

Energy



Audit

2022-23



ST. XAVIER'S COLLEGE MAHUADANR
(Affiliated to Nilamber-Pitamber University, Medininagar)
Accredited by NAAC at 'B' grade(1st Cycle)

St. Xavier's College, Mahuadanr

(Affiliated to Nilamber-Pitamber University, Medininagar)

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Energy Audit 2022-23



ABOUT THE PROJECT

The working details of the assignment are as follows: -

Project:	Energy Audit
Client:	St. Xavier's College, Mahuadanr
Segment:	Educational Building and Auditorium
Site:	Mahuadanr
Duration:	6 th April 2023 to 20 th April 2023

External Audit Members

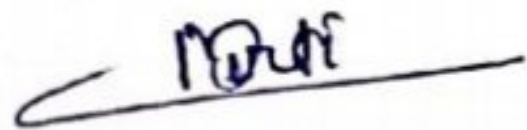
Mr. Shubhojeet Chakraborty	Electrical and Electronics Engineer Birla Institute of Technology, Ranchi
Mr. Shubham Toppo	Electrical and Electronics Engineer Birla Institute of Technology, Ranchi

Internal Audit Members

Dr. Fr. M. K. Jose SJ	Principal St. Xavier's College, Mahuadanr Sr. Kaslin Juliet Assistant Professor
Asst. Prof. Sr. Kaslin Juliet	IQAC Co-ordinator and Vice-Principal HoD, Department of Botany St. Xavier's College Mahuadanr
Asst. Prof. Binay Yadav	HoD, Department of Chemistry
Asst. Prof. Fr. Sanjay Martin SJ	Assistant Professor Department of Chemistry
Asst. Prof. Neha Minj	Assistant Professor Department of Mathematics
Asst. Prof. Anjna Ekka	Assistant Professor Department of Mathematics
Asst. Prof. Aaliya Nadim	Assistant Professor Department of Mathematics

ACKNOWLEDGEMENT

IQAC and Energy Audit Assessment Team thanks the Principal, St. Xavier's College, Mahuadanr for assigning the task of Energy Audit of SXCM to us. We appreciate the cooperation that we got from all the faculties and students during the entire process. Our special thanks to the Principal Dr. Fr. M.K. Jose SJ for his support and encouragement from the very beginning to the end of the process. We are also thankful to other staff and office members who were actively involved while the data collection and field measurements.



Fr. Sanjay Martin SJ
Co-ordinator,
Energy Audit Team
St. Xavier's College, Mahuadanr

DISCLAIMER

Energy Audit Team has prepared this report based on the data collected from the entire building of the college and auditorium. All reasonable care has been taken in its preparation. Details contained in this report have been compiled in trust based on information gathered.

Prepared by:

IQAC & Energy Audit Team SXCM



Principal
St. Xavier's College
Mahuadanr

ENERGY AUDIT

An Energy Audit is an inspection survey and an analysis of energy flows for energy conservation in a building. It may include a process or system to reduce the amount of energy input into the system without negatively affecting the output. In commercial and industrial real estate, an energy audit is the first step in identifying opportunities to reduce energy expense and carbon footprint. The need for an energy audit is to identify the savings potential and cost reducing methods, understand the ways in which fuel is used, where the waste occurs and find the scope for improvement.

An energy audit is proposed and conducted to ensure that energy saving practices are implemented and followed in Educational Institutions and Industrial sectors in a sustainable way. Energy audit involves several facts including energy savings potential, energy management, finding alternatives, etc. With these facts in mind, the audit's specific objectives are to assess the competence of the sustainability management and control system, as well as the departments' compliance with applicable rules, policies and standards. It has the potential to have a significant influence on the organization's operational cost as well as the environmental impact.

Eco-campus concept mainly focuses on the efficient use of energy and its conservation including savings opportunities in a sustainable manner. It also focuses on the reduction of contribution to carbon emissions, carbon footprint calculation, procurement of star rated equipment for a cost effective and secure supply of energy, encourage and enhance energy use conservation in all buildings, reduce the organization's energy consumption, reduce wastes to landfill, and integrate environmental considerations into all contracts and services considered to have significant environmental impacts.

The conduct of energy audit using internal and external energy auditors is playing important role in any Institution in terms of energy management. It is able to measure the impact of energy potential in an organization so that we can determine better ways to manage the impact on environment. It is necessary to know how much the organization is contributing towards sustainable development in terms of energy management is being done. It is therefore to recommend measuring the carbon footprint in each organization which may be useful for maintaining the eco-friendly campus to the stakeholders.

ENERGY AUDIT POLICY

Preamble:

Environment-friendly options and energy harvesting are of prime importance, which are the key factors in achieving Sustainable Development Goals (SDGs) for any organization. Rapidly and dynamically increasing energy requirement demands effective response. Hence, St. Xavier's College, Mahuadanr has incorporated alternate energy source in the form of Solar PV generation. The College's energy policy prefers efficient energy management and conservation through efficient procedures specified in its policy.

Statement:

The Energy policy of SXCM monitors, conserves and manages the energy needs of the campus, balancing the energy demand and supply. It is the responsibility of the institute to create awareness among the students and staff about the energy conservation measures. Efficiency is to be maintained with maximum utilization of Renewable PV Power Generating system and effective utilization of the Electric Energy, optimal consumption of lighting load with the proper energy conservation measures in the campus.

The following objectives will lead to the implementation of SXCM Energy policy

Objectives:

- Improvement in Energy efficiency to reduce Energy consumption and cost.
- Minimization of energy consumption by utilizing maximum use of day light and natural ventilation as the windows are glassed.

Action Plan:

- Conduct of External Energy Audit once in a year
- Meet the Energy needs of the campus with back-up power supply system for supplying uninterrupted energy demands.
- Establishment of energy efficient utilization measures in the supply, demand systems as part of energy management of the campus.

- Implementation of Sensor-based energy conservation.
- Replacement of the existing conventional lighting with the LED lamps.
- Expansion of Solar PV System.
- Create awareness among the students and staff in Energy conservation and management by conducting training programs.
- Obtain Energy Audit certification.
- Provide experts to industry and other organizations in the area of energy management by offering Energy Audit Services.

The Institute shall continuously review and update the approved policy and be committed to its implementation.

EXECUTIVE SUMMARY

The objective of the audit was to study the energy consumption pattern of the facility, identify the areas where potential for energy/ cost saving exists and prepare proposals for energy/cost saving along with investment and payback periods.

Objective of the Energy Audit:

The Energy Audit provides the vital information for overall energy conservation program in the college building, energy utilization analysis and evaluation of energy conservation measures.

The Role of an Energy Audit:

The energy Audit gives a positive orientation to the energy cost reduction, preventive maintenance and quality control program which are vital for production and utility activities. Such an audit program will help to keep focus on variations which occur in the energy costs, availability and reliability of supply of energy, decide on appropriate energy mix, identify energy conservation technologies, retrofit for energy conservation equipment etc. The primary objective of Energy audit is to determine ways to reduce energy consumption per unit of product output or to lower operating costs. The salient observations and

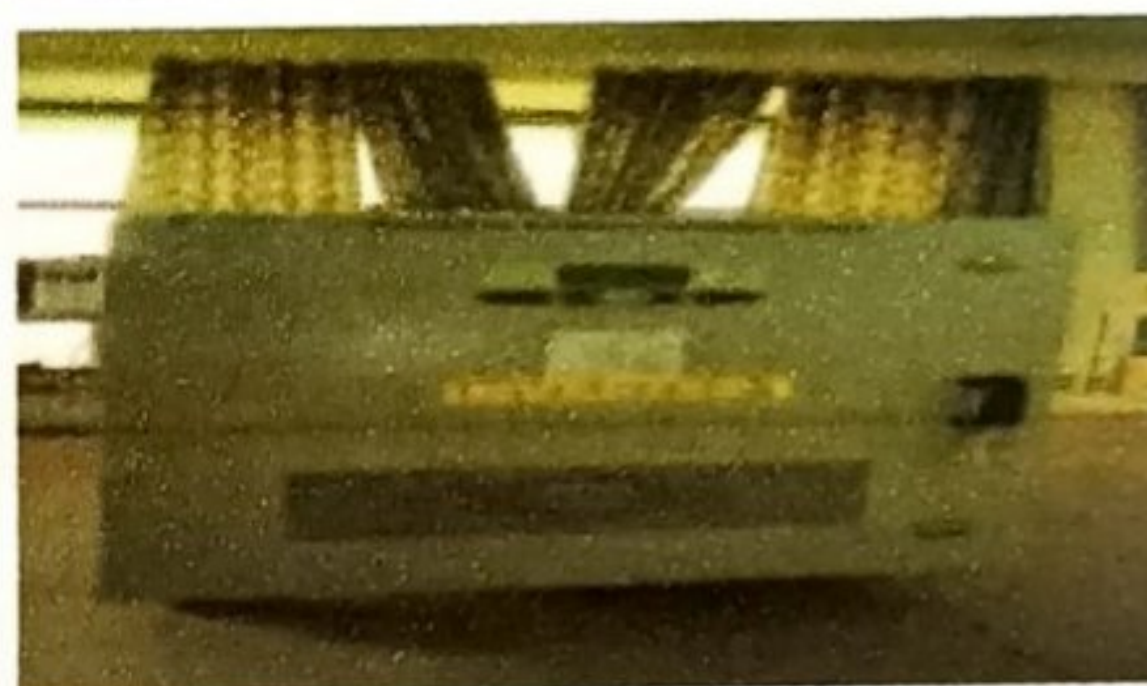
recommendations are given below.

St. Xavier's College, Mahuadanr uses energy in the following forms:

□ **From JBVNL(Jharkhand Bijli Vitran Nigam Limited)**

It is the largest electricity distribution company of Jharkhand State and the major source of electricity for the college building.

□ **Electricity SOLAR Grid connected solarplant**



The College has installed a 60 kb rooftop solar power system which feeds the energy need of the campus. The power deficit created by an unsteady supply of electricity by JBVNL at this remote location is thus met by solar energy.



☐ **HighSpeedDiesel Generator(HSDG)**

HSDG is also an alternative source of electric supply when it is needed in the college.

Electricalenergyisusedforvariousapplications. Thesearethefollowingsmajorconsu
mersofelectricityin the facility:

- ☐ Computers
- ☐ Lighting
- ☐ Fans
- ☐ Other Lab Equipments
- ☐ Printers
- ☐ Xerox machines
- ☐ UPS
- ☐ LCD Projector
- ☐ Router system
- ☐ Pumping motor



Principal's Office



Account's Office



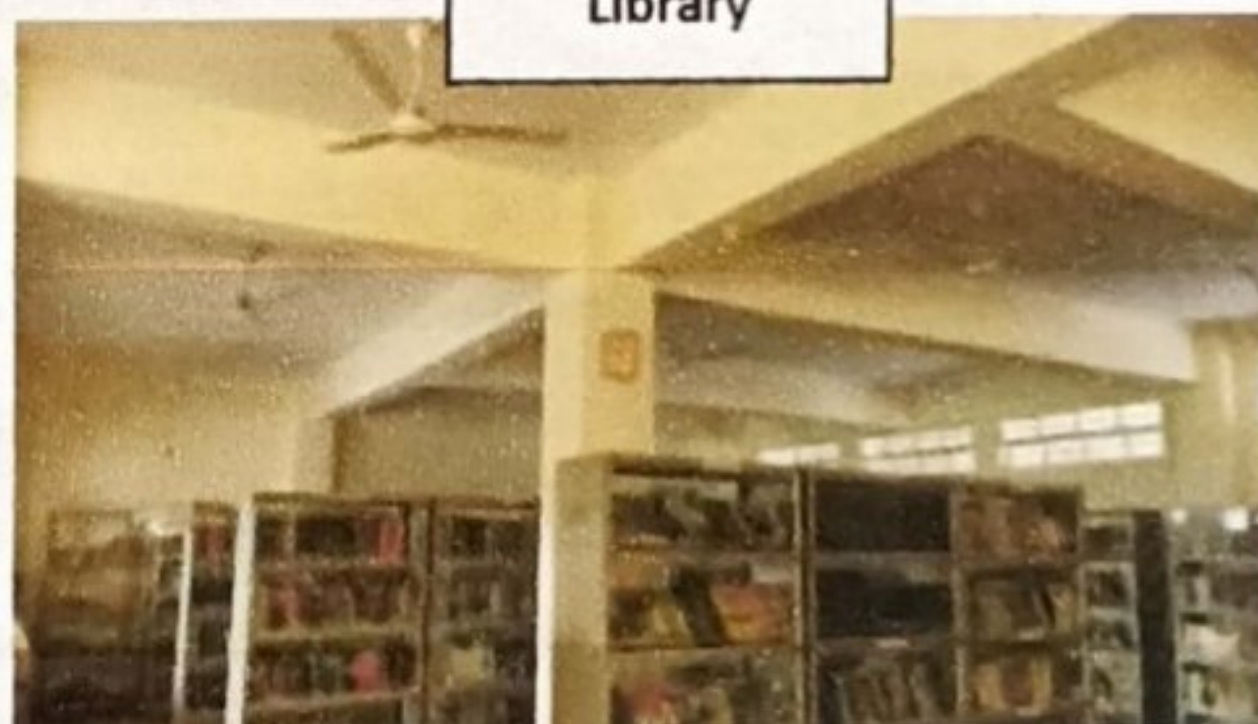
Computer Lab



ICT Room



Reading Room



Library



Auditorium

ABOUT THE COLLEGE:

St. Xavier's College, Mahuadanr is a co-educational Under-graduate institution in Latehar district of Jharkhand, situated amid nature's exotic scenic beauty. It was established in 2011 by Hazaribag Jesuit Education Society, to impart quality higher education primarily to the underprivileged students. However, being inclusive, the College admits students, irrespective of caste, creed, gender and economic disparities. This is the only institution of higher learning in this tribal dominated rural region. The College possesses 24.46 acres of land: 10 acres in its own name and 14.46 acres in that of the parent body. St. Xavier's College is affiliated to the Nilamber-Pitamber University, Medininagar, Palamu. A significant achievement of the College in year 2018 was going through the process of accreditation by NACC and obtaining "B" grade, despite of location difficulties. The College is imparting undergraduate level higher education in Arts, Science and Commerce streams with honors courses. For effective implementation of its program, the academic calendar is prepared meticulously, and plans are made for outcome-based education. Higher education policy is followed fastidiously. The lesson plans and the progress registers are maintained subject wise and stream wise. The students' feedbacks are obtained periodically. The Endeavour of the College is to take higher education to its peak. The College equips the students with new knowledge, skills, understanding and learning habits with positive attitude. Skill oriented certificate courses under UG program have been introduced. It has been certified by ISO 9001:2015. The IQAC of the college facilitates it in various extension and co-curricular activities. The holistic development of the students is the objective of the College. Accordingly research methodology has been initiated, motivating the staff and the students to take up research projects. National and International seminars, workshops and youth festivals are conducted at regular intervals. The pedagogy of the College aims at developing creative and critical thinking among the students. Dissemination of high morals and values for integrated development of the students is a major thrust of the college. Exploiting their potentials the students are inspired through the best possible higher education to become learned, service minded and leadership oriented citizens of tomorrow in the constantly changing world.

The College envisions quality higher education through promotion of learner-centric environment by quality parameters for holistic development of the students and staff. The college has high quality infrastructure, spacious classrooms, smart classrooms with ICT facilities, library with separate reading rooms with ICT facilities, well equipped science labs,



Geography and computer labs, indoors and outdoor games facilities, well-qualified and dynamic faculty that regularly updates itself to enhance teaching, research and outreach processes. Good education is transformative; hence realizing the responsibility involved in their citizenship through education in our college, they in turn will work for the transformation of the Society and the Nation. Hence the College strives hard and works together with relentless determination. Its emphasizes the all-round development of the students which is achieved through contextualized study through diverse academic activities and competitions which develop entrepreneurial skill, leadership quality, management skill, team spirit, communication and presentation skills, creativity thereby equipping them to plunge into the competitive world. Internship, Fieldtrips and Education trips are arranged that the students may relate the class room knowledge with the outside reality and confidently enter the exciting world of discovery and exploration. Academic and personal counseling is a regular feature of the College; it provides personal direction and developmental guidance. Counseling brings better rapport between the teachers and the students and the students are helped to deal with their personal challenges and their career planning. Accomplishment in the academic and co-curricular activities is a great achievement. There are six University toppers, the result is 100% and the students have become multidimensional. Co-curricular and extra-curricular activities promote the process of creative and critical thinking. They inculcate social and moral values, compassion, pride for one's culture and awareness of one's rights and duties; they also make the students good persons and confident leaders. The college develops versatile personality of the students and fills them with hope and dreams of greater success.

VISION:

"Inspired by the life and teaching of Jesus Christ and the Jesuit spirit of *"magis"* (for the greater and better), St. Xavier's College aspires to develop professionally competent and compassionately committed people for creating a just and humane society by promoting harmonious living with different socio-cultural groups and with the whole creation".

MISSION:

- To provide quality based academic excellence especially for tribal youth.
- To motivate students to be a people skill-oriented, competent, committed, conscientious and compassionate.

- To promote modern and scientific techniques as well as the cultural values of the local people.
- To capitalize on potential benefits for students in terms of research opportunities, mentoring and networking that are singular to comprehensive institutions.
- To sow the seeds of multifarious challenges of life among the tribal youth by means of understanding ethical dimensions of personal and professional life; also to procure means of examining their own values, attitudes and beliefs.
- To prepare students for a life of meaningful professional service and leadership.

AIMS:

It aims at

- To study the energy consumption in the entire college campus.
- Identifying the quality and cost of various energy inputs.
- To identify the potential areas of energy optimization.
- Implementation of measures for energy conservation and realization of savings.

Steps for Energy Managements and Energy audit:

- ❖ Action to set implementation priority
- ❖ Observation of the energy consumption of electrical appliances within the college building.
- ❖ Analyze energy usage history to create a base for which saving can be measured in the building.

To determine what can be done to reduce energy consumption throughout the building and what options can be used for the improvement if funding is available.

Study of Month wise Load Factor Variation

Electrical Load factor is a measure of the utilization rate, or efficiency of electrical energy usage. It is the ratio of total energy (KWh) used in the billing period divided by the possible total energy used within the period, if used at the peak demand (KW) during the entire period.

Thus, **Load Factor**=KWh/(KW/hours in the period/number of days in the billing cycle)

For example,

Let, total kWh =36000 kWh

Demand= 100 kWh

No. Of days =30 days

Hours per day=24 hrs

Solution:

$$\text{Monthly load factor} = \frac{36000}{100 \times 30 \times 24} = 0.50$$

S. No.	Month	Load Factor
1	May-22	0.0927
2	June-22	0.1020
3	July-22	0.116
4	Aug-22	0.087
5	Sept-22	0.05413
6	Oct-22	0.04229
7	Nov-22	0.10155
8	Dec-22	0.05238
9	Jan-23	0.09996
10	Feb-23	0.1562
	Average	0.090421

TOTAL ENERGY CONSUMPTION (Ten months)=21657.00 KWH

AVERAGE ENERGY CONSUMPTION (PER MONTH)=216.57 KWH (approx.)

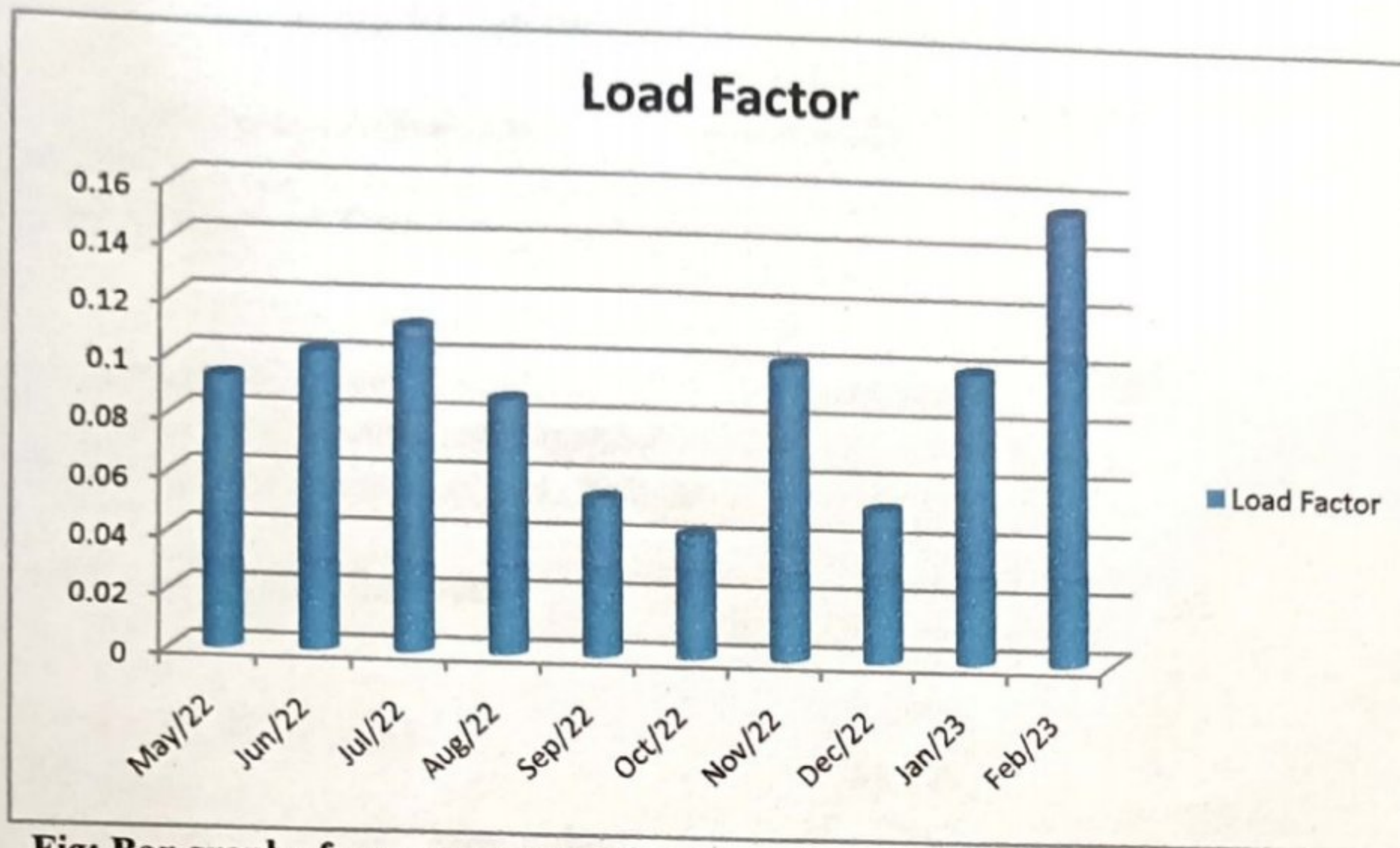


Fig: Bar graph of energy consumption in a college building in a year.

We have analyzed from the bar graph that load factor ratio above 0.08 electrical uses is reasonably efficient. Load factor below 0.08 denote slower consumption of energy as per demand. From the above bar graph the highest load factor is in the month of February 2023 i.e. energy consumption was high as per the demand.

RECOMMENDATION:

- All Class Rooms and labs to have Display Messages regarding optimum use of electrical appliances in the room like lights, fans, computers and projectors.
- Display the stickers of save electricity, save nature everywhere in the campus.
- All projectors to be kept OFF or in idle mode if there will be no presentation slides.
- All computers to have power saving settings to turn off monitors and hard discs, say after 10 minutes/30 minutes.
- Lights in toilet area may be kept OFF during daytime.
- Need to focus on existing solar plant which is generating power below the rated power.

Action Taken Report

Display Messages for Optimum Electrical Appliance Use:

Installed display messages in all classrooms and labs emphasizing the optimal use of electrical appliances such as lights, fans, computers, and projectors.

The messages provide tips on energy-saving practices and remind occupants to switch off appliances when not in use.

Promotion of Energy Conservation Stickers:

Distributed "Save Electricity, Save Nature" stickers throughout the campus, prominently displaying them in common areas, classrooms, and labs.

Conducted awareness campaigns to encourage students, faculty, and staff to adopt energy-saving behaviors and promote environmental sustainability.

Projector Management for Energy Efficiency:

Implemented a policy requiring all projectors to be kept off or in idle mode when not actively used for presentations.

Educated faculty and staff on the importance of minimizing projector usage to conserve energy and reduce operational costs.

Power Saving Settings for Computers:

Configured power-saving settings on all computers campus-wide to automatically turn off monitors and hard disks after periods of inactivity.

Conducted training sessions for computer users to promote awareness and compliance with power-saving measures.

Efficient Toilet Area Lighting Management:

Implemented regular inspections to monitor the effectiveness of the lighting management system and address any issues promptly.

Focus on Solar Plant Optimization:

Conducted a thorough assessment of the existing solar power plant to identify factors contributing to below-rated power generation.

Implemented corrective measures to optimize the performance of the solar plant, including maintenance, repairs, and upgrades as necessary.

Enhanced monitoring and management practices to ensure the solar plant operates at its full capacity and contributes effectively to energy needs.

Name and Signature of the Energy Audit team 2022-23

External Audit Members

Mr. Shubhojeet Chakraborty
Electrical and Electronics Engineer
Birla Institute of Technology, Ranchi

shubhojeet chakraborty

Mr. Shubham Toppo
Electrical and Electronics Engineer
Birla Institute of Technology, Ranchi

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Kaslin

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N. Minj

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Aaliya

Binay Pandanathji



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About the Project

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Project:	Energy Audit
Client:	St. Xavier's College, Mahuadanr
Segment:	Educational Building
Site:	C49C+HGF, Rajdanda, Mahuadanr
Project Scope:	1) Reviewing the energy consumption behaviour of the institution and verification of energy inventories. 2) Reviewing of existing / opportunities for non-conventional sources of energy. 3) Recommendation for energy efficient measures & cost benefit analysis.

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ENERGY AUDIT POLICY

Preamble:

Environment-friendly options and energy harvesting are of prime importance, which are the key factors in achieving Sustainable Development Goals (SDGs) for any organization. Rapidly and dynamically increasing energy requirement demands effective response. Hence, St. Xavier's College, Mahuadanr has incorporated alternate energy source in the form of Solar PV generation. The College's energy policy prefers efficient energy management and conservation through efficient procedures specified in its policy.

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- The Institute shall continuously review and update the approved policy and be committed to its implementation.

EXECUTIVE SUMMARY

The objective of the audit was to study the energy consumption pattern of the facility, identify the areas where potential for energy/ cost saving exists and prepare proposals for energy/cost saving along with investment and payback periods.

Objectives of Energy Audit

The Energy Audit provides the vital information for overall energy conservation program in the college building, energy utilization analysis and evaluation of energy conservation measures.

The Role of an Energy Audit

The energy Audit gives a positive orientation to the energy cost reduction, preventive maintenance and quality control program which are vital for production and utility activities. Such an audit program will help to keep focus on variations which occur in the energy costs, availability and reliability of supply of energy, decide on appropriate energy mix, identify energy conservation technologies, retrofit for energy conservation equipment etc. The primary objective of Energy audit is to determine ways to reduce energy consumption per unit of product output or to lower operating costs. The salient observations and recommendations are given below.

Aims and Objectives of an Energy Audit

An energy audit is a useful tool for developing and implementing comprehensive energy management plans of an organization. The aim of an energy audit is to identify the energy efficiency, conservation, and savings opportunities at the premises of the audit sites in a systematic manner. The audit process is carried out as per the following:

- Review of energy saving opportunities and measures implemented in the audit sites.

- Identification of additional various energy conservation measures and saving opportunities.
- Implementation of alternative energy resources for energy saving opportunities and decision making in the field of energy management.
- Providing a technical information on how to build an energy balance as well as guidance to be sought for particular applications.
- Detailed analysis on the calculation of energy consumption, analysis of latest electricity bill of the campus, understanding the tariff plan provided by the central and State Electricity Board.
- List ways that the use of energy in terms of electricity, electric stove, kettle, microwave, LPG, firewood, petrol, diesel, and others.
- Analysis of electricity bill amount for the last two to three years, amount paid for LPG cylinders for last one year and amount paid for water consumption for human beings and watering to the plants.
- Use of incandescent (tungsten) bulb and CFL bulbs, fans, cooling apparatus, heaters, computers, xerox machines, inverter, generators and laboratory equipment and instruments installed in the organization.
- Alternative energy sources/ nonconventional energy sources are employed in the organization.

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- To promote modern and scientific techniques as well as the cultural values of the local people.
- To capitalize on potential benefits for students in terms of research opportunities, mentoring and networking that are singular to comprehensive institutions.
- To sow the seeds of multifarious challenges of life among the tribal youth by means of understanding ethical dimensions of personal and professional life; also to procure means of examining their own values, attitudes and beliefs.
- To prepare students for a life of meaningful professional service and leadership.

AIMS

The college aims at:

- To study the energy consumption in the entire college campus.
- To identify the quality and cost of various energy inputs.
- To identify the potential areas of energy optimization.

ENERGY CONSUMPTION PROFILE

St. Xavier's College, Mahuadanr uses energy in the following forms:

- From JBVNL (Jharkhand Bijli Vitran Nigam Limited)

It is the largest electricity distribution company of Jharkhand State and the major source of electricity for the college building.

Electricity SOLAR Grid connected solarplant

The College has installed a 60 kb rooftop solar power system which feeds the energy need of the campus. The power deficit created by an unsteady supply of electricity by JBVNL at this remote location is thus met by solar energy.



- HighSpeedDiesel Generator(HSDG)



HSDG is also a source of electric supply when it is needed in the college.

These are the followings major consumers of electricity in the facility:

- Computers
- Lighting
- Fans
- Other Lab Equipment
- Printers
- Xerox machines
- UPS
- LCD Projector
- Router system
- pumping motor

Steps for Energy Managements and Energy audit

- ❖ Action to set implementation priority
- ❖ Observation of the energy consumption of electrical appliances within the college building.
- ❖ Analyse energy usage history to create a base for which saving can be measured in the building.
- ❖ To determine what can be done to reduce energy consumption throughout the building and what options can be used for the improvement if funding is available.

Study of Month wise Load Factor Variation

Electrical Load factor is a measure of the utilization rate, or efficiency of electrical energy usage. It is the ratio of total energy (KWh) used in the billing period divided by the possible total energy used within the period, if used at the peak demand (KW) during the entire period.

Thus, **Load Factor = KWh/ (KW/hours in the period/ number of days in the billing cycle)**

For example:

Let, total kWh = 360000 kWh

St. Xavier's College, Mahuadanr

Demand = 100kW

No. of Days = 30 days

Hours per day = 24 hours

Solution:

$$\text{Monthly load factor} = \frac{36000}{100 \times 30 \times 24} = 0.50$$
$$= 0.50 \times 100 = 50\%$$

S.No.	Month	Load Factor
1	Aug-21	0.050
2	Sept-21	0.04287
3	Oct-21	0.0495
4	Nov-21	0.0685
5	Dec-21	0.094
6	Jan-22	0.0675
7	Feb-22	0.05014
8	March-	0.0532
9	April-22	0.0549
	Average	0.05895

TOTAL ENERGY CONSUMPTION (Nine months) = **8128.00 KWH**

AVERAGE ENERGY CONSUMPTION (PER MONTH) = **903.1111KWH (approx.)**

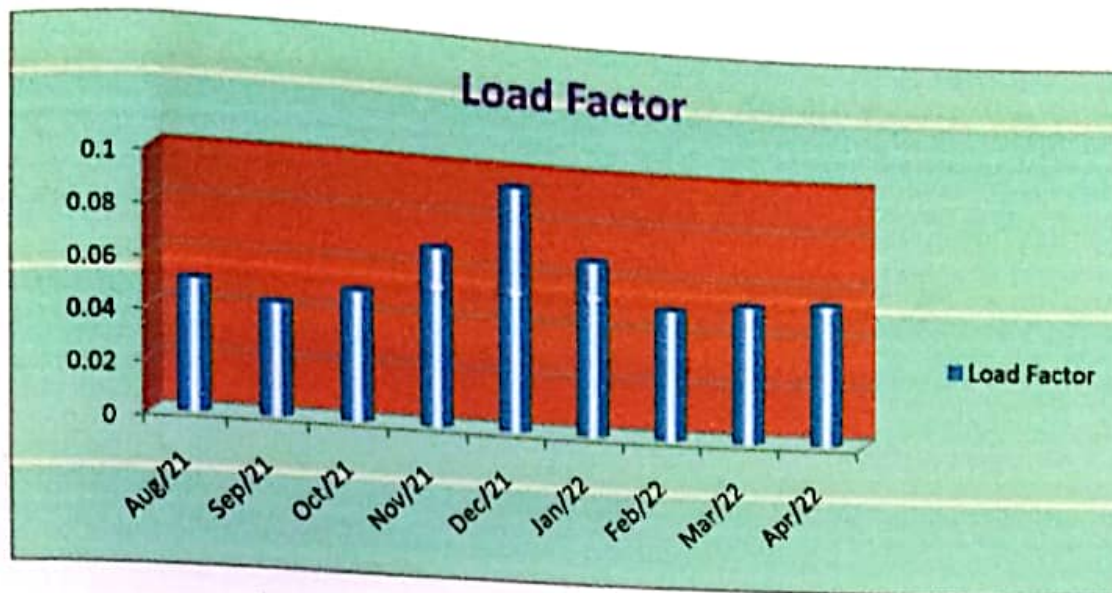


Fig: Bar graph of energy consumption in a college building in a year

We have analyzed from the bar graph that load factor ratio above 0.75 electrical uses is reasonably efficient. Load factor below 0.5 denotes lower consumption of energy as per demand. From the above bar graph the highest load factor is in the month of December 2021 i.e. energy consumption was high as per the demand.

RECOMMENDATIONS

- Replacing CFL (Compact Fluorescent Lamp) Lights with LED (Light Emitting Diode) Lights
- All Class Rooms and labs to have Display Messages regarding optimum use of electrical appliances in the room like lights, fans, computers and projectors.
- Display the stickers of save electricity, save nature everywhere in the campus.
- All projectors to be kept OFF or in idle mode if there will be no presentation slides.
- All computers to have power saving settings to turn off monitors and hard discs, say after 10 minutes/30 minutes.
- Lights in toilet area may be kept OFF during daytime.
- Monthly use of electricity in the college is very high which may be reduced to a greater extent by means of undertaking a periodical energy audit.
- Energy audit should be done internally on regular interval in order to increase energy efficiency and reducing risk of electrical and fire hazards.
- The use of biomass can contribute in the generation of energy to power small internal works, which can reduce the cost of fuel used to do the work.

Action Taken Report

Replacing CFL Lights with LED Lights:

Conducted a comprehensive audit of all lighting fixtures across the campus to identify areas for CFL to LED replacement.

Procured and installed LED lights in classrooms, labs, and other facilities, prioritizing areas with higher usage and longer operating hours.

Trained maintenance staff on the installation and maintenance of LED lighting systems.

Displaying Messages for Optimum Electrical Appliance Use:

Implemented a program to display messages in all classrooms and labs regarding the optimal use of electrical appliances, including lights, fans, computers, and projectors.

Collaborated with faculty and student representatives to develop informative and engaging messages aimed at promoting energy conservation practices.

Promotion of Energy Conservation Stickers:

Distributed "Save Electricity, Save Nature" stickers to be prominently displayed raising awareness among students, faculty, and staff about the importance of energy conservation.

Organized campaigns and events to reinforce the message of energy conservation and encourage active participation in sustainability initiatives.

Optimizing Projector and Computer Power Usage:

Implemented policies to ensure projectors are turned off or placed in idle mode when not in use for presentations, reducing unnecessary energy consumption.

Configured power-saving settings on all computers to automatically turn off monitors and hard disks after specified periods of inactivity, such as 10 minutes or 30 minutes.

Efficient Toilet Area Lighting Management:

Keeping lights off during daytime hours when natural light is sufficient.

Conducted regular inspections to ensure proper functioning of the lighting management system and promptly address any issues.

Undertaking Periodical Energy Audits:

Conducted a thorough energy audit of the college facilities to identify opportunities for reducing energy consumption and improving efficiency.

Analyzed energy usage patterns and identified areas for potential savings, such as lighting, and equipment operation.

Internal Energy Auditing for Increased Efficiency:

Established a dedicated team responsible for conducting regular internal energy audits to monitor and improve energy efficiency.

Implemented measures to address identified inefficiencies and reduce the risk of electrical and fire hazards, including equipment maintenance and upgrades.

Utilizing Biomass for Energy Generation:

Explored the feasibility of using biomass as a renewable energy source to power small internal works within the college campus.

Conducted research and feasibility studies to assess the potential cost savings and environmental benefits of biomass energy utilization.

Name and Signature of the Energy Audit team 2021-22

External Audit Members

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Birla Institute of Technology, Ranchi

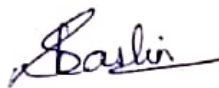
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Internal Audit Members

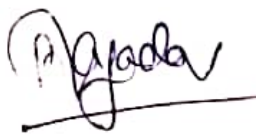
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Principal
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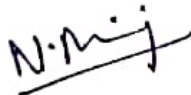
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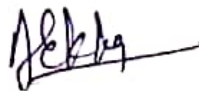
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St. Xavier's College Mahuadanr



Energy



Audit

2020-21



ST. XAVIER'S COLLEGE MAHUADANR

(Affiliated to Nilamber-Pitamber University, Medininagar)

Accredited by NAAC at 'B' grade(1st Cycle)

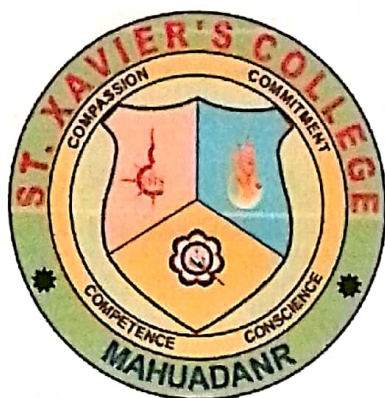


St. Xavier's College, Mahuadanr

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Energy Audit 2020-21



About the Project

The working details of the assignment are as follows:

Project:	Energy Audit
Client:	St. Xavier's College, Mahuadanr
Segment:	Educational Building
Site:	C49C+HGF, Rajdanda, Mahuadanr
Project Scope:	1) Reviewing the energy consumption behaviour of the Institution and verification of energy inventories. 2) Reviewing of existing / opportunities for non-conventional sources of energy. 3) Recommendation for energy efficient measures & cost benefit analysis.

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Mukul Toppo	Assistant Professor Department of Chemistry
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Anjna Ekka	Assistant Professor Department of Mathematics

ACKNOWLEDGEMENT

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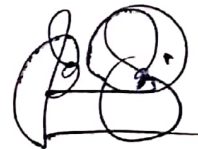
Mukul Toppo
Co-ordinator,
Energy Audit Team
St. Xavier's College, Mahuadanr

DISCLAIMER

Energy Audit Team has prepared this report based on collected data from the entire building of the college and auditorium. All reasonable care has been taken in its preparation. Details contained in this report have been compiled in trust based on information gathered.

Prepared by:

IQAC & Energy Audit Team SXCM



Principal
St. Xavier's College
Mahuadanr

ENERGY AUDIT

An Energy Audit is an inspection survey and an analysis of energy flows for energy conservation in a building. It may include a process or system to reduce the amount of energy input into the system without negatively affecting the output. In commercial and industrial real estate, an energy audit is the first step in identifying opportunities to reduce energy expense and carbon footprint. The need for an energy audit is to identify the savings potential and cost reducing methods, understand the ways in which fuel is used, where the waste occurs and find the scope for improvement.

An energy audit is proposed and conducted to ensure that energy saving practices are implemented and followed in Educational Institutions and Industrial sectors in a sustainable way. Energy audit involves several facts including energy savings potential, energy management, finding alternatives, etc. With these facts in mind, the audit's specific objectives are to assess the competence of the sustainability management and control system, as well as the departments' compliance with applicable rules, policies and standards. It has the potential to have a significant influence on the organization's operational cost as well as the environmental impact.

Eco-campus concept mainly focuses on the efficient use of energy and its conservation including savings opportunities in a sustainable manner. It also focuses on the reduction of contribution to carbon emissions, carbon footprint calculation, procurement of star rated equipment for a cost effective and secure supply of energy, encourage and enhance energy use conservation in all buildings, reduce the organization's energy consumption, reduce wastes to landfill, and integrate environmental considerations into all contracts and services considered to have significant environmental impacts.

The conduct of energy audit using internal and external energy auditors is playing important role in any Institution in terms of energy management. It is able to measure the impact of energy potential in an organization so that we can determine better ways to manage the impact on environment. It is necessary to know how much the organization is contributing towards sustainable development in terms of energy management is being done. It is therefore to recommend measuring the carbon footprint in each organization which may be useful for maintaining the eco-friendly campus to the stakeholders.

ENERGY AUDIT POLICY

Preamble:

Environment-friendly options and energy harvesting are of prime importance, which are the key factors in achieving Sustainable Development Goals (SDGs) for any organization. Rapidly and dynamically increasing energy requirement demands effective response. Hence, St. Xavier's College, Mahuadanr has incorporated alternate energy source in the form of Solar PV generation. The College's energy policy prefers efficient energy management and conservation through efficient procedures specified in its policy.

Statement:

The Energy policy of SXCM monitors, conserves and manages the energy needs of the campus, balancing the energy demand and supply. It is the responsibility of the institute to create awareness among the students and staff about the energy conservation measures. Efficiency is to be maintained with maximum utilization of Renewable PV Power Generating system and effective utilization of the Electric Energy, optimal consumption of lighting load with the proper energy conservation measures in the campus.

The following objectives will lead to the implementation of SXCM Energy policy

Objectives:

- Improvement in Energy efficiency to reduce Energy consumption and cost.
- Minimize the energy consumption by utilizing maximum use of day light and natural ventilation as the windows are glassed.

Action Plan:

- Conduct of External Energy Audit once in a year.
- Meet the Energy needs of the campus with back-up power supply system for supplying uninterrupted energy demands.
- Establishment of energy efficient utilization measures in the supply, demand systems as part of energy management of the campus.
- Implementation of Sensor-based energy conservation.
- Replacement of the existing conventional lighting with the LED lamps.
- Expansion of Solar PV System.

- Create awareness among the students and staff in Energy conservation and management by conducting training programs.
- Obtain Energy Audit certification.
- Provide experts to industry and other organizations in the area of energy management by offering Energy Audit Services.
- The Institute shall continuously review and update the approved policy and be committed to its implementation.

Aims and Objectives of an Energy Audit

An energy audit is a useful tool for developing and implementing comprehensive energy management plans of an organization. The aim of an energy audit is to identify the energy efficiency, conservation, and savings opportunities at the premises of the audit sites in a systematic manner. The audit process is carried out as per the following:

- Review of energy saving opportunities and measures implemented in the audit sites.
- Identification of additional various energy conservation measures and saving opportunities.
- Implementation of alternative energy resources for energy saving opportunities and decision making in the field of energy management.
- Providing a technical information on how to build an energy balance as well as guidance to be sought for particular applications.
- Detailed analysis on the calculation of energy consumption, analysis of latest electricity bill of the campus, understanding the tariff plan provided by the central and State Electricity Board.
- List ways that the use of energy in terms of electricity, electric stove, kettle, microwave, LPG, firewood, petrol, diesel, and others.
- Analysis of electricity bill amount for the last two to three years, amount paid for LPG cylinders for last one year and amount paid for water consumption for human beings and watering to the plants.
- Use of incandescent (tungsten) bulb and CFL bulbs, fans, cooling apparatus, heaters, computers, xerox machines, inverter, generators and laboratory equipment and instruments installed in the organization.
- Alternative energy sources/ nonconventional energy sources are employed in the organization.

ABOUT THE COLLEGE

St. Xavier's College, Mahuadanr is a co-educational Under-graduate institution in Latehar district of Jharkhand, situated amid nature's exotic scenic beauty. It was established in 2011 by Hazaribag Jesuit Education Society, to impart quality higher education primarily to the underprivileged students. However, being inclusive, the College admits students, irrespective of caste, creed, gender, and economic disparities. This is the only institution of higher learning in this tribal dominated rural region. The College possesses 24.46 acres of land: 10 acres in its own name and 14.46 acres in that of the parent body. St. Xavier's College is affiliated to the Nilamber-Pitamber University, Medininagar, Palamu. A significant achievement of the college in year 2018 was going through the process of accreditation by NACC and obtaining "B" grade, despite of location difficulties. The College is imparting undergraduate level higher education in Arts, Science and Commerce streams with honours courses. For effective implementation of its programmes the academic calendar is prepared meticulously, and plans are made for outcome-based education. Higher education policy is followed fastidiously. The lesson plans and the progress registers are maintained subject wise and stream wise. The students' feedbacks are obtained periodically. The endeavour of the College is to take higher education to its peak. The college equips the students with new knowledge, skills, understanding and learning habits with positive attitude. Skill oriented certificate courses under UG programme have been introduced. It has been certified by ISO 9001:2015. The IQAC of the college facilitates it in various extension and co-curricular activities. The holistic development of the students is the objective of the college. Accordingly, research methodology has been initiated, motivating the staff and the students to take up research projects. National and International seminars, workshops and youth festivals are conducted at regular intervals. The pedagogy of the College aims at developing creative and critical thin king among the students. Dissemination of high morals and values for integrated development of the students is a major thrust of the college. Exploiting their potentials, the students are inspired through the best possible higher education to become learned, service minded and leadership oriented citizens of tomorrow in the constantly changing world.

The College envisions quality higher education through promotion of learner-centric environment by quality parameters for holistic development of the students and staff. The college has high quality infrastructure, spacious classrooms, smart classrooms with ICT facilities, library with separate reading rooms with ICT facilities, well equipped science labs,

St. Xavier's College, Mahuadanr P a g e | 7

Geography and computer labs, indoor and outdoor games facilities, well-qualified and dynamic faculty that regularly updates itself to enhance teaching, research and outreach processes. Good education is transformative; hence realizing the responsibility involved in their citizenship through education in our college, they in turn will work for the transformation of the Society and the Nation. Hence the College strives hard and works together with relentless determination. Its emphasis is the all-round development of the students which is achieved through contextualized study through diverse academic activities and competitions which develop entrepreneurial skill, leadership quality, management skill, team spirit, communication and presentation skills, creativity thereby equipping them to plunge into the competitive world. Internship, Field trips and Education trips are arranged that the students may relate the classroom knowledge with the outside reality and confidently enter the exciting world of discovery and exploration. Academic and personal counselling is a regular feature of the college; it provides personal direction and developmental guidance. Counselling brings better rapport between the teachers and the students are helped to deal with their personal challenges and their career planning. Accomplishment in the academic and co-curricular activities is a great achievement. There are six University toppers, the result is 100% and the students have become multidimensional. Co-curricular and extra-curricular activities promote the process of creative and critical thinking. They inculcate social and moral values, compassion, pride for one's culture and awareness of one's rights and duties; they also make the students good persons and confident leaders. The college develops versatile personality of the students and fills them with hope and dreams of greater success.

Vision:

"Inspired by the life and teaching of Jesus Christ and the Jesuit spirit of "magis" (for the greater and better), St. Xavier's College aspires to develop professionally competent and compassionately committed people for creating a just and humane society by promoting harmonious living with different socio-cultural groups and with the whole creation".

Mission:

- To provide quality based academic excellence especially for tribal youth.
- To motivate students to be a people skill-oriented, competent, committed, conscientious and compassionate.

- To promote modern and scientific techniques as well as the cultural values of the local people.

Energy Consumption Profile

Source of Energy

St. Xavier's College Mahuadanr uses energy from the following sources.

- **Electricity From JBVNL (Jharkhand Bijli Vitran Nigam Limited)**

This college receives electricity from Jharkhand Bijli Vitran Nigam Limited. It is the largest electricity distribution company of Jharkhand State and the major source of electricity for the college building.

- **High Speed Diesel Generator System (HSDG)**

A diesel generator with the capacity of 20 KV is installed for energy supply to the entire campus. This is run whenever power supply from State Electric Board, JBVNL is not available.

Energy Saving Measures for DG Sets

Ensure steady load conditions on the DG set and provide cold dust free air at intake of air washers for large sets, in case of dry, hot weather can be considered.

- **Electricity SOLAR Grid connected Solar Plant**

The College has installed a rooftop solar power system which feeds the energy need of the campus. The power deficit created by an unsteady supply of electricity by JBVNL at this remote location is thus met by solar energy.



Systems Studied during the Energy Audit

- Physical verification of lighting, fan, machines ventilators load fixtures.
- Verification of installed energy efficient systems.
- Inspection of solar panel, generators, uninterrupted power supply machines.
- Verification and installation of safety systems.
- Inspection and verification of the maintenance aspects of installed generators and additional backup power sources.
- Review the potential usage of alternative energy resources.
- Review the energy conservation awareness among the stakeholders for optimum use of electricity and its savings.

Load Factor

S.No.	Month	Load Factor
1	July-20	0.03642
2	Aug-20	0.03728
3	Sep-20	0.06836
4	Oct-20	0.05764
5	Nov-20	0.04703
6	Dec-20	0.05739
7	Jan-21	0.04642
8	Feb-21	0.05058
9	Mar-21	0.05083
10	Apr-21	0.05292
11	May-21	0.05708
	Average	0.56194

TOTAL ENERGY CONSUMPTION (11 months) = 1849.45 KWH

AVERAGE ENERGY CONSUMPTION (PER MONTH) = 168.132 KWH

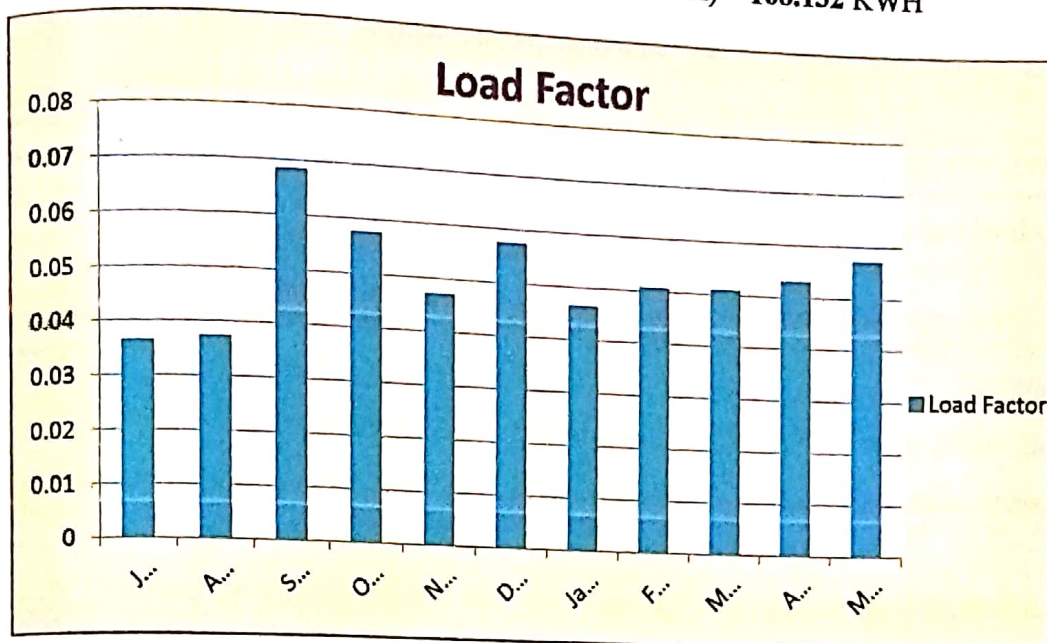


Fig: Bar graph of energy consumption in the college building in year 2020-21

Best Practices followed in the Organization

- ✓ Installed roof top solar power plant.
- ✓ LED lights and Solar lights are used.
- ✓ Electrical wires, switch boxes and stabilizers are properly covered without any damage which could cause any problems to the staff and the students.
- ✓ Generator and UPS are protected properly with fencing and kept awareness boards on like 'Danger' and 'Warnings.'
- ✓ Replaced old generation computers with LED monitors.

Implementation of measures for energy conservation

The following energy conservation measures can be adopted at the institution.

Replace the Fluorescent Tube Lights (FTL) with LED tube lights:

The 40 W FTLs can be replaced with the LED tube lights of 20 W. These changes can be made at the places where the usage is higher. Usually minimum of 1 year's warranty is given and approximate burning hour is 40000 (considering 15 years usage, 6 hours per day running).

Recommendations

- The energy audit included suggestions for energy cost reduction, preventive maintenance, and quality control activities, all of which are critical for utility operation in the audit sites.
- Use motion sensor in corridors, passage, library, classrooms, and toilets.
- All computers to have power saving settings to turn off monitors and hard discs say after 10 minutes/ 30 minutes.
- Turn off electrical equipment when not in use.
- All projectors to be kept OFF or in idle mode if there would be no presentation slides.
- There could be institute level student organizations that keeps track of the energy consumption parameters of the various departments, classrooms, halls, areas, meters, etc.
- Continuous monitoring and analysis of energy consumption by dedicated team may be planned within the campus.
- Optimal water usage and temperature settings may be used which are coming under automatic process towards energy savings.
- Energy auditing inside the campus should be done on a regular basis and report should be made public to generate awareness.
- Need to create energy efficiency/ renewable energy awareness among the college campus i.e. solar, wind, biogas energy etc. college should take initiative to arrange seminars, lectures, paper presentation competition among students and staff for general awareness.
- Maintain appliances and replace old appliances in all laboratories.
- Install biogas kitchen for the college canteen.

Action Taken Report:

Implementation of Energy Audit Recommendations:

Incorporated suggestions from the energy audit report for energy cost reduction, preventive maintenance, and quality control activities into utility operation procedures at the audit sites.

Established protocols for regular review and update of energy audit recommendations to ensure continuous improvement in energy efficiency.

Power Saving Settings for Computers:

Configured power-saving settings on all computers campus-wide to automatically turn off monitors and hard disks after specified periods of inactivity (e.g., 10 minutes/30 minutes), contributing to significant energy savings.

Equipment Shutdown Protocol:

Implemented a protocol for turning off electrical equipment when not in use, including computers, printers, copiers, and other office appliances, to minimize standby power consumption.

Projector Management and Energy Tracking:

Projectors off or in idle mode when not in use for presentations, with oversight from institute-level student organizations responsible for monitoring energy consumption parameters.

Established a system for tracking energy usage in various departments, classrooms, halls, and other areas to identify opportunities for further energy conservation.

Establishment of Energy Monitoring Team:

Formed a dedicated team tasked with continuously monitoring and analyzing energy consumption within the campus.

Provided team members with training and resources necessary to effectively monitor energy usage and identify areas for improvement.

Optimization of Water Usage and Temperature Settings:

Implemented automatic processes for optimal water usage and temperature settings to maximize energy savings, including the use of smart controls and sensors where applicable.

Conducted regular inspections and maintenance to ensure the efficiency of water and heating systems.

Regular Energy Auditing and Public Reporting:

Scheduled regular energy audits within the campus to assess energy usage patterns, identify inefficiencies, and recommend improvements.

Promotion of Energy Efficiency and Renewable Energy:

Organized seminars, and lectures among students and staff to create awareness about energy efficiency and renewable energy sources such as solar, wind, and biogas.

Collaborated with relevant stakeholders to facilitate the implementation of energy-efficient technologies and practices across the campus.

Appliance Maintenance and Replacement:

Implemented a program for regular maintenance of appliances and equipment in all laboratories to ensure optimal performance and energy efficiency.

Initiated the process of replacing old appliances with energy-efficient models to reduce energy consumption and operational costs.

Name and Signature of the Energy Audit team 2020-21

External Audit Members

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Electrical and Electronics Engineer
Birla Institute of Technology, Ranchi

shubhojeet chakraborty

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Pony Pandanathji



St. Xavier's College Mahuadanr



Energy



Audit

2019-20



ST. XAVIER'S COLLEGE MAHUADANR
(Affiliated to Nilamber-Pitamber University, Medinipur)
Accredited by NAAC at 'B' grade(1st Cycle)



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Energy Audit 2019-20



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Asst. Prof. Anjna Ekka	Assistant Professor Department of Mathematics

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Mukul Toppo

Co-ordinator,

Energy Audit Team

St. Xavier's College, Mahuadanr

DISCLAIMER

Energy Audit Team has prepared this report based on the data collected from the entire building of the college and auditorium. All reasonable care has been taken in its preparation. Details contained in this report have been compiled in trust based on information gathered.

Prepared by:

IQAC & Energy Audit Team SXCM



Principal
St. Xavier's College
Mehsana

ENERGY AUDIT

An Energy Audit is an inspection survey and an analysis of energy flows for energy conservation in a building. It may include a process or system to reduce the amount of energy input into the system without negatively affecting the output. In commercial and industrial real estate, an energy audit is the first step in identifying opportunities to reduce energy expense and carbon footprint. The need for an energy audit is to identify the savings potential and cost reducing methods, understand the ways in which fuel is used, where the waste occurs and find the scope for improvement.

An energy audit is proposed and conducted to ensure that energy saving practices are implemented and followed in Educational Institutions and Industrial sectors in a sustainable way. Energy audit involves several facts including energy savings potential, energy management, finding alternatives, etc. With these facts in mind, the audit's specific objectives are to assess the competence of the sustainability management and control system, as well as the departments' compliance with applicable rules, policies and standards. It has the potential to have a significant influence on the organization's operational cost as well as the environmental impact.

Eco-campus concept mainly focuses on the efficient use of energy and its conservation including savings opportunities in a sustainable manner. It also focuses on the reduction of contribution to carbon emissions, carbon footprint calculation, procurement of star rated equipment for a cost effective and secure supply of energy, encourage and enhance energy use conservation in all buildings, reduce the organization's energy consumption, reduce wastes to landfill, and integrate environmental considerations into all contracts and services considered to have significant environmental impacts.

The conduct of energy audit using internal and external energy auditors is playing important role in any Institution in terms of energy management. It is able to measure the impact of energy potential in an organization so that we can determine better ways to manage the impact on environment. It is necessary to know how much the organization is contributing towards sustainable development in terms of energy management is being done. It is therefore to recommend measuring the carbon footprint in each organization which may be useful for maintaining the eco-friendly campus to the stakeholders.

ENERGY AUDIT POLICY

Preamble:

Environment-friendly options and energy harvesting are of prime importance, which are the key factors in achieving Sustainable Development Goals (SDGs) for any organization. Rapidly and dynamically increasing energy requirement demands effective response. Hence, St. Xavier's College, Mahuadanr has incorporated alternate energy source in the form of Solar PV generation. The College's energy policy prefers efficient energy management and conservation through efficient procedures specified in its policy.

Statement:

The Energy policy of SXCM monitors, conserves and manages the energy needs of the campus, balancing the energy demand and supply. It is the responsibility of the institute to create awareness among the students and staff about the energy conservation measures. Efficiency is to be maintained with maximum utilization of Renewable PV Power Generating system and effective utilization of the Electric Energy, optimal consumption of lighting load with the proper energy conservation measures in the campus.

The following objectives will lead to the implementation of SXCM Energy policy

Objectives:

- Improvement in Energy efficiency to reduce Energy consumption and cost.
- Minimize the energy consumption by utilizing maximum use of day light and natural ventilation as the windows are glassed.

Action Plan:

- Conduct of External Energy Audit once in a year
- Meet the Energy needs of the campus with back-up power supply system for supplying uninterrupted energy demands.
- Establishment of energy efficient utilization measures in the supply, demand systems as part of energy management of the campus.
- Implementation of Sensor-based energy conservation.
- Replacement of the existing conventional lighting with the LED lamps.
- Expansion of Solar PV System.
- Create awareness among the students and staff in Energy conservation and management by conducting training programs.
- Obtain Energy Audit certification.
- Provide experts to industry and other organizations in the area of energy management by offering Energy Audit Services.
- The Institute shall continuously review and update the approved policy and be committed to its implementation.

Executive Summary

The objective of the audit was to study the energy consumption pattern of the facility, identify the areas where potential for energy/ cost saving exists and prepare proposals for energy/cost saving along with investment and payback periods.

Objectives of Energy Audit

The Energy Audit provides the vital information about the overall energy conservation program in the College building, energy utilization analysis and evaluation of energy conservation measures.

The Role of an Energy Audit

An energy audit identifies the areas in the establishment that unnecessarily consumes too much energy and assesses energy saving opportunities, which is the most cost-effective to improve, so that money can be saved. It also balances the total energy inputs with its use and identifies the opportunities of energy consumption.

The salient observations and recommendations are given below.

Aims of Energy Audit

It aims

- To study the energy consumption in the entire college campus.
- To identify the quality and cost of various energy inputs.
- To identify the potential areas of energy optimization.
- To implement the measures for energy conservation and realization of savings.

Steps for Energy Managements and Energy audit

- Action to set implementation priority.
- Observation of the energy consumption of electrical appliances within the college building.
- Analysis of energy usage history to create a base for which saving can be measured in the building.
- Determination of what can be done to reduce energy consumption throughout the building and what options can be used for the improvement if funding is available.

ABOUT THE COLLEGE

St. Xavier's College, Mahuadanr is a co-educational Under-graduate institution in Latehar district of Jharkhand, situated amid nature's exotic scenic beauty. It was established in 2011 by Hazaribag Jesuit Education Society, to impart quality higher education primarily to the underprivileged students. However, being inclusive, the College admits students, irrespective of caste, creed, gender, and economic disparities. This is the only institution of higher learning in this tribal dominated rural region. The College possesses 24.46 acres of land: 10 acres in its own name and 14.46 acres in that of the parent body. St. Xavier's College is affiliated to the Nilamber-Pitamber University, Medininagar, Palamu. A significant achievement of the college in year 2018 was going through the process of accreditation by NACC and obtaining "B" grade, despite of location difficulties. The College is imparting undergraduate level higher education in Arts, Science and Commerce streams with honours courses. For effective implementation of its programmes the academic calendar is prepared meticulously and plans are made for outcome-based education. Higher education policy is followed fastidiously. The lesson plans and the progress registers are maintained subject wise and stream wise. The students' feedbacks are obtained periodically. The endeavour of the College is to take higher education to its peak. The college equips the students with new knowledge, skills, understanding and learning habits with positive attitude. Skill oriented certificate courses under UG programme have been introduced. It has been certified by ISO 9001:2015. The IQAC of the college facilitates it in various extension and co-curricular activities. The holistic development of the students is the objective of the College. Accordingly, research methodology has been initiated, motivating the staff and the students to take up research projects. National and International seminars, workshops and youth festivals are conducted at regular intervals. The pedagogy of the college aims at developing creative and critical thin king among the students. Dissemination of high morals and values for integrated development of the students is a major thrust of the College. Exploiting their potentials, the students are inspired through the best possible higher education to become learned, service minded and leadership-oriented citizens of tomorrow in the constantly changing world.

The College envisions quality higher education through promotion of learner-centric environment by quality parameters for holistic development of the students and staff. The college has high quality infrastructure, spacious classrooms, smart classrooms with ICT

facilities, library with separate reading rooms with ICT facilities, well equipped science labs, Geography, and computer labs, indoors and outdoors games facilities, well-qualified and dynamic faculty that regularly updates itself to enhance teaching, research and outreach processes. Good education is transformative; hence realizing the responsibility involved in their citizenship through education in our college, they in turn will work for the transformation of the Society and the Nation. Hence the College strives hard and works together with relentless determination. Its emphasis is the all-round development of the students which is achieved through contextualized study through diverse academic activities and competitions which develop entrepreneurial skill, leadership quality, management skill, team spirit, communication and presentation skills, creativity thereby equipping them to plunge into the competitive world. Internship, Field trips and Education trips are arranged that the students may relate the classroom knowledge with the outside reality and confidently enter the exciting world of discovery and exploration. Academic and personal counselling is a regular feature of the college; it provides personal direction and developmental guidance. Counselling brings better rapport between the teachers and the students, and the students are helped to deal with their personal challenges and their career planning. Accomplishment in the academic and co-curricular activities is a great achievement. There are six University toppers, the result is 100% and the students have become multidimensional. Co-curricular and extra-curricular activities promote the process of creative and critical thinking. They inculcate social and moral values, compassion, pride for one's culture and awareness of one's rights and duties; they also make the students good persons and confident leaders. The College develops versatile personality of the students and fills them with hope and dreams of greater success.

Vision:

“Inspired by the life and teaching of Jesus Christ and the Jesuit spirit of “magis” (for the greater and better), St. Xavier's College aspires to develop professionally competent and compassionately committed people for creating a just and humane society by promoting harmonious living with different socio-cultural groups and with the whole creation”.

Mission:

- To provide quality based academic excellence especially for tribal youth.
- To motivate students to be a people skill-oriented, competent, committed, conscientious and compassionate.

- To promote modern and scientific techniques as well as the cultural values of the local people.
- To capitalize on potential benefits for students in terms of research opportunities, mentoring and networking that are singular to comprehensive institutions.
- To sow the seeds of multifarious challenges of life among the tribal youth by means of understanding ethical dimensions of personal and professional life; also, to procure means of examining their own values, attitudes and beliefs.
- To prepare students for a life of meaningful professional service and leadership.

ENERGY CONSUMPTION PROFILE

St. Xavier's College, Mahuadanr uses energy in the following forms:

- **From JBVNL (Jharkhand Bijli Vitran Nigam Limited)**
It is the largest electricity distribution company of Jharkhand State and the major source of electricity for the college building.
- **Electricity SOLAR Grid connected solar plant**



The College has installed a rooftop solar power system which feeds the energy need of the campus. The power deficit created by an unsteady supply of electricity by JBVNL at this remote location is thus met by solar energy.

- **High Speed Diesel Generator (HSDG)**



HSDG is also a source of electric supply when it is needed in the College.

Electrical energy is used for various applications.

These are the followings major consumers of electricity in the facility:

- Computers
- Lighting
- Fans
- Other Lab Equipment
- Printers
- Xerox machines
- UPS
- LCD Projector
- Router system
- Pumping motor

Systems Studied during the Energy Audit

- Physical verification of lighting, fan, machines ventilators load fixtures.
- Verification of installed energy efficient systems.
- Inspection of solar panel, generators, uninterrupted power supply machines.
- Verification and installation of safety systems.
- Inspect and verify the maintenance aspects of installed generators ad additional backup power sources.
- Analysis of the electricity consumption through the supply utility company.
- Review the potential usage of alternative energy resources.
- Review the energy conservation awareness among the stakeholders for optimum use of electricity and its savings.

TOTAL ENERGY CONSUMPTION (PER YEAR) = 1121.00 KWH

TOTAL ENERGY CONSUMPTION (PER MONTH) = 93.4166 KWH (approx.)

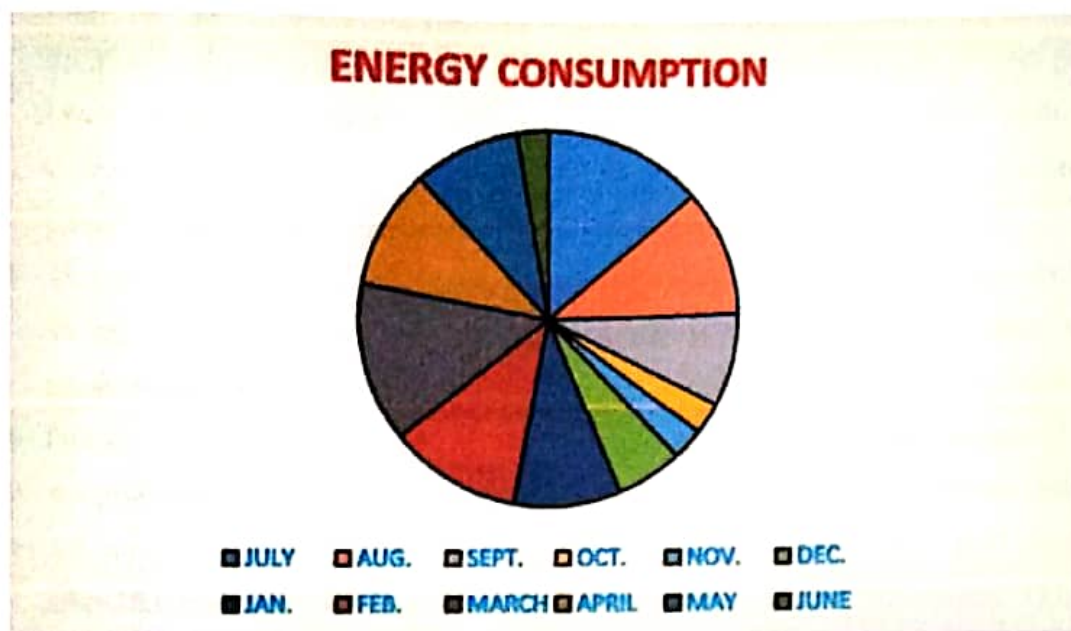


Fig: Pie chart of energy consumption St. Xavier's College, Mahuadanr 2019-20.

CONCLUSION

Natural resources on earth are limited and consuming very sharply. It can be saved by employing energy efficiency and it is very necessary to prevent depletion of natural resources. The energy audit of college buildings shows that it should be taken some necessary steps for reducing energy consumption. People should be aware about energy conservation and reduce energy consumption by adopting modern technologies.

RECOMMENDATIONS

- ❖ Replacing CFL (Compact Fluorescent Lamp) Lights with LED (Light Emitting Diode) Lights

The CFL lights can be replaced with the LED lights. These changes can be made at the places where the life is higher. The life of an LED bulb is usually 50,000 powers hours or may be more while CFL has only 8000 hours of life. LED bulb never explodes but CFL bulb breaks down. LED bulb consumes less power as compared to CFL. CFL consumes about 80% of energy in a year.

- ❖ The standard luminous efficacy of the TFLs (Tubular Fluorescent Lamps) is between 40 lm/W to 60 lm/W. They can be replaced with LED bulbs and tubes which consumes lesser energy.
- ❖ Display the stickers of save electricity, save nature everywhere in the campus.
- ❖ All projectors to be kept OFF or in idle mode if there will be no presentation slides.
- ❖ All computers to have power saving settings to turn off monitors and hard discs, say after 10 minutes/30 minutes.
- ❖ Lights in toilet area may be kept OFF during daytime.
- ❖ Need to focus on existing solar plant which is generating power below the rated power.

Action Taken Report:

Replacing CFL Lights with LED Lights:

Conducted a thorough assessment of existing CFL lighting fixtures across the campus.

Developed a detailed plan for the systematic replacement of CFL lights with LED lights in areas where LED technology offers longer lifespan and greater energy efficiency.

Initiated procurement of LED bulbs and tubes based on the identified requirements.

LED Advantages and Implementation Strategy:

Conducted awareness campaigns among staff and students to highlight the benefits of LED lights over CFL lights, including longer lifespan, lower power consumption, and reduced risk of breakage.

Identified priority areas for LED replacement based on factors such as energy consumption, usage patterns, and potential cost savings.

Collaborated with vendors to procure high-quality LED bulbs and tubes that meet the campus's lighting requirements and sustainability goals.

Promoting Energy Conservation Awareness:

Designed and distributed stickers promoting the message of "Save Electricity, Save Nature" to be displayed prominently across the campus.

Conducted awareness campaigns, workshops, and seminars to educate the campus community about the importance of energy conservation and the role of LED lighting in reducing environmental impact.

Optimizing Projectors and Computers:

Implemented a policy to ensure projectors are turned off or placed in idle mode when not in use for presentations.

Configured power-saving settings on all computers to automatically turn off monitors and hard disks after periods of inactivity (e.g., 10 minutes/30 minutes), reducing energy consumption.

Efficient Toilet Area Lighting Management:

Ensuring lights are kept off during daytime when natural light is sufficient.

Conducted regular inspections to monitor the effectiveness of the lighting management system and address any issues promptly.

Optimizing Solar Power Generation:

Conducted a comprehensive review of the existing solar power plant to identify factors causing it to operate below its rated power.

Implemented corrective measures to optimize the performance of the solar power plant, including maintenance, repairs, and upgrades as necessary.

Monitoring and Evaluation:

Established a monitoring mechanism to track the progress of LED replacement initiatives, energy savings achieved, and the overall impact on campus energy consumption.

Conducted regular audits and assessments to evaluate the effectiveness of implemented measures and identify areas for further improvement.

Name and Signature of the Energy Audit team 2019-20

External Audit Members

Mr. Shubhojeet Chakraborty
Electrical and Electronics Engineer
Birla Institute of Technology, Ranchi

shubhojeet chakraborty

Mr. Shubham Toppo
Electrical and Electronics Engineer
Birla Institute of Technology, Ranchi

Shubham Toppo

Internal Audit Members

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Principal
St. Xavier's College, Mahuadanr

Dr. Fr. M. K. Jose SJ

Asst. Prof. Sr. Kaslin Juliet
IQAC Coordinator and Vice-Principal
HoD, Department of Botany
St. Xavier's College Mahuadanr

Kaslin

Asst. Prof. Binay Yadav
HoD, Department of Chemistry
St. Xavier's College Mahuadanr.

Binay Yadav

Asst. Prof. Mukul Toppo
Assistant Professor
Department of Chemistry

Mukul

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HoD, Department of Mathematics,
St. Xavier's College Mahuadanr.

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Asst. Prof. Anjna Ekka
Assistant Professor
Department of Mathematics

Anjna Ekka

Diby Pandalanathoi



St. Xavier's College Mahuadanr



Energy



Audit

2018-19



ST. XAVIER'S COLLEGE MAHUADANR

(Affiliated to Nilamber-Pitamber University, Medininagar)

Accredited by NAAC at 'B' grade(1st Cycle)

St. Xavier's College, Mahuadanr

(Affiliated to Nilamber-Pitamber University, Medinipur)

Website: www.sxcmla.in

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Energy Audit 2018-19



About the Project

The working details of the assignment are as follows:

Project:	Energy Audit
Client:	St. Xavier's College, Mahuadanr
Segment:	Educational Building
Site:	C49C+HGF, Rajdanda, Mahuadanr
Project Scope:	1) Reviewing the energy consumption behavior of the institution and verification of energy inventories. 2) Reviewing of existing / opportunities for non-conventional sources of energy. 3) Recommendation for energy efficient measures & cost benefit analysis.

External Audit Members

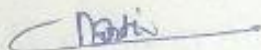
Mr. Shubhojeet Chakraborty	Electrical and Electronics Engineer Birla Institute of Technology, Ranchi
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Asst. Prof. Binay Kumar Yadav	HoD, Department of Chemistry St. Xavier's College Mahuadanr.
Asst. Prof. Sanjay Martin Kujur	Asst. Prof. Department of Chemistry, St. Xavier's College Mahuadanr
Asst. Prof. Neha Minj	HoD Department of Mathematics, St. Xavier's College Mahuadanr.
Asst. Prof. Aaliya Nadim	Asst. Prof. Department of Mathematics St. Xavier's College Mahuadanr.

ACKNOWLEDGEMENT

IQAC and Energy Audit Assessment Team thanks the Principal, St. Xavier's College, Mahuadanr for assigning the task of Energy Audit of SXCM to us. We appreciate the cooperation that we got from all the faculties and students during the entire process. Our special thanks to the Principal Dr. Fr. M.K. Jose SJ for his support and encouragement from the very beginning to the end of the process. We are also thankful to other staff and office members who were actively involved while the data collection and field measurements.



Fr. Sanjay Martin SJ

Co-ordinator,

Energy Audit Team

St. Xavier's College, Mahuadanr

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Principal
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ENERGY AUDIT POLICY

Preamble:

Environment-friendly options and energy harvesting are of prime importance, which are the key factors in achieving Sustainable Development Goals (SDGs) for any organization. Rapidly and dynamically increasing energy requirement demands effective response. Hence, St. Xavier's College, Mahuadanr has incorporated alternate energy source in the form of Solar PV generation. The College's energy policy prefers efficient energy management and conservation through efficient procedures specified in its policy.

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- Expansion of Solar PV System.
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- Obtain Energy Audit certification.
- Provide experts to industry and other organizations in the area of energy management by offering Energy Audit Services.
- The Institute shall continuously review and update the approved policy and be committed to its implementation.

Executive Summary

The objective of the audit was to study the energy consumption pattern of the facility, identify the areas where potential for energy/ cost saving exists and prepare proposals for energy/cost saving along with investment and payback periods.

Objectives of Energy Audit

- To study the present pattern of energy consumption.
- To identify potential areas for energy optimization.
- To recommend energy conservation proposals with cost-benefit analysis.

The approach to the energy audit was focused its attention on energy management and optimization of energy efficiency of the systems, subsystems, and equipment. The key to such performance evaluation lies in the sound knowledge of the performance of equipment and system as a whole. The objective of Energy Audit is to balance the total energy inputs with their use and to identify the energy conservation opportunities in the stream. Energy Audit also gives focused attention to energy cost involved in achieving higher performance with technical and financial analysis.

Benefits of an Energy Audit

- **Identify Problems:** An energy audit can help identify any issues that the equipment might have. For example, the auditor could find small leaks in the compressed air system. These leaks would cost a significant amount of money if it is not noticed. Auditors can

also detect dangerous health risks like the carbon monoxide that's emitted from equipment that hasn't been vented properly. With a regular energy audit, the organization will be able to address these kinds of issues promptly to help ensure the health and safety of the staff members.

- **Reduced Energy Expenses:** The most obvious benefit is that the less energy the organization uses, the less money that the organization will have to spend on energy costs.
- **Show Environmental Concern:** By taking steps to be more energy efficient, the organization will be showing the employees and clients that the organization cares about the impact on the environment.
- **Increased Property Value:** Using the recommendations of an energy auditor to make facility more energy efficient could also help to increase its overall worth. Things like solar panels high-efficiency LED lighting and weatherization procedures are all things that contribute to a higher property value.
- **Longer Equipment Lifespan:** An energy auditor might recommend updating some of the equipment for maximum energy savings. If the organization decides to upgrade, it will not only save on energy costs, but also expect the equipment to last a longer time. This is because newer, more energy-efficient equipment doesn't have to work as hard as the older, outdated units to provide the same level of performance.
- **Energy Audit Evaluation:** Energy audit will evaluate the organization as a whole; the goal is not to evaluate single measures but to consider a wide range of available alternatives.
- **Energy audit Opportunities:** The audit will not only inform about the opportunities but also provide information with financial analysis. This will enable prioritization based on financial benefit and return on investment. It provides technical information regarding the proposed conservation measures.
- **Energy Audit Quality Analysis:** A good quality audit will analyse the historical energy use and find potential issues using statistical methods. Provide information with emissions analysis to help understand the benefits of the decisions from an environmental standpoint. Understand where energy is used, and which areas are worth focusing on the most. Provide benchmark information to help understand the energy use performance compared to others.

ABOUT THE COLLEGE

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Geography and computer labs, indoors and out door games facilities, well-qualified and dynamic faculty that regularly updates itself to enhance teaching, research and outreach processes. Good education is transformative; hence realizing the responsibility involved in their citizenship through education in our College, they in turn will work for the transformation of the Society and the Nation. Hence the College strives hard and works together with relentless determination. Its emphasis is the all-round development of the students which is achieved through contextualized study through diverse academic activities and competitions which develop entrepreneurial skill, leadership quality, management skill, team spirit, communication and presentation skills, creativity thereby equipping them to plunge into the competitive world. Internship, Field trips and Education trips are arranged that the students may relate the classroom knowledge with the outside reality and confidently enter the exciting world of discovery and exploration. Academic and personal counselling is a regular feature of the college; it provides personal direction and developmental guidance. Counselling brings better rapport between the teachers and the students are helped to deal with their personal challenges and their career planning. Accomplishment in the academic and co-curricular activities is a great achievement. There are six University toppers, the result is 100% and the students have become multidimensional. Co-curricular and extra-curricular activities promote the process of creative and critical thinking. They inculcate social and moral values, compassion, pride for one's culture and awareness of one's rights and duties; they also make the students good persons and confident leaders. The College develops versatile personality of the students and fills them with hope and dreams of greater success.

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- To motivate students to be a people skill-oriented, competent, committed, conscientious and compassionate.

- To promote modern and scientific techniques as well as the cultural values of the local people.

Energy Consumption Profile

Source of Energy

St. Xavier's College Mahuadanr uses energy from the following sources.

- **Electricity From JBVNL (Jharkhand Bijli Vitran Nigam Limited)**

This College receives electricity from Jharkhand Bijli Vitran Nigam Limited. It is the largest electricity distribution company of Jharkhand State and the major source of electricity for the college building.

- **High Speed Diesel Generator System (HSDG)**

Total 20 KV a diesel generator is installed for giving energy supply to the entire campus.

This is run whenever power supply from State Electric Board, JBVNL is not available.

Energy Saving Measures for DG Sets

Ensure steady load conditions on the DG set and provide cold dust free air at intake of air washers for large sets, in case of dry, hot weather can be considered.

- **Electricity SOLAR Grid connected Solar Plant**

The College has installed a rooftop solar power system which feeds the energy need of the campus. The power deficit created by an unsteady supply of electricity by JBVNL at this remote location is thus met by solar energy.



11	May-19	0.06417
	Average	0.88972

TOTAL ENERGY CONSUMPTION (11 months) = 2681.55 KWH

AVERAGE ENERGY CONSUMPTION (PER MONTH) = 243.777 (approx.)

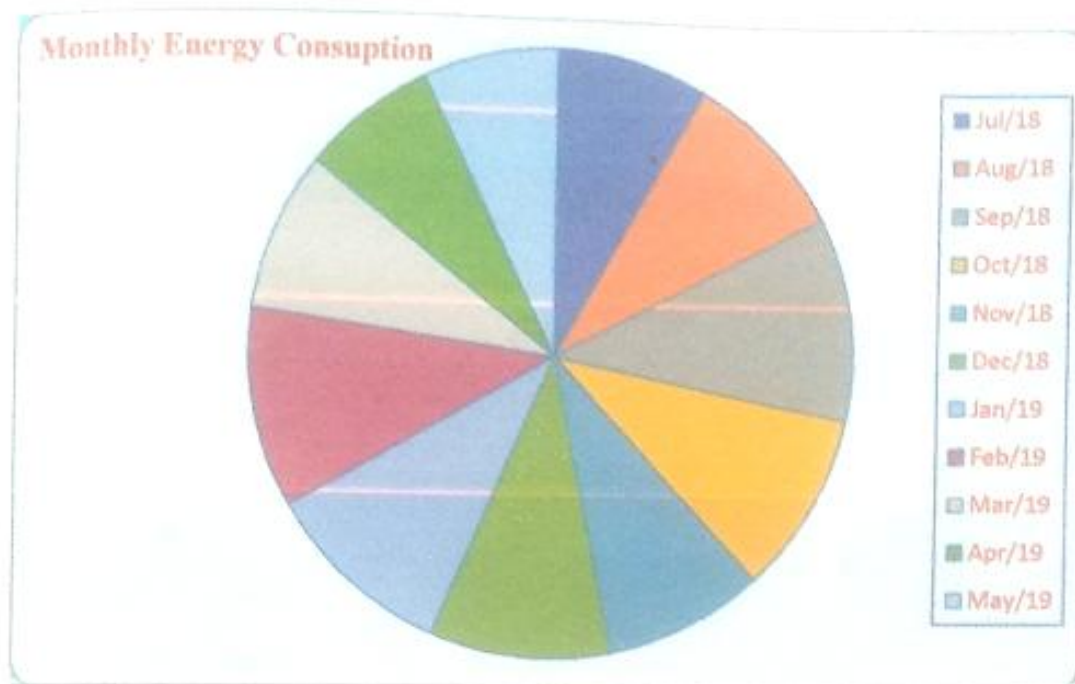


Fig: Pie chart of energy consumption St. Xavier's College, Mahuadanr 2018-19.

Recommendations

- Most of the time, all the tube lights in a classroom are kept ON, even though there is sufficient light level near the window opening. In such cases, the light row near the window may be kept off.
- All computers to have power saving settings to turn off monitors and hard discs say after 10 minutes/ 30 minutes.
- Lights in toilet area may be kept OFF during the daytime.
- There exists a significant opportunity to replace the fluorescent lamps with new Generation LED lights.
- Need to replace fluorescent tube lights and CFL lights by smart LED tube and bulb.
- Need to focus on existing solar plant which is generating power below the rated power.

Action Taken Report:

Optimizing Tube Light Usage in Classrooms:

Conducted awareness sessions for teachers and staff on the importance of energy conservation and efficient use of lighting.

Implemented a policy to switch off the lights near windows when sufficient natural light is available.

Implementing Power Saving Settings for Computers:

Configured power saving settings on all computers to automatically turn off monitors and hard disks after a specified period of inactivity (e.g., 10 minutes/30 minutes).

Conducted training sessions for staff and students to encourage them to manually switch off computers when not in use for extended periods.

Managing Toilet Area Lighting:

Implemented a schedule for routine inspections to ensure lights are switched off during daylight hours and promptly address any malfunctioning sensors.

Transitioning to LED Lighting:

Conducted a comprehensive audit to assess the feasibility of replacing fluorescent lamps with LED lights.

Identified areas with high energy consumption and prioritized them for LED retrofitting.

Procured and installed new generation LED lights in designated areas, focusing on energy efficiency and cost-effectiveness.

Upgrading to Smart LED Technology and Optimizing Solar Power Generation:

Initiated the process of replacing fluorescent tube lights and CFL lights with smart LED tubes and bulbs.

Collaborated with vendors to source smart LED lighting solutions that offer advanced features such as dimming and scheduling for further energy savings.

Conducted maintenance and performance checks on the existing solar power plant to ensure it operates at its rated capacity, addressing any issues or inefficiencies promptly.

Monitoring and Evaluation:

Established a monitoring mechanism to track energy consumption, cost savings, and environmental impact resulting from implemented measures.

Regularly review and assess the effectiveness of the initiatives taken, making adjustments as necessary to achieve optimal energy efficiency and sustainability goals.

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