment Audit of Shivraj College of Arts, Commerce & D. S. Kadam Science College, Gadhinglaj, Kolhapur in the academic year 2021-22. Environment auditing is the process of identifying and determining whether institution practices are eco-friendly and sustainable. The main objective of college to carry out Environment audit is to check Environment practices followed by college and to conduct a well formulated audit to understand where we stand on a scale of environmental soundness.

Conclusions:

From the Environment audit conducted by college following are some of the conclusions which can be taken for improvement of the college campus to become environment friendly college campus.

1. Electricity consumption is more at science departments.
2. Use of fans and LED lamps in the college is good.
3. Solar System is used for electric generation and water heating at hostel.
4. Toilets and bathrooms are consuming more lights.
5. Internal road lights used above limits.
6. Passage lights are used without reason.

Recommendations:

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

1. The data related to all measured environmental parameters should be monitored and recorded regularly and information be made available to administration.
2. The college should develop internal procedures to ensure its compliances with environmental legislation and responsibility be fixed to carry out it in practice.
3. All street lighting should be changed to LED lights and solar systems to save electricity.
4. Take care of unwanted usage of lightning devices.
5. Gave few access to students for lightning and charging switches.
6. College having huge space, should develop own solar system for total campus.