



PREFACE

An energy audit is a study of a plant or facility to determine how and where energy is used and to identify methods for energy savings. There is now a universal recognition of the fact that new technologies and much greater use of some that already exist provide the most hopeful prospects for the future. The opportunities lie in the use of existing renewable energy technologies, greater efforts at energy efficiency and the dissemination of these technologies and options.

Energy has been identified as a crucial and balancing factor in the indices for sustainable development since the Earth Summit in 1992. Especially in the contemporary scenario, it is acknowledged that the heavy and unbalanced energy consumption adversely affects energy price and economic growth, and most countries now give priority to energy conservation methods.

The Energy Conservation Act, 2001, defines Energy auditing as the verification, monitoring analysis of use of energy including submission of technical report containing recommendations for improving energy efficiency with cost benefit analysis and an action plan to reduce energy consumption. It facilitates a systematic approach to the energy management in a system, trying to balance the total energy input with its use. It identifies all the energy streams in a system and quantifies the use of energy according to its discrete functions.

The energy audit of KOHINOOR BUSINESS SCHOOL was carried out by Energy Audit team. This report is our mite in contributing to the larger picture of effective energy management and conservation. As is known, energy auditing is an on-going process, a part of a larger procedure to ensure long-term sustainable development.

We have enlisted plausible solutions based on the outcome of our analysis of data, and our recommendations, which can be implemented wholeheartedly in the campus in order to ensure minimizing energy waste and maximizing energy potential. We hope in all earnest that these will be given its due and that the audit will be fruitful in terms of energy conservation.



ACKNOWLEDGMENT

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- Director of KOHINOOR BUSINESS SCHOOL Dr A.A. Attarwala
- Teaching & Supporting Staff of Collage For giving us necessary inputs to carry out this very vital exercise of ENERGY Audit. We are also thankful to other staff members who were actively involved while collecting the data and conducting field measurements



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1. 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.

The salient observations and recommendations are given below.

KOHINOOR BUSINESS SCHOOL uses energy in the following forms:

- a. Electricity from Maha discount (Local Discount)-13000 units
- b. Electricity from solar-12000 units

1. Electrical energy is used for various applications, like

- Computers
- Lighting
- Air-Conditioning
- Fans



2. INTRODUCTION OF INSTITUTE

KOHINOOR BUSINESS SCHOOL WHICH SPREAD OVER 18381.45 Sq.m the institute is situated at Mumbai, Kurla West. The institute came into existence by Mumbai university, establish year of the institute is 2010. The Kohinoor Business School situated at its integrated campus in Kohinoor City vidyavihar Kurla.

The KOHINOOR BUSINESS SCHOOL entrusted the work of conducting a Detailed Energy Audit of campus at Kurla (Mumbai) with the main objectives as below:

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



3. INTRODUCTION OF ENERGY AUDIT

Energy is a primary and most universal measure of all kind of work by human being and nature. It is one of the real contributions to the economic development of any nation. On account of the developing nation, the energy sector shows acceptance up to a significant level to expand energy requirements based on colossal investments to meet them. The aim of this report is to describe the indispensability of Energy in the present time based on the bulk utilization of different forms of energies to cater the demands. An Energy Audit is an investigation of a plant or office to decide how and where energy is utilized and to distinguish diverse strategies for energy saving Identification of the areas consuming major energy need prior attention to look for energy saving potential. The energy audit is the most effective tool for optimizing the efficiency of the plant without affecting the output of the system. Most of the country in the world is focused on the improving energy efficiency in the various sector.

According to the present scenario, it is more important to the next generation to get awareness about the efficient use of energy resources, when they are taking education in school. In this respects, advancement of energy proficiency in school is being advanced through the foundation of energy clubs.

An improvement in energy efficiency within your organization can potentially bring significant benefits. With this in mind, VARSWHASOOKT has developed energy audit services to help you find the best information for improvement opportunities. Energy audit services are a key part of our dedicated energy efficiency services and the first step towards your comprehensive energy management strategy.

is the important part of India's effort to improve its energy efficiency, energy quality, and energy intensity. The government of India promoting the energy efficiency in India through Energy Conservation Act 2001. The act instructs the central Government and Bureau of Energy Efficiency to find a way to encourage and advance energy productivity in all area of the economy. Government of India also promoting energy efficiency and awareness at school level by implementing student building Energy Audit is the important part of India's effort to improve its energy efficiency, energy quality, and energy intensity. The government of India promoting the energy efficiency in India through Energy Conservation Act 2001. The act instructs the central Government and Bureau of Energy Efficiency to find a way to encourage and advance energy productivity in all area of the economy. Government of India also promoting energy efficiency and awareness at school level by implementing student building capability programmed under Energy Conservation awareness scheme.



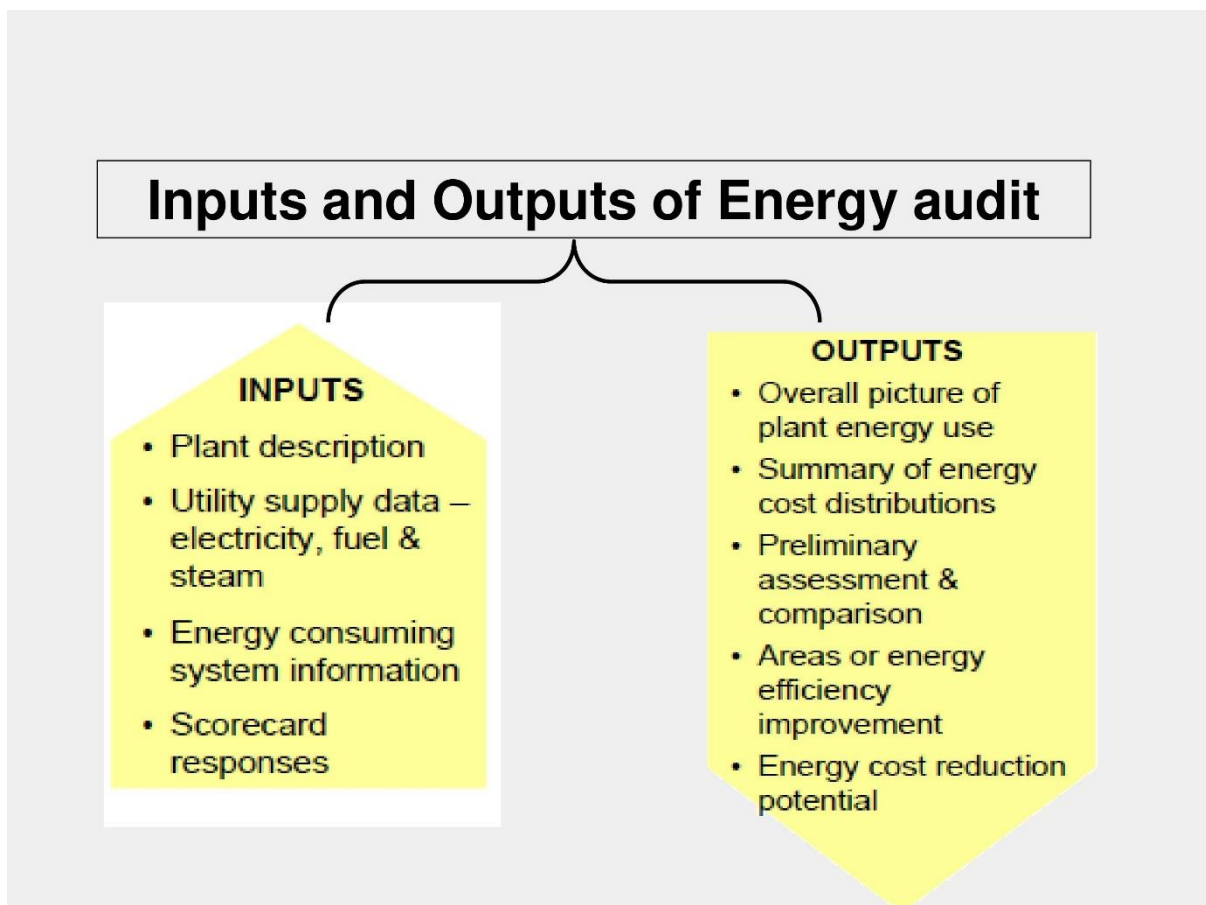
4. METHODOLOGY

Energy audits are primarily classified into

- Preliminary Audit
- Detailed Audit

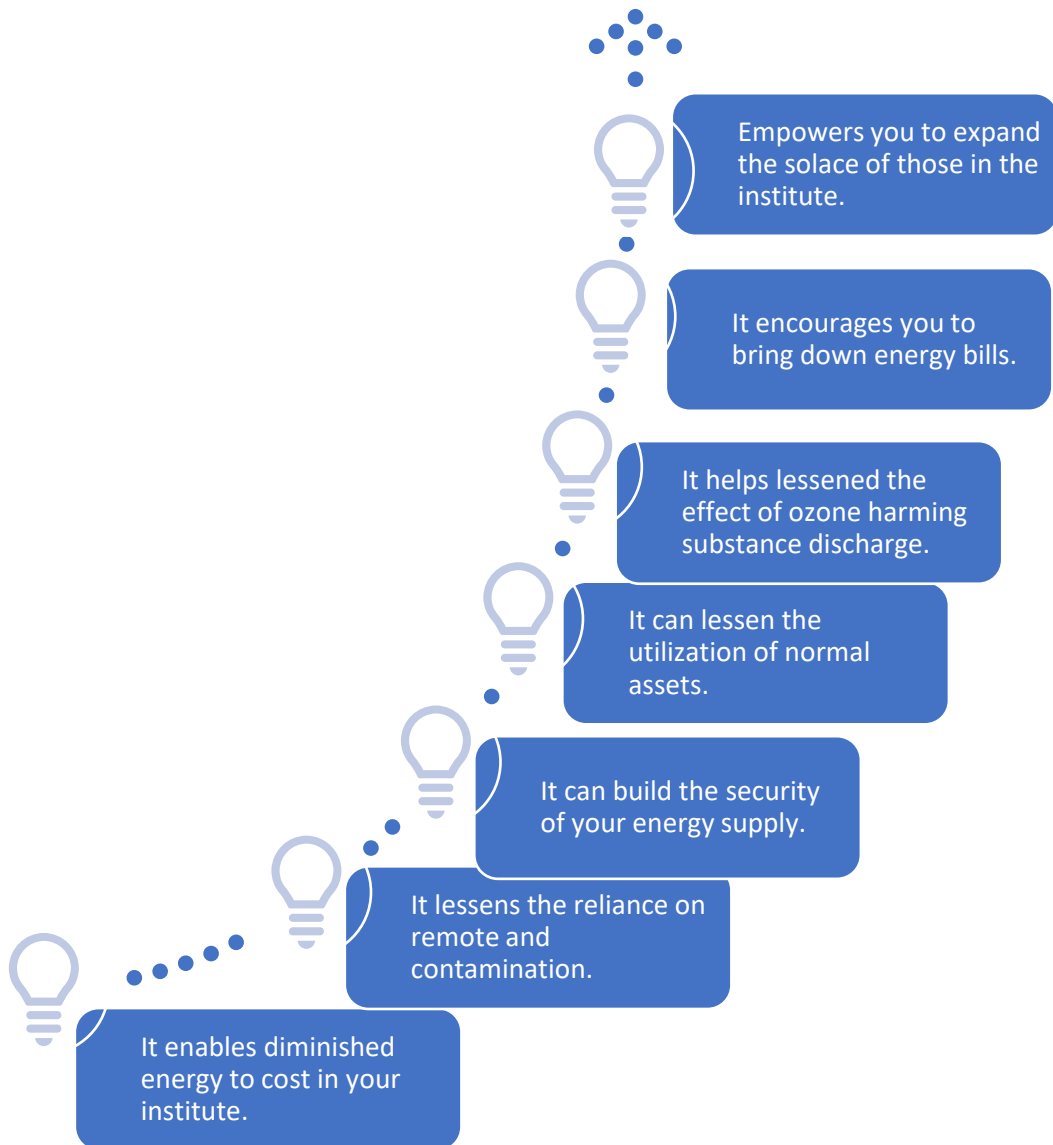
Since the Detailed Audit is meant for industry, and because of the limited size and the amount of energy consumption of the institution, the Preliminary Audit method was chosen for this year.

Scope of work and methodology were as per the proposal. While undertaking data collection, field trials and their analysis, due care was always taken to avoid abnormal situations so as to generate normal/representative pattern of energy consumption at the facility.





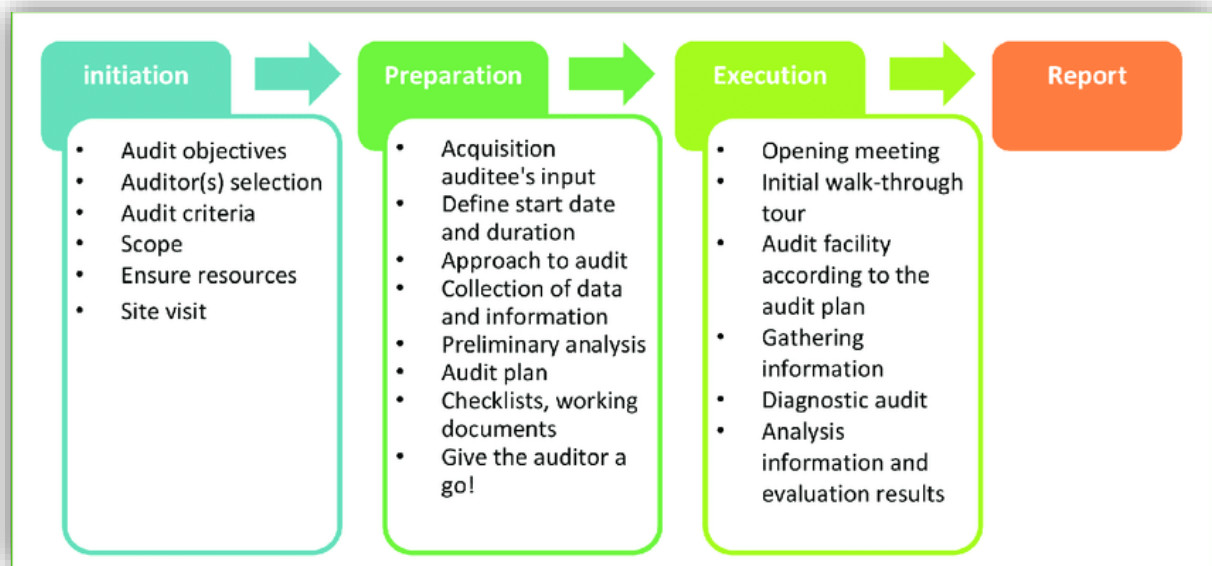
5. PURPOSE OF ENERGY AUDIT





6. OBJECTIVES

- A. Verify the steps adopted for energy management in the campus.
- B. Spot the inefficient or inadequate practices, if any.
- C. Improve the energy preserving measures and methods.
- D. Identify potential energy saving opportunities.
- E. Formulate feasible steps and measures to be adopted in the campus.





7. SCOPE OF ENERGY AUDIT

The work of energy audit has the objective of finding opportunities of energy conservation, saving and to recommend action plan with calculation of investment option and energy saving.

The scope of energy audit is,

1. To study and audit MSEDCL bill.
2. Study of lighting system and its measurement.
3. Harmonic measurement and its study.
4. Splitting of air conditioner.
5. Identification of energy saving opportunity and energy conservation.
6. Load study and submission of technical report.



8. SYSTEM STUDIED DURING ENERGY AUDIT

CHECK POINTS

MSEDCL monthly electricity is studied and audited.

Lighting system in campus is studied and illumination is measured.

UPS load measurement (harmonic measurement at UPS input and main feeder after MSEDCL meter). Study of energy utilization requirement.

Split air conditioner operation.

Energy saving opportunities is identified.

The identified saving opportunities are summarized for review and implementation.



9. ENERGY CONSUMPTION PROFILE

The loads were segregated based on the end use as lighting and fans, Computer/printers, water pumping. Quantification, types and necessary measurements were carried out. The

de tails are given below

a) PUMPS

	Primary chilled water pumps		
	Pump 1	Pump 2	Pump 3
Motor Details			
Make	Crompton Greaves Ltd	ABB	ABB
Type	3 phase Induction	3 phase Induction	3 phase Induction
Rated Kw	15kw	15kw	15kw
Efficiency	90	90	90
Pump Details			
Make	Mather & Platt Pumps Ltd	Mather & Platt Pumps Ltd	Mather & Platt Pumps Ltd
Capacity	109	109	109
Head	30.5m	30.6m	30.6m
Rated motor kW	15 kw	15kw	15kw
No. of pumps installed	1	1	1
No. of pumps operating	1	1	1



PUMPS

Equipment	Condenser water pumps		
	Pump 1	Pump 2	Pump 3
Motor Details			
Make	Crompton Greaves Ltd	ABB	ABB
Type	3 phase Induction	3 phase Induction	3 phase Induction
Rated kW	18.5 Kw	18.5 Kw	18.5 Kw
Efficiency	90.6	90.6	90.6
Pump Details			
Make	Wilo	Wilo	Wilo
Capacity	1480rpm	1480rpm	1480rpm
Head	27-43	27-43	27-43
Rated motor kW	18.5 kW	18.5kW	18.5 kW
No. of pumps installed	1	1	1
No. of pumps operating	1	1	1

b) CHILLER

Make	Trane
Model	RTHDC1E1F1
Type	Helical Rotary Liquid Chiller
Condenser type	Water cool
TR	215tr
Rated capacity	816.8
Refrigerant used	Non-flammable gas
Supply chilled water temperature	44° F
Return Chilled water Temperature	54° F
Entering Condenser water temperature	90° F
Leaving condenser water	100° F
Rated KW	6.09
No. of chillers installed	2
Type of Starter	Adaptive Controller



c) FUC INVENTORY

Kohinoor Business School

Sr. No.	Unit	Capacity	Qty	TR
1	FCU	2TR	37	74
2	FCU	3TR	15	45
3	FCU	2.5TR	5	12.5
4	FCU	1TR	1	1
5	Cassette	1.5	5	7.5
6	Cassette	3.2	4	12.8
7	Chilled Water Pump	480 GPM	1	
8	Condenser Water Pump	600 GPM	1	
9	Cooling Tower	200 TR	1	
			70	152.8

- **Kohinoor International School**

Sr. No.	Unit	Capacity	Qty	TR
1	FCU	2TR	14	28
2	FCU	3TR	35	105
3	FCU	2.5TR	10	25
4	FCU	1TR	5	5
5	AHU	8TR	1	8
6	Chilled Water Pump	480 GPM	2	
7	Condenser Water Pump	600 GPM	2	
8	Cooling Tower	200 TR	1	
10	Make Up Pump		2	
TOTAL			72	171
SUB TOTAL				323.8



d) LED INVENTORY DECEMBER 2019

Wattages	36W	18W	10W	5W	35W	56W	48W	
Total	149	95	36	3	9	18	23	
Total Wattage	5364	1710	360	15	315	1008	1104	

Wattages	36W	18W	10W	5W	35W	56W	48W	
Total Purchase Lights								
Total Used Lights	149	95	36	3	9	18	23	0
Total Balance	-149	-95	-36	-3	-9	-18	-23	0

e) TOTAL ANNUAL LIGHT POWER USED

Sr No.	Floor	Wattage
1	Basement	464
2	Ground	4384
3	1st	2032
4	2nd	1928
5	3 rd	3396
6	4th	4982
7	5 th	3374
Total		20560
Annual power in Watt		246720
Annual power in K W		246KW



Total Annual Lighting LED power

KBS

Sr No.	Floor	Wattage
1		36
2	Ground	1200
3	1st	976
4	2nd	976
5	3rd	64
6	4th	3710
7	5th	20
Total		6982
Annual power in Watt		83784
Annual power in K W		83.78KW



10. BEST PRACTICES FOR ENERGY SAVING



Solar Panel 1



Solar Invertor



11. RECOMMENDATION

1. Solar energy application is recommended for battery charging of UPS.
2. All Classrooms and labs to have Display Messages regarding optimum use of electrical appliances in the room like, lights, fans, computers and projectors.
3. Voltage and current harmonic measured are beyond permissible limit which needs harmonic mitigation treatment.
4. Some CRT monitor of PCS are recommended to replace with energy efficient LCD monitors to conserve energy.
5. Motor pump set is recommended to provide power capacitor.
6. Air conditioner shall be operated between temperature range of 24-25⁰C to maintain lower cooling load on compressor to save energy.
7. Turn ON the AC when required and turn it OFF when students will not be in their classrooms.
8. Install MCB for separate room so that we do not need to switch OFF all the loads when walkout from the classroom.
9. Use advance system adjust the temperature setting of AC according to the weather conditions.
10. Use light colour for wall which reflect day light to improve the illumination.
11. To maintain the illumination, De-dust the lightning fixture.
12. Setting the computers, monitors etc. to sleep mode when not required which saves approximately 40% energy
13. Occupancy sensors detect indoor activity within a certain area. They provide convenience by turning lights on automatically when someone enters a room, and save energy by turning lights off soon after the last occupant has left the room. Occupancy sensors must be located where they will detect occupants or occupant activity in all parts of the room.
14. Use lighting controls to automatically turn lights on and off as needed, and save energy. Of course, you can save energy by turning off lights when they're not needed, but sometimes we forget or don't notice that we've left them on.

The most common types of lighting controls include:

- Dimmers
- Motion, occupancy, and photosensors
- Timers.



15. Motion sensors automatically turn outdoor lights on when they detect motion and turn them off a short while later. They are very useful for outdoor security and utility lighting.
16. Dimmer controls provide variable indoor lighting. When you dim lightbulbs, it reduces their wattage and output, which helps save energy.
17. Timers can be used to turn on and off outdoor and indoor lights at specific times. There are two types of timers: manual timers, which plug into an electrical outlet for controlling objects such as lamps or light strings.
18. You can use photosensors to prevent outdoor lights from operating during daylight hours. This can help save energy because you don't have to remember to turn off your outdoor lights



12. CONCLUSION

Energy audit is an effective tool in identifying and perusing a comprehensive energy management program. A careful audit of any type will give the organization a plan with which it can effectively manage the organization energy system at minimum energy cost. In this paper a detailed study has been made to reduce the electrical energy consumption in the campus of KOHINOOR BUSINESS SCHOOL. It highlights the amount of energy savings, thereby reducing the energy crisis considerably. After implementing recommendations energy audit of institute, the electrical energy saving per year can be achieved as **20% to 30%** and total cost saving of electrical bill per year can be **20% to 30%**.