SUPREME

CERTIFICATE

This is to certify that "Supreme Electrical Energy and Consultancy Services, LLP", Pune has conducted **Energy Audit** of "Zeal Institute of Business Administration Computer Application and Research, Narhe, Pune-411041" as per the Energy Conservation Act-2001. It has been observed that the institute not only has implemented various Energy Efficiency measures to conserve electrical energy but also started utilizing energy from renewable energy sources.

Sanjay A. Deokar 15/10/2022
Certified Energy Auditor
R. No. EA:4494

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Dr. Sanjay A. Deokar 15/10/2022
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Energy Audit Report

Zeal Institute of Business Administration Computer Application and Research

Pune-411041.

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PREFACE

Energy management and audit is a process including Inspection, Survey & Analysis of energy flows for energy conservation in a building, a process or a system to reduce the amount of energy input into the system without negatively affecting the output. It is the translation of conservation ideas into realities, by evolving technically feasible solutions with economic and other organizational considerations within a specified time.

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.

This Energy Audit of Zeal Institute of Business Administration Computer Application and Research", Narhe, Pune-411041, campus is just one step towards our destination of achieving energy efficiency and we would like to emphasize that an energy audit is a continuous process. We have compiled a list of possible actions to conserve and efficiently utilize our scarce resources and identified their savings potential. The next step would be to prioritize their implementation. We look forward with optimism that the institute authorities, staff and students shall ensure the maximum execution of the recommendations and the success of this work. We are also thankful to the other staff members who were actively involved while taking measurements and conducting field study.

Dr. Sanjay A. Deokar

BEE Certified Energy Auditor (EA- 4494)

Indian Green Building Council (AP)

Environmental Lead Auditor (ISO:14001-2015)

CERTIFICATE

This is to certify that "Supreme Electrical Energy and Consultancy Services, LLP", Pune has conducted Energy Audit of "Zeal Institute of Business Administration Computer Application and Research", Narhe, Pune-411041. It has been observed that the campus has taken initiatives to implement various energy efficiency measures (ECM's) by identifying various energy conservation opportunities (ECO's) to conserve electrical energy but also started utilizing energy from hybrid renewable energy sources like wind Power and roof top Solar PV system.

Dr. Sanjay A. Deokar
BEE Certified Energy Auditor (EA- 4494)
Indian Green Building Council (AP)
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LIST OF INSTRUMENTS USED:

Three Phase Power Analyzer (Dranetz, USA)

Single Phase Power Analyzer (ALM 10, Germany)

Lux meter, Power guard, Multimeter, Contact Thermometer, Tachometer.

SITE VISIT

Organization Name:	Zeal Institute of Business Administration Computer Application and Research.
Site Name & Address:	Zeal Education Society's, Survey No. 39, Narhegaon, Taluka : Haveli, Pune (Maharashtra):411041 Website: zibacar.in
Energy Auditor:	1. Dr. Sanjay A. Deokar (ME, PhD-Electrical Engg.) BEE Certified Energy Auditor (EA- 4494) Indian Green Building Council (AP) Chartered Engineer(IEI) Environmental Lead Auditor (ISO:14001-2015) **[**supremeelectricalenergy@gmail.com**]** [M:9823141287]

1. INTRODUCTION

1.1 Energy Audit

Energy plays a key role in the development and growth of the economy. The Government of India has put special emphasis to ensuring adequate, reliable, secure and cost effective supplies and to utilizing energy resources efficiently while minimizing the negative impacts on the environment. To ensure that there is sustainability of energy in the future, energy audit activities are necessary to determine suitable steps to be undertaken to use energy efficiently. An energy audit is an examination of the energy consumption of the equipment or system to ensure that energy is being used efficiently. This is one of the responsibilities of the Registered Electrical Energy Manager (REEM). This is a guideline for Registered Electrical Energy Manager (REEM) during their energy audit exercise. REEM should not be bound with this guideline but they have to establish their own justification in order to meet the facilities requirement according to the types and purposes such as offices, hotels, shopping complexes, hospital, college/universities etc
Objectives:

i) To set minimum standards for undertaking detailed energy audit.

ii) To guide REEM, asset owner and/or operator to identify Energy Conservation Measures (ECMs) in buildings.

1.2 Energy Audit Definitions

There are several definitions of an energy audit. Some guidebooks define energy audit as a systematic, documented verification process of objectively obtaining and evaluating energy audit evidence, in conformance with energy audit criteria and followed by communication of results to the client1 (CIPEC 2002). In the Indian Energy Conservation Act 20012 (BEE 2008), an energy audit is defined as the verification, monitoring and analysis of the use of energy and submission of technical report containing recommendations for improving energy efficiency with cost benefit analysis and an action plan to reduce energy consumption. An energy audit is a

study conducted to identify where, when and how much energy is being used in the business and how to reduce the cost of energy for the business. Even though there are several definitions, the objective or goal is the same which is to reduce the energy consumption without compromising comfort and quality of the building. This guideline is meant for REEM who have basic understanding on energy audits, for them to conform to the requirements of the Efficient Management of Electrical Energy Regulations 2008 (EMEER 2008).

1.2.1. Walk-through/preliminary Energy Audit

Walk-through audit is a process used to establish an overall picture of the potential of energy savings through visual inspection of the premises including air conditioning system, lighting, metering, building automation, building maintenance and other factors affecting energy consumption of the building. References to the records of equipment ratings, technical catalogues, operation and maintenance (O&M) manuals that are readily available will be very helpful to quickly determine whether equipment or systems are operating efficiently. Calculation, usually simple in nature, should be done to quantify the savings achievable for implementation of the identified Energy Conservation Measures (ECMs).

The walk-through/preliminary energy audit usually is carried out in one or two days by either REEM alone or with a team, depending on the size, complexity of the building and the scope of audit. Usually, simple instruments such as a clamp amp meter, thermometer, hygrometer (humidity meter) and lux meter will serve the purpose.

1.2. 2. Detailed Energy Audit

The detailed energy audit involves in-depth investigations into how the energy is currently being consumed, current performance of the existing systems and identification of various potential Energy Conservation Measures. It also gives the estimated cost and simple payback periods for all recommended Energy Conservation Measures.

The detailed energy audit involves the following four (4) main processes:

i) Data collection

ii) End-use load distribution

iii) Identification of Energy Conservation Measures

iv) Reporting and presentation

1.3. Detail Energy Audit Process

1.3.1. Data Collection

One of the key tasks in Energy Auditing is the collection of all energy related data required by the REEM to apportion the total facility energy consumption into various energy end-uses. The collected data is then used to build a reliable picture of where and how much energy is being consumed and the cost of energy being used at the building. Data collection is one of the most laborious tasks in Energy Auditing and inability to collect the required data will lead to less reliable Energy Audit results.

One of the difficulties faced by the REEM in order to establish the building's major end-use demands (air-conditioning, lighting and general equipment) is the limited or lack of building metering equipment. To be able to estimate reliably the major building's end-use demand, it is recommended that the REEM uses the following three steps to identify the building end-use demand:

a) Desktop data collection
b) Field data collection
c) Cross checking of load demand data

The process of carrying out these three steps of data collection is explained in the following paragraphs:

a) Desktop Data Collection

The purpose of desktop data collection is to minimize the field energy related data collection by using all available facility data. It would be advisable during the initial process to collect preliminary building energy related data using a Building Detailed Audit form. This form allows the REEM to understand the nature of the audited building and areas to focus on during the auditing. The data collection through the form can be used to estimate the time and manpower required for the field data collection activity later.

To minimize the time and manpower for the field data collection, the REEM should try to gather energy related data as much as possible using available resources such as:

i) Architectural drawings (as built drawing)
ii) Mechanical & Electrical drawings
    • Lighting circuit drawings (as built drawing)
    • Air conditioning system drawing and design manual (as built drawing)
    • Single line power supply schematic drawings (as built drawing)
iii) Electrical energy bill historical data (for at least one year)
iv) Load control systems such as timers, building automation system if any and others (as built drawing)

The REEM will use all desktop available energy related data to estimate the current building major energy end-uses.

The desktop data gathering should be considered as a first step of data collection, which will be complemented and verified during the Field Data Collection process.

b) Field Data Collection

The field data collection is a critical step for:

i. Complementing the missing data, which the REEM could not find during the Desktop Data Collection process.
ii. Verifying the accuracy of Desktop Data.
iii. Understanding closely the building operations, energy wastages and building maintenance status.
iv. Carrying out the necessary field measurements required to establish main incoming load profile, major energy end-uses such as Heating Ventilation and Air Conditioning (HVAC), lighting and others. Establishing actual building load apportioning.

c) Cross Checking of Load Demand Data

The accuracy of estimated end-use energy consumption will affect the accuracy of estimated energy savings of various building ECMs. Therefore, for reliable estimate of the building and end-use energy consumption, it is recommended to use the following approach:

Use the field data collected to estimate the building's total and end-use energy consumptions. Due to a number of assumptions used in this method, in particular the equipment loading and time usage factors, the accuracy in estimating the building total end-use energy consumption may vary depending on the loads measured. For instance, due to the predictable nature of lighting load, this method allows reliable determination of the building lighting load.

Use appropriate data loggers to record the building and end-use load cycles. For example, it is recommended to record typical daily load profiles of main incoming for seven (7) days, one (1) to seven (7) days for HVAC system and one (1) hour to one (1) day for other equipments.

The logged data can be used to verify the accuracy of the estimated building total and end-use energy consumption generated by the desktop data collection. If there is a large deviation between the end-use loads estimated by desktop data collection and the end use loads estimated by field data collection, the REEM should alter the assumptions (equipment loading and time usage factors) applied in estimating the building equipment loads used in the desktop data collection to reduce these deviations to an acceptable range. REEM should take into account other factors such as seasonal variations and occupancy changes during the year that may affect overall energy consumption.

1.4 Analysis and Identification of Energy Conservation Measures (ECMs)

The effectiveness of an energy audit is related to the understanding in depth of the nature and operations of the audited building by the REEM. Knowing the acceptable level of comfort and tolerance for lighting, temperature and humidity level by employees are essential to come up with effective and acceptable ECMs.

1.5 About Institute & Facility Description: -

ZES has established in the year 1996, under the expert guidance of Shri. S. M. Katkar to provide quality education, Zeal Education Society has made a mark for itself as a renowned institute in the Pune region. ZES offer a team of highly qualified Staff, state of the art infrastructure and extraordinary vision that every student who is a part of the Zeal family marches out of the campus with top level confidence and abilities to be competent enough to face the cutting edge competition in the corporate world today. The society imparts knowledge from KG to PhD by establishing Zeal College of Engineering and Research, Zeal Polytechnic, Zeal Group of

Management Institutes, Dnyanganga School, Dnyanganga Junior College, Dnyanganga College of Education and Silver Crest School. All the courses are approved by AICTE, New Delhi, recognized by DTE Govt. of Maharashtra & affiliated to Savitribai Phule Pune University. ZIBACAR welcomes you to the one the finest management institutes in Pune region. We are committed to the proper progress of students for a flourishing career.

The Institute aims at bringing out the budding talents within each student and offer a motivating supervision to discover their capabilities which can help them become competent professionals.

The Institute extends its full support and guidance through well qualified staff who are more that eager to improve professional as well as personal skills and help the students explore their full potential.

ZIBACAR offers state of the art infrastructure inclusive of a pleasant campus, up-to-date equipment and facilities that help the students to concentrate on their work. .

We have a team of highly qualified professors who strive to ensure that they impart knowledge which is sync with the University syllabus and the currents industry prerequisites. The amenities like Culture Centre, Music Studio, Dance Studio, TED Studio etc. have been offering opportunities to the students to showcase their talent.

The college is equipped with state of art infrastructural facilities like advanced class rooms, laboratories with high end equipment's, updated library, playground, gymnasium and auditorium. The college has hostel facility for the boys and girls in the campus. Vision and Mission of the institute is given below:

Vision:

To be recognized as a Management Institute of Excellence by developing an individual's potentials in the field of Management through spread of knowledge and wisdom in an intelligent environment.

Mission:

- **By enriching the knowledge and enhancing the facilities through management education with relevance of industry and society as a whole.**
- **By facilitating a harmonious symphony of excellence in teaching with a practical approach which shall be synonymous with academic rigor, research culture and sustained efforts to maximize value based education.**
- **By developing holistic focus on character building along with a range of curricular, co-curricular and extracurricular activities.**

1.6 Methodology Adopted -

Pre-audit stage:

Defining scope of energy audit.

Forming an energy audit team.

Estimating time frame .

Collecting building information.

Energy audit stage:

Conducting site inspection and measurement.

Analyzing data collected.

Preparing energy audit report.

Post-audit stage:

Implementation of energy management opportunities.

Monitoring and review.

Energy Audit has conducted as per the guidelines of Bureau of Energy Efficiency (BEE)

- Relevant Data collection like inventory list of lighting fixtures, pumps, air cconditioner and other equipment's.
- Measurement of main supply Voltage, Current, p.f., kW, kVAR, kVA and Voltage & Current Harmonics are done at the LT side of the Transformer and trend is recorded.

- Measurement of power consumption load centers at distribution panels.
- Analysis of the past data for understanding the consumption pattern.
- Recommendation of energy improvement projects and methods to reduce the energy cost.
- Analysis of Techno-economic feasibility of the project with simple payback.

2. ENERGY CONSUMPTION PATTERN

2.1 Electricity Bills:-

The Electricity Bill of a utility consists of

- Maximum demand
- Load factor
- Power Factor (PF) incentive
- Time of Day Tariff (TOD tariffs)

Maximum Demand:

Maximum demand is the highest average kVA recorded during any one-demand interval within the month. The demand interval is normally 30 minutes, but may vary from utility to utility from 15 minutes to 60 minutes. The demand is measured using a tri-vector meter / digital energy meter.

Load Factor:

Load factor is the ratio of average load to maximum-billed load. It is an indicating parameter to show if maximum demand can be reduced. The monthly load factor is calculated as follows:

$$\text{Load Factor} = \frac{\text{Actual units consumed}}{\text{Maximum demand X No of hours per month X Average P.F.}}$$

P.F incentives:

PF is the ratio of ACTIVE POWER to APPARENT POWER.

Thus,

PF = KW/KVA.

Hence, PF can be maintained by controlling the Maximum Demand.PF can also be improved by installing a capacitor bank at the connected load as per the requirement the rating of the capacitor bank directly depends upon the desired and the existing PF which is given by the relation:

kVAr Rating = kW [tan φ1 – tan φ2]

Where,

KVAr rating= No. of capacitors required.

tan φ1=Existing Power Factor.

tan φ2=Improved Power Factor.

As per the MSEDCL tariff, whenever average power factor in a month, is more than 0.95, following incentives are offered:

For every 0.01 improvement of average PF above 0.95, an incentive of 1% of the amount of monthly energy bill, (excluding Regulatory Liability Charge (RLC), Demand Charges, Fuel and Other Cost Adjustment Charges (FOCA), Electricity Duty) is offered.

For PF of above 0.99 the effective incentive will amount to 5% of the energy charges, and for unity PF the effective incentive will amount to 7% of the energy charges.

TOD Tariff:

Time of Day metering (TOD), also known as Time of Usage (TOU) or Seasonal Time of Day (SToD), metering involves dividing the day, month and year into tariff slots and with higher rates at peak load periods and low tariff rates at off-peak load periods. While this can be used to automatically control usage on the part of the customer (resulting in automatic load control), it is often simply the customer's responsibility to control his own usage, or pay accordingly

(voluntary load control). This also allows the utilities to plan their transmission infrastructure appropriately. See also Demand-side Management (DSM).

TOD metering normally splits rates into an arrangement of multiple segments including on-peak, off-peak, mid-peak or shoulder, and critical peak. A typical arrangement is a peak occurring during the day (non-holiday days only), such as from 1 pm to 9 pm Monday through Friday during the summer and from 6:30 am to 12 noon and 5 pm to 9 pm during the winter. More complex arrangements include the use of critical peaks, which occur during high demand periods. The times of peak demand/cost will vary in different markets around the world.

For all HT consumers the Time of Day (TOD) tariff is applicable in Maharashtra. For this purpose the day has been divided into 4 different time zones as given in table

Zone	**Consumption during following hours of the day**	Energy charge (p/u)
A	2200- 0600 hrs	-1.50
B	0600-0900 hrs	0
	1200-1800 hrs	0
C	0900- 1200 hrs	0.80
D	1800-2200 hrs	1.10

The Campus of ZES, (Zeal Institute of Business Administration Computer Application and Research) is LT consumer with 188 KVA contract demand and **Zeal Education Society has installed 120 KW roof top Solar PV net metering system. It generates 15000 units per month which are 30% of total energy consumption.**

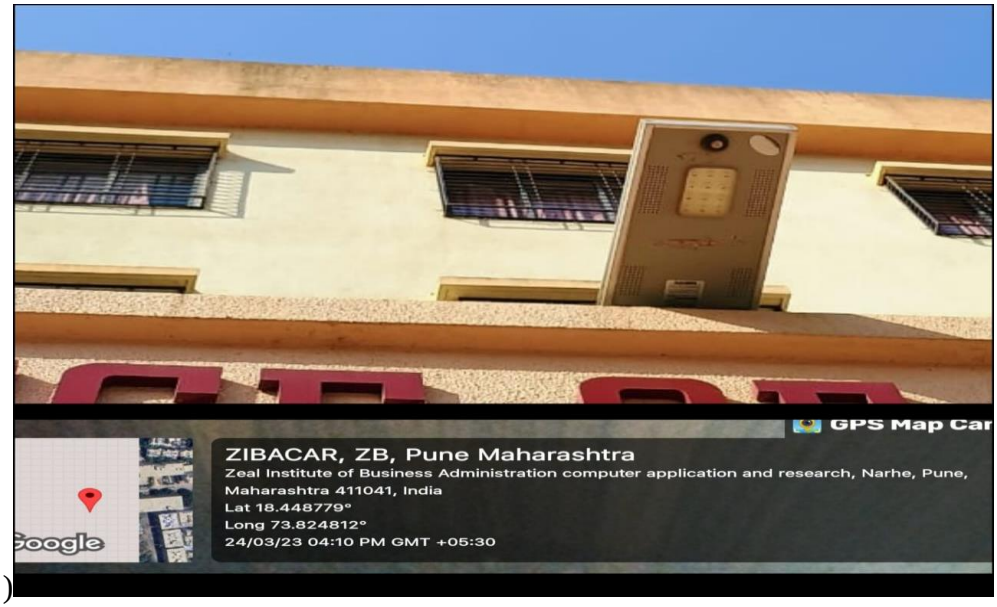
Sr. No	**Unit**	**Meter No.**	**Contract Demand**	**Connected Load capacity**	**Category**
1	1	170019032730	188KVA	150KW	89LT-VII B I

The total electricity bill for the year 2022-23 was **Rs.5570011.30.** The average monthly electricity bill of the campus for the year 2022-23 was **Rs. 464167.608.** The total energy consumption for the year 2022-23 was 491816 units. The average monthly energy consumption of the campus is 40984 KWh (units). In the year 2022-23 the average billed demand was 128**KVA. The average power factor was 0.990.**

At present connected load of the institution is 32 KW

(**Note: 1.** The billing unit & yearly energy consumption is at actual mentioned on Electricity bill.)

Energy Efficiency Measres Implimented in the Campus: It has been observed that campus has installed 20W all in one integrated solar based fixures in the campus . The Institute has total lighting load 8KW, in which 2KW lighting fixures are LED type. The 25% of Lighing load is Energy efficient (i.e.LED Fixures are installed in the building).



(20 W all in one integrated solar baed fixures with motion senser system)

(LED Fixures in the Campus)

Solar Rooftop Net Meteringing system in the Campus

Solar PV Roof Top Net Metering System: It has been observed that ZES has Installed 120 KW Net Metering Solar PV rooftop system in the campus which is generating 50000 KWh (Units) Per month. The energy consumption demand of the campus is 96000 units per month. It seems that installed solar PV roof top net metering system is fulfilling 30% energy demand of the campus.

It is strongly recommended to install another 200 KW solar PV roof top net metering system, which will substantially contribute to reduce power consumption from Grid as well as it helps to keep the environment clean. The payback period would be less than 4 years by taking the benefit of 30 % government subsidy. It has been observed that ZES has installed 4000 Liter per hr solar PV roof top hot water system at the girl's hostel

Important of Carbon Credit:

In India, being a tropical country, solar energy has largest potential than other green energy sources. But all technologies of electricity generation do have carbon footprint (CFP), which is

the total amount of CO_2 and other GHG, emitted over the full life cycle of the processes. The utilization of solar energy is usually accomplished by using photovoltaic (PV) cells and modules. This technology is often referred to as low carbon or carbon neutral because they do not emit CO_2 during its operation. However, it is not carbon-free form of energy generation, because CO_2 emissions do arise in other phases of its life cycle such as during extraction, construction, maintenance and decommissioning. These cells are extracted from silica (quartzite sand) at high temperature. Production of silicon cells (called as silicon wafers) from silica can be regarded as the direct non-green part of the technology and contributes significant fraction to CFP.Solar technology is encouraged due to its low CFP compared with the fossil fuel technology and also for carbon credit (CC) by way of reduction of CO_2 emission in the environment. The CC trading (Emission trading) is an administrative approach that provides economic incentives for achieving reductions in the emission of pollutants and is a tradable permit scheme. International treaties such as the Kyoto Protocol set quotas on the amount of GHG which a country can produce. Countries in turn set quotas on the emissions of businesses. Again, the businesses that are over their quotas must buy CC for their excess emissions, while businesses that are below their quota can sell their remaining credits. Even, the credits can be exchanged between businesses or bought and sold in international markets (Chicago Climate Exchange and European Climate Exchange) at the prevailing market price. Study reveals that during 2005–06, European and Japanese Companies were the major buyers and China was the major seller of the CC. Again, the amount of CC earned is obviously associated with the amount of solar electricity produced, which usually depends on climatic conditions of the area and also the efficiency of the cells along with other prevailing conditions. Hence, there are large variations on the extent of solar energy production using PV cells and, consequently, on the CC earned as well as on the contribution of CO_2 emission to CFP. The solar energy is considered as an important alternative to mitigate GHG emission in India as the country receives considerable amount of solar radiation. In this context, it is posing a serious question whether this technology is reducing CFP or contributing to CFP and to what extent? This estimation is extremely important for planning the combination of energy generation system to be used in the country. Literature survey reveals that the studies on this aspect are very rare. This has

reinforced the present study to estimate the following: (i) to quantify the degree of solar energy production; (ii) to reveal the amount of carbon credit earned per megawatt-hour per year by using this green technology; and (iii) to quantify the amount of direct CO_2 generation per megawatt-hour per year during the extraction of silicon wafers used in a PV module using real-life data and also to highlight the contribution of this CO_2 to CFP in the India.

(120KW Net metering solar PV Roof top system in the Campus)

Carbon Credit calculation for 200 KW Solar PV Plant

During 22 years, the 200 kW plant can generate (150000 KWh(Units)/per year with 300 clean sunny days, average 2.5 units per KW) 3300000 KWh(Units) Energy(3300Mwh).

On considering the average value of 0.932 tonnes of CO_2 emission reduction per megawatt-hour of electricity. In this Plant, CO_2 emission reduction per megawatt-hour for 22 years as per the calculation will be 3300 × 0.932 = 3075 tonnes.

As pointed out earlier, if this value is traded at the rate of 40$/tonnes, then total reduction will be3075 × 40 = 123000$ *82 = Rs. 1,0086000.00 in 22 years.

3. ENERGY EFFICIECY RECOMMENDATIONS

It has been observed that the load on the campus is not constant as well as during the time of day (TOD) energy consumption also varies significantly. The contribution of lightning load, fan load and computers are found to be dominant. So there is a wide area to reduce energy consumption by replacing the conventional appliances by new highly efficient appliances. This could find the major & economically viable solution to reduce energy consumption & ultimately leads to reduction in electricity bill. For calculating the power consumption, it is required to have the diversity factor, as the facility working period is considered the diversity factor is assumed to be 0.4 (i.e,40%) it signifies that the 40% load consumption out of 100% total connected load. The working days for the college premises are 240 days while working hours are 7 hrs this will give the exact energy consumption. The commercial rate according to tariff scheme is on an average Rs.12.0/unit. The required data will also include the various ratings of conventional as well as efficient appliances.

3.1 Replace existing ceiling fan (70 W) by energy efficient fans (28 W BLDC Motor fans).

The overall benefit by this replacement is:

Old Fitting:

Type fitting	: 70W ceiling fans
No of Fitting	: 70 Nos.
Total Wattage	: 4900 Watts.
Operating Hours	: 270 days x 7 hours = 1890 hrs.
Electricity Consumed per year	: 9261(Units)
Electricity Rate	: Rs.12.0 per unit
Annual Electricity Cost	**: Rs.1,11,132.00**

New Fitting:

Type fitting	: **28** W Energy efficient fans
No of Fitting	: 70 Nos.
Cost of fitting	: Rs.3500 (per fitting)
Total Investment for fitting	**: Rs. 2,45,000/-**
Operating Hours	: 270 days x 7 hours = 1680 hrs.
Electricity Consumed per year	: 3704 kWh (Units)
Electricity Rate	: Rs.12.0 per unit
Annual Electricity Cost	**: Rs. 44,452.80**

Simple payback period:

Net annual saving	: Rs.1, 11,132.00- Rs.44452.00= **Rs.66,680.00/-**
Simple payback period	: Total Investment / Net Annual Saving
	: 1.66 Years**.**

Existing 70 W Fan ***Proposed 28 W BLDC energy efficient fan***

3.2 Sensor based solar operated led outdoor light

An LED based solar street lighting system aims at providing solar electricity for operating LED lights for specified hours of operation per day. Rapid developments in solar cells, LED lighting and energy storage are creating great opportunities for solar-powered solid-state lighting.

It is recommended to install more sensor based all in one integrated solar operated LED street lamp in the campus.

3.3 Principal/Director/Head of Department (HOD) cabin IOT automation:

Mobile based IOT system can be installed in the Principal/Directors/HOD cabin to control electrical devices in the campus. It will helps to reduce energy consumption.

Load Factor Incentive: The Commission has retained the Load factor incentive for consumers having Load Factor above 75% based on contract demand. Consumers having load factor over 75% upto 85% will be entitled to a rebate of 0.75% on the energy charges for every percentage point increase in load factor from 75% to 85%. Consumers having a load factor over 85 % will be entitled to rebate of 1% on the energy charges for every percentage point increase in load factor from 85%. The total rebate under this head will be subject to a ceiling of 15% of the energy charges for that consumer.

It is strongly recommended to maintain load factor above 0.75 to avail L.F incentives.

3.4 Energy efficiency of Water pumping systems:

The most significant savings in the energy consumption of a pumping system can be achieved by selecting the most appropriate pump technology and Energy efficient motors star rated motors. For an application with premium efficiency. This selection process starts with gaining a complete understanding of the application, fluid characteristics and flow demands. Matching the most appropriate pump construction with the optimum impeller design will result in the most cost-effective solution, both in terms of initial capital investment and long-term operating costs.

The correct sizing of the pump represents the next most significant economic opportunity to reduce energy consumption. Oversizing often occurs in the design phase by the customer, because it is quite common to add multiple safety factors to the required head and flow values. Therefore, an over-sized pump is selected and, consequently, the pump does not run within its best efficiency area during normal production, resulting in a considerable waste of energy.

Replacing a pump with a new, high-efficiency design reduces the energy consumption normally by between 3% and 20%, but in some cases, there can be as much as a 50% reduction.

Factors such as pipe size (diameter), overall pipe length, pipe surface roughness, as well as control valves will influence the system pressure drop and resulting energy consumption for the system. Replacing an over-sized pump with a more suitable design size brings a great potential for savings. In some cases, significant savings can also be achieved by modifying the existing pump with a different kind of impeller or adding a VSD. At the same time, it is imperative that you take care of energy efficiency while pumping procurement itself. Choosing pump manufacturers who have a good track record of energy efficient pumps will be advantageous. A minor drop in the energy efficiency of pumps across the plant can lead to a major cumulative loss to the system. Hence whenever you are procuring new pumps, always keep the energy efficiency of pumps as one of the deciding factors and opt for a reputed pump manufacturer that can provide you with good quality and energy efficient pumps.

3.4 Energy Saving in Computers: For energy savings, consider the following guidelines:

- Enable the sleep mode on your monitor if you aren't going to use your PC for more than 20 minutes.

- Switch off both the CPU and monitor if you are not going to use your PC for more than 2 hours. **ENERGY STAR-labelled computers use 30%-65% less energy than computers without this designation, depending on usage. Consider buying a laptop for your next computer upgrade; laptops use much less energy than desktop computers.**

3.5 Replace the existing ordinary FTL-Copper Choke (1x40W+16W choke), with 20W LED Tube light.

The overall benefit by this replacement is:

Old Fitting:

Type fitting	: 1x40W MC FTL
No of Fitting	: 60 Nos.
Total Wattage Including Choke	: 56 W
Operating Hours	: 270 days x 7 hours = 1890 hrs.
Electricity Consumed per year	: 6350 kWh (Unit)
Electricity Rate	: Rs. 12 per unit
Annual Electricity Cost	**: Rs.76,200/-**

New Fitting:

Type fitting	: 20 W LED Tube
No of Fitting	: 60 Nos.
Cost of fitting	: Rs.350 (per fitting)
Total Investment for fitting	**: Rs. 21,000/-**
Operating Hours	: 270 days x 7 hours = 1890 hrs.
Electricity Consumed per year	: 2268 kWh (Unit)
Electricity Rate	: Rs. 12 per unit
Annual Electricity Cost	**: Rs. 27,216/-**

Simple payback period:

Net annual saving	: Rs. 76,200 - Rs. 27,216= **Rs. 48984/-**
Simple payback period	: Total Investment / Net Annual Saving
	: **15 days.**

Energy Efficiency Measures Implemented in the Campus.

- ✓ **Institute has implemented various energy efficiency measures in the campus i.e. Use of 9W/18W LED lights in the various building and LED Street Lights.**
- ✓ **Automatic Power Factor Correction Bank has installed at the distribution side which has helped to maintain power factor almost unity.**
- ✓ **Institute has started utilizing energy from renewable energy resources.**

CONCLUSION

The Campus of ZES, (Zeal Institute of Business Administration Computer Application and Research) is LT consumer with 188 KVA contract demand and **Zeal Education Society has installed 120 KW roof top Solar PV net metering system. It generates 50000 units per months which is 30% of total energy consumption.**

The total electricity bill for the year 2022-23 was **Rs.5570011.30.** The average monthly electricity bill of the campus for the year 2022-23 was **Rs. 464167.608.** The total energy consumption for the year 2022-23 was 491816 units. The average monthly energy consumption of the campus is 40984 KWh (units). In the year 2022-23 the average billed demand was 128**KVA. The average power factor was 0.990. It has been observed that ZES has installed 4000 Liter per hr solar PV roof top hot water system at the girl's hostel.**

At present connected load of the campus is 32 KW including electric motor load, lighting load, computer load and UPS Load and other load. Institute has implemented various energy conservation measures in the campus, which has helped to reduce large amount of Electrical Energy consumption.