Energy Audit Report

(2021-22)

Shramjivi Shikshan Prasarak Mandal's

Adarsh Mahavidyalaya,

Tq. Omerga – 413606 Dist. Osmanabad (Maharashtra)

Energy Audit Conducted by

KEDAR KHAMITKAR & ASSOCIATES

MEDA Govt. of Maharashtra Institution Empanelled Energy Auditor

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Preface

An energy audit is a study of a 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.

Data collection for energy audit of the Adarsh Mahavidyala, Omerga (M.S.) was conceded by EA Team for the period of 3rd September 2022 to 5th September 2022. This audit was over sighted to inquire about convenience to progress the energy competence of the campus.

All data collected from each classroom, Library, every department. The work is completed by considering how many Tubes, Fan, A.Cs, Electronic instruments, etc. in each room. How much was participation of each component in total electricity consumption.

Acknowledgement

We express our sincere gratitude to the authorities of Shramjivi Shikshan Prasarak Mandal's Adarsh Mahavidyala Omerga for entrusting and offering the opportunity of energy performance assessment assignment.

Honorable Dr. D.P.Garud - Principal

We are thankful to Staff for their positive support in undertaking the task of system mapping and energy efficiency assessment of all electrical system, utilities and other workshop equipment. The field studies would not have been completed on time without their interaction and guidance. We are grateful to their cooperation during field studies and providing necessary data for the study.

Kedar Khamitkar

- Energy Auditor, Certified by Bureau of Energy Efficiency, Ministry of Power, Govt. of India
- Empanelled MAHAURJA , Govt. of Maharashtra

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.

Shramjivi Shikshan Prasarak Mandal Adarsh Mahavidyala Omerga Uses Electrical Energy from MSEDCL Maharashtra State Electricity Distribution Company Limited.

1. Electrical energy is used for various applications like: Lighting, Air-Conditioning, Fans Other Electrical Equipment, Computers, Printers, Xerox machines, LCD Projector, Router System, Flood light, Pumping Motor etc.

2. The average cost of energy is around Rupees **103663**/-Month.

3. The Specific Energy Consumption (SEC) is the ratio of energy required per square meter.

Total Electricity Consumption **23603** KWH /Year

Total Built-up Area **3236** Sq. Meter

In this case the SEC is evaluated as electrical units consumed per square meter of area.

It is calculated as under for (Electricity): **7.29** KWH/Sq. Meter

4. After the measurement and analysis, we propose herewith following Energy Efficiency Improvement measures.

Chapter: 1 Introduction of the Institute

Shramjivi Shikshan Prasarak Mandal's Adarsh Mahavidyala

In the period of Indian National Movement Rajshri Shahu Maharaj, Shikshanmaharshi Karve, Karmveer Bhaurao Patil and Maharshi Shinde have made a precious contribution in the educational arena. In the post-independence period, the government has planned the number of schemes. The education adores in Omerga taluka, the youth social workers, Hon. Shri. Vinayakrao Patil, Hon. Shri. Basavraj Patil (Ex-State Minister for Rural Development, Maharshtra State), Shri. Ramkrishnapant Kharosekar, Shri. Marutirao Suryawanshi, Shri. Wamanrao Suryawanshi and other members of management council got mobilized and established Shramjivi Shikshan Prasarak Mandal on 10th September 1984. Since its establishment the institution has been providing the quality education for the students or rural arena. The college aims at shaping the bright future of students in a proper way, because a student is the central figure in the stream of education in the universe.

College has been consistently attempting not only to provide a mere formal education or just create a graduate but also it has been struggling to inculcate ethical values, values of life, social awareness for arising the feeling of national integration. We all teachers not only offer the victuals of knowledge and intelligence to students but also we offer love, affection and faith to them and we consistently try to uplift them to the door of their highest apex of success and satisfaction. The college aims at the versatile development of the students through the ethical, intellectual, physical and cultural values.

College has been started the courses Microbiology, Industrial Chemistry & Computer Science etc. We have also started PG Courses of an M. A. (History), M.Sc.(Mathematics), M.Sc.(Botany), M.Sc.(Zoology), M.Sc. (Comp.Sci) and M.Sc. (Micro-Bio), etc. so that the student of this area should not face any inconvenience.

Scope of Work, Methodology and Approach:

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.

Approach to Energy Audit:

We focused our attention on energy management and optimization of energy efficiency of the systems, sub systems and equipment's. The key to such performance evaluation lies in the Sound knowledge of performance of equipment's and system as a whole.

Energy Audit:

The objective of Energy Audit is to balance the total energy inputs with its use and to identify the energy conservation opportunities in the stream. Energy Audit also gives focused Attention to energy cost and cost involved in achieving higher performance with technical and financial analysis. The best alternative is selected on financial analysis basis.

Adarsh Mahavidyala entrusted the work of conducting a detailed Energy Audit of campus with the main objectives are as bellows:

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

Chapter 2: Energy Audit Methodology

Energy Audit Study is divided into following steps

1. Historical data analysis:

The historical data analysis involves establishment of energy consumption pattern to the established base line data on energy consumption and its variation with change in production volumes.

2. Actual measurement and data analysis:

This step involves actual site measurement and field trials using various portable Measurement instruments. It also involves input to output analysis to establish actual operating Equipment efficiency and finding out losses in the system.

3. Identification and evaluation of Energy Conservation Opportunities:

This step involves evaluation of energy conservation opportunities identified during the energy audit. It gives potential of energy saving and investment required to implement the Proposed modifications with payback period.

4. Energy Audit Instruments used

a) Power Quality Analyser HIOKI - 3197

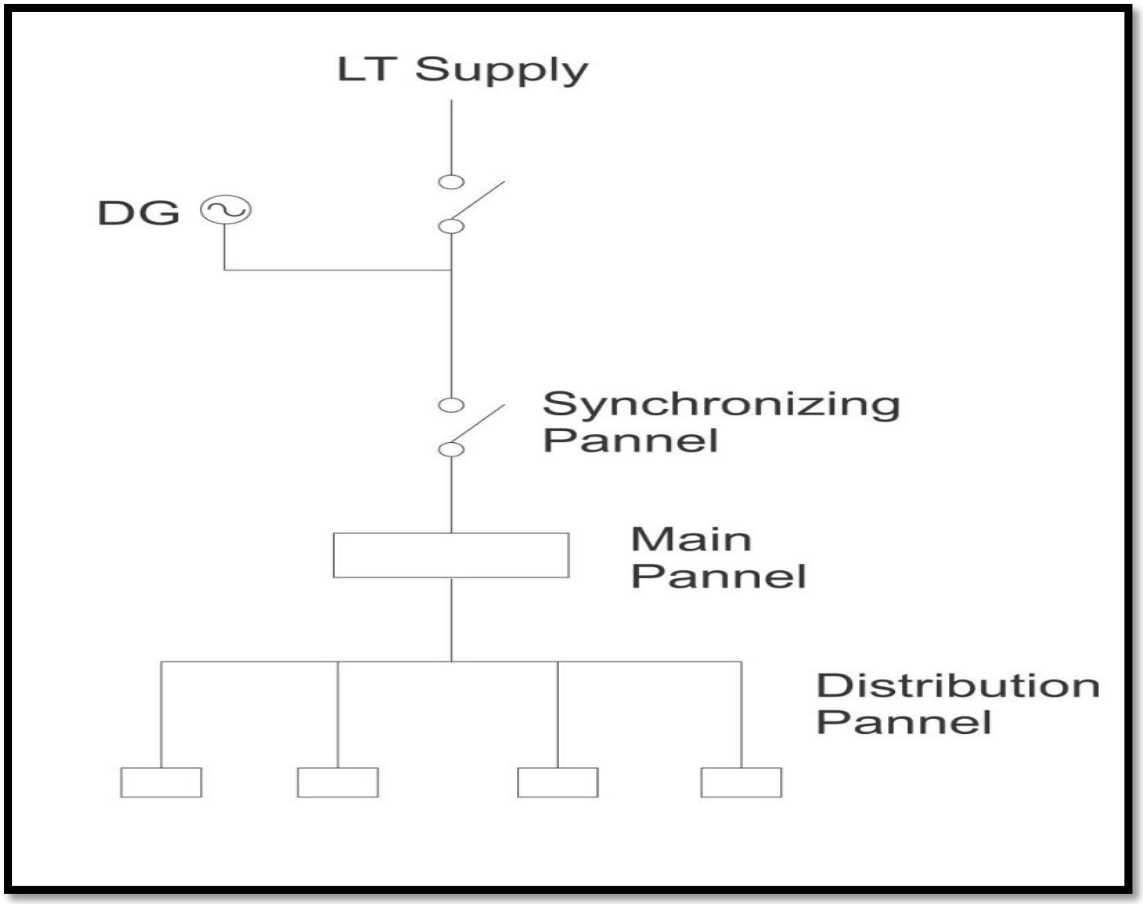
b) Lux Meter MECO

c) Thermometer

d) Wattmeter MECO

Chapter: 3. Study of Electrical Systems

Electrical Supply Details:



The electrical supply to Adarsh Mahavidyala Institute comes from MSEDCL LT supply.

Standby Diesel Generator:

Adarsh Mahavidyala has been installed Diesel generator of Capacity – **32** kVA.

Observations & Suggestions:

Install KWH meter & Keep logbook.

Electrical Energy Cost Analysis:

The electrical bills from MSEDCL for 12 months from Sept 2021 to Aug 2022 have been studied. In Adarsh Mahavidyala Campus Single Meter has been installed. The details of meter are as under

Study of Electrical Demand:

		Consumer No.	596526014201
SN	Details of Electricity Demand	**Tariff**	**88 LT-VII B I**
1	Sanctioned Load	**30**	KW
2	Contract Demand	**37.50**	kVA
3	Recorded Maximum Demand	**23**	kVA

Observations: Its observe that-

Total Contract Demand is **37.50 kVA**

While the recorded Maximum Demand is **23 kVA**.

Chapter: 4 Power Quality Supply

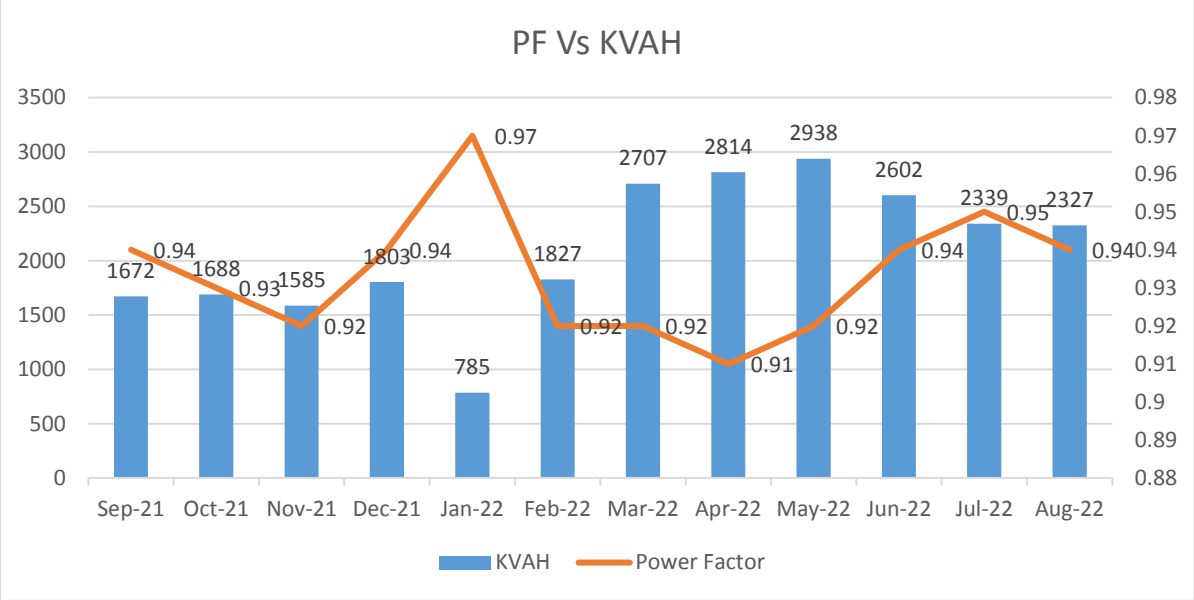
Good power quality saves money and energy. Direct savings to consumers come from lower energy cost and reactive power tariffs. Indirect savings are gained by avoiding circumstances such as damage and premature aging of equipment, loss of production or loss of data and work.
Power quality issues can affect the operation of critical loads and can have the negative impact on operation. Important to monitor the cost of energy wasted due to poor power quality.

Suggestions: Install Survo Voltage Stabliser 20KVA capacity

Solution for Poor Power Quality Servo voltage stabiliser is one of the best solutions to catch the issues of phase unbalancing and voltage variations.

Chapter: 5 Historical Data Analysis

Study of Variation of Monthly Units consumption & Power Factor: In this Chapter, we study the details of the 12 month Electricity Bills.



Variation in KVAH & Power Factor (PF)

Month	KVAH	Power Factor
Aug-22	2327	0.94
Jul-22	2339	0.95
Jun-22	2602	0.94
May-22	2938	0.92
Apr-22	2814	0.91
Mar-22	2707	0.92
Feb-22	1827	0.92
Jan-22	785	0.97
Dec-21	1803	0.94
Nov-21	1585	0.92
Oct-21	1688	0.93
Sep-21	1672	0.94

Conclusion: Variation of PF the Power Factor to reduce the utility power bill. Most utility bills are influenced by KVAH usage.

Study of Month wise Electricity Bill Variation:

SN	Month	Power Factor	Amount
1	Aug-22	0.94	104,510.00
2	Jul-22	0.95	70,630.00
3	Jun-22	0.94	36,510.00
4	May-22	0.92	104,220.00
5	Apr-22	0.91	68,300.00
6	Mar-22	0.92	33,620.00
7	Feb-22	0.92	114,200.00
8	Jan-22	0.97	89,710.00
9	Dec-21	0.94	166,970.00
10	Nov-21	0.92	141,640.00
11	Oct-21	0.93	118,920.00
12	Sep-21	0.94	194,730.00

KVAh Billing – MERC Directives/ Ruling

(Case No.195 of 2017 dtd. 12.09.2018)

MAHAVITARAN
Maharashtra State Electricity Distribution Co. Ltd

- **Commission intends to implement KVAh billing to all HT consumer and LT consumers having load above 20 kW from 1 April, 2020.**
- **MSEDCL to educate the consumers and take all necessary steps to ensure that all the consumers are billed by KVAh method from the next MYT i.e. from 1st April 2020.**
- **MSEDCL -**

  - To take necessary steps such as meter replacement and preparedness of billing software if required.

  - Wherever possible, start collecting category-wise energy consumption details in KVAh terms

kWh Billing	kVAh Billing
Consumers are billed as per kWh Consumption	Consumers are billed as per kVAh Consumption.
Power factor is also monitored separately though Incentive & Penalty Mechanism.	Inbuilt incentive/ penalty mechanism. No need for computation and monitoring of PF.
	Consumer drawing/injecting more reactive power will have to pay more and vice versa.
	Encourage consumer to minimize reactive power drawal/ injection

The Prime Objective of the kVAh based billing is to encourage the consumers to maintain near unity Power factor to achieve loss reduction, improve system stability, power quality and improve voltage profile

Power Factor (P.F.):

A good Power Factor provides a better voltage. Reducing the pressure on electrical distribution network.

Introduction- Apparent Energy (kVAh) & Power Factor...(1) MAHAVITARAN Maharashtra State Electricity Distribution Co. Ltd

1. Active or real power (kWh)

It is actually consumed and converted into useful work for creating heat, light and motion and is measured in (kW) and is totalized by the electric meter in (kWh).

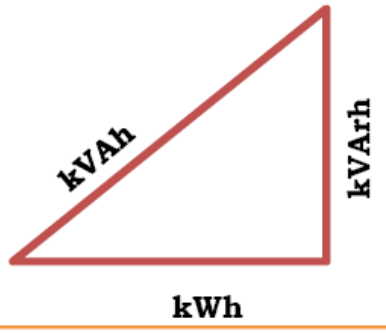
2. Reactive power (kVArh)

Reactive power is used to provide the electromagnetic / electrostatic field in inductive and capacitive equipment like motors, air conditioners, fans and is measured in kVAr (lag/ lead) and is totalised by the energy meter as kVArh .

3. Apparent Energy : kVAh

$$kVAh = \sqrt{(kWh^2 + kVArh^2)}$$

4. $$\text{Power Factor} = \frac{KWh}{KVAh}$$



Reducing cable heating, cable over loading and cable losses.

Reducing over loadings of control gears and switch-gears etc.

To maintain PF unity install APFC.

Install APFC: - Automatic Power Factor Controller (10 kVAr)

Study of Month wise Maximum Demand Variation:

SN	Month	KVA
1	Aug-22	23
2	Jul-22	20
3	Jun-22	18
4	May-22	21
5	Apr-22	23
6	Mar-22	21
7	Feb-22	14
8	Jan-22	14
9	Dec-21	11
10	Nov-21	13
11	Oct-21	14
12	Sep-21	10

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 = 100kW

No. of Days = 30 days

Hours per day = 24 hours

Solution:

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

$$= 0.50 \times 100 = 50\%$$

Load Factor Calculation		
Daily	Monthly	Annual
$\frac{\text{Total KW Hr through 24Hr}}{\text{Peak Load in KW X 24Hr}}$	$\frac{\text{Total KW Hr through month}}{\text{Peak Load in KW X 720Hrs}}$	$\frac{\text{Total KW Hr through year}}{\text{Peak Load in KW X 8760Hrs}}$

Month wise Load Factor Variation

Sr. No.	Month	Load Factor
1	Aug-22	0.09
2	Jul-22	0.1
3	Jun-22	0.11
4	May-22	0.12
5	Apr-22	0.11
6	Mar-22	0.11
7	Feb-22	0.07
8	Jan-22	0.06
9	Dec-21	0.07
10	Nov-21	0.06
11	Oct-21	0.07
12	Sep-21	0.07
	Average	**0.08**

Conclusion: Variation in monthly Load Factor

If your load factor ratio is above 0.75 electrical usage is reasonably efficient. If the load factor is below 0.5, you have periods of very high usage (demand) and a low utilization rate. Low load factor customers would benefit from a peak demand control system or from a Battery Energy Storage System to distribute electrical usage out over longer intervals of time and smooth peaks.

Low load factors, such as below 0.4, contribute significantly to the overall monthly electric bill in the form of demand charges. These demand charges are listed on the bill as coincident demand, facilities demand, and summer time related demand.

General Observations based on Electricity Bill:

1. For College Campus the Contract Demand (CD) is 37.50 kVA and minimum billing Demand is 40% of the Contract Demand (i.e. 15 kVA) since, the MD recorded is 23kVA.

2. The average electricity cost is Rs. 7.23/- considering the last twelve months (Excluding TOD charges, MD and PF charges)

3. Average monthly Power Factor is maintained near P.F. 0.92

4. Load Factor need to be improved to maximum value.

5. Power factor is affected during April 2022 Found Very Poor i.e. 0.91. Similarly found Poor during Feb 22 and March 22 is 0.92

Suggestion's: Need to improve Power Factor up to 0.99

Install APFC of 30 KVAR

Chapter: 6 Campus Total Connected Load:

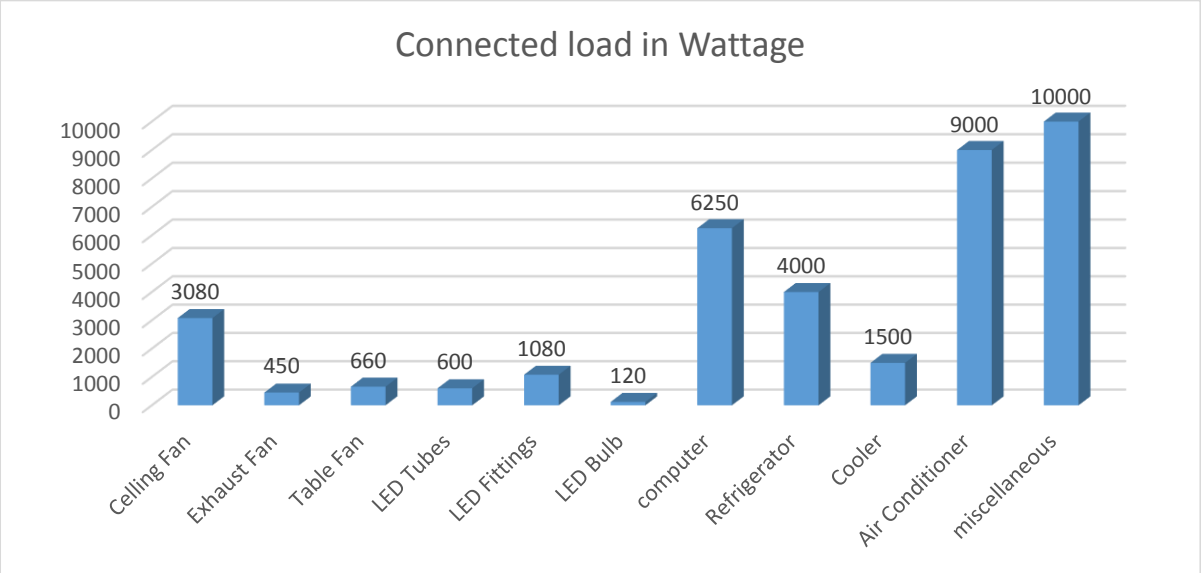
Electrical Equipment in the Institute

Following are the major consumers of electricity in the facility:

◎ Computers ◎ Lighting CFL ◎ Air-Conditioning ◎ Fans

◎ Other Lab Equipment ◎ Printers ◎ Xerox machines

◎ LCD Projector ◎ Router system ◎ Flood light ◎ Pumping motor



Remarks:

◎ It has been observed that in Adarsh Mahavidyalaya Omerga building majority of electrical power consumption is through light load such as Ceiling Fan, LED and power load such as Air Conditioning, ups, etc. unnecessary use of electrical equipment can be avoided.

◎ As per individual level load consumption, we can understand the scope for improvement of energy saving. Hence our electricity bill will be reduced by proper load management techniques along with optimum utilization of resources.

Chapter: 7 Energy Conservation Proposals

(Energy Efficiency Improvement)

SN	Recommendations	KWH Savings / year	Investment	Payback
1	**Install APFC (20 kVAr)** Automatic Power Factor Controller @10% Savings	2500	35000/-	3.27 yrs.
2	**Replacement of Existing Inefficient Ceiling Fans** (70w) Qty. 44 No's with Efficient BLDC fans (28W)	4731	96800/-	4.7 Yrs.
3	**Improve Power Quality :** Install Voltage Servo Stabilizer	2500	75000/-	3.75 yrs.
5	**Install occupancy Sensors / Closed Circuit Cameras** Energy Consumption Monitoring & Security purpose	500	25000/-	4.5 Yrs.
6	**Conduct Awareness Training Programs** **Sign Board 'Switch off button when not necessary'**	1000	No Investment	Immediate

General Recommendations

Create Awareness:

◎ All Class Rooms and labs to have Display Messages regarding optimum use of electrical appliances in the room like, lights, fans, computers and projectors. Save electricity.

Display the stickers of save electricity

Save nature everywhere in the campus. So that all stakeholders encouraged to save the electricity.

◎ Most of the time, all the tube lights in a class room 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.

◎ Try to get the benefit of -01.50 rate in addition to actual rate for per unit consumption of electric motor pumping during 2200 – 0600 Hrs.

◎ 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 after10 minutes/30 minutes.

◎ The comfort/Default air conditioning temperature to be set between 24˚C to 26˚C.

c) Executive Recommendations:

1. There has to be Institute level student community that keeps track of the energy consumption Parameters of the various departments, class rooms, halls, areas, meters, etc.

2. Energy auditing inside the campus has to be done on a regular basis and report should be made public to generate awareness.

3. Need to create energy efficiency/ renewable energy awareness among the college campus i.e. solar, wind, Biogas energy. College should take initiative to arrange seminars, lectures, paper presentation competition among students and staff for general awareness.

Chapter 8: Apply for ECBC:

The Energy Conservation Building Code (ECBC) was developed by the BEE Govt. of India. ECBC sets minimum energy standards for commercial buildings having a connected load of 100kW or contract demand of 120 KVA and above.

While the Central Government has powers under the EC Act 2001, the state governments have the flexibility to modify the code to suit local or regional needs and notify them. Presently, the code is in voluntary phase of implementation. About 22 states are at various stages of mandating ECBC, wherein most of building construction activities are happening across the country.

ECBC scope for the Existing Institute Building:

In existing Institute building we could save up to 30 percent of electricity by applying ECBC code. For this we could do retrofitting in the existing building and can make building close to ECBC compliant building.

Energy Audit Studies have revealed a savings potential to the extent of 40% in end use such as lighting, cooling, ventilation, refrigeration etc. In order to address this institutional barrier, the Bureau of Energy Efficiency has taken up the task of institutionalizing energy efficiency services, and of promoting energy efficiency delivery mechanisms.

Complementing the efforts of the government of India, the ECBC has been integrated in other rating & compliance systems being followed in the country such as EIA (Environmental Impact Assessment) for large area development under MoEF (Ministry of Environment & Forest), Green Rating for Integrated Habitat Assessment (GRIHA) rating system of ADARSH **and** Leadership in Energy & Environmental Design (LEED) rating system of **the** Indian Green Building Council (IGBC)**.**

प्रतिज्ञा

हम सत्यनिष्ठा से प्रतिज्ञा करते हैं कि अपने सभी कार्यों में पेट्रोलियम उत्पादों के संरक्षण हेतु सतत् प्रयासरत रहेंगे, ताकि देश की प्रगति के लिए आवश्यक ये दुर्लभ संसाधन दीर्घकाल तक टिके रहें। आदर्श नागरिक होने के नाते हम अधिकाधिक लोगों को तेल एवं गैस संरक्षण के प्रति सजग करेंगे ताकि पेट्रोलियम पदार्थों के दुरुपयोग से बचा जा सके।