

**THIRUTHANGAL NADAR COLLEGE**

**ENERGY AUDIT REPORT (2022 – 2023)**

**Audited by**

**DEPARTMENT OF PHYSICS**



# **THIRUTHANGAL NADAR COLLEGE**

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**PRINCIPAL**

## **OBJECTIVES OF ENERGY AUDIT**

The primary objectives of energy audit are to identify and evaluate opportunities to reduce energy consumption per unit of product output and reduce operating costs through energy conservation and planning. Energy audit produces a bench-mark for managing energy in the organization and also provides the basis for planning a more effective use of energy throughout the organization. This auditing is an attempt to consume electrical power in our campus. Department of Physics is effectively performing this auditing every year, which was initiated from June 2017.

## **SCOPE OF THE ENERGY AUDIT**

The scope of the energy audit includes an examination of the following areas,

- Energy distribution network of electricity, water, Air Conditioners, fans, lights (LED and CFL), Xerox machines, computers, projectors, cameras, bore-well motors and fridge.
- Energy utilization efficiency of all equipments and buildings
- Efficient planning, operation, maintenance and housekeeping.

## **PREFACE**

Data collection for energy audit of the Thiruthangal Nadar College Campus was conceded by Physics Department team from 01/6/2022 to 31/5/2023. This audit was over sighted to inquire about convenience to progress the energy competence of the campus. To drop the energy utilization whilst cultivate or humanizing comfort, health and safety were of prime anxiety. This audit required to recognize mainly energy proficient appliances. Besides, many each day processes concerning common appliances have been provided which facilitate sinking the energy expenditure. Students of Physics department were very helpful in completing the energy audit survey, which included all data that was collected from each classroom, laboratory and other miscellaneous rooms as well. The electrical equipment's and appliances that were taken under consideration included total no. of lights, fans, A.Cs, electronic instruments, and etc. in each room, chamber, corridor area and etc., together with the unit of electrical power that would be consumed by each of the component in the total electricity consumption.

## **ACKNOWLEDGEMENT**

We are very thankful for Hon. Secretary & Correspondent Thiru. A. Narayanamurthy & Principal Dr. V. Devi for this opportunity to conduct Energy audit of various facilities in college campus. We are also thankful for Vice Principals, various HODs, Staff members, Electrician Mr. Kamaraj & their respective subordinate staffs Mr. Ganeshan, who have given their valuable contribution in guiding & supporting us during campus survey for data collection, network study & measurement for accomplishing successful Energy audit.

This report made with sincere efforts gives details of the relevant data collected during energy audit study, observation, analysis & recommendations made pertaining to different facilities in our campus. Several Energy Conservation Opportunities (Measures) have been identified & proposed in course of our study & these options when implemented, are expected to bring in lasting benefits (saving) in terms of energy as well as cost saving to the management.

We are very much delighted in submitting this Detailed Energy Audit Report to our Hon. Principal, Dr. V. Devi, and thanking him for the implementation of identified Energy Conservation Opportunity as well as recommendations, after sincere study & observations.

## **ABOUT THE COLLEGE**

Thiruthangal Nadar College was established in the year 1997 as a college for men and was upgraded as a co-educational institution in 2002 to cater to the needs of women in North Chennai thus empowering them. It is a Self-Financing institution affiliated to the University of Madras. It was instituted by the magnanimous members of Chennaivazh Hindu Nadar Uravinmurai Dharma Fund with a deep sense of generosity and compassion to the under-privileged student community. The benevolent members of the

management have extended their exemplary services in the field of education with an exuberant spirit of facilitating and providing wider opportunities to the youth from different backgrounds. The motto of the institution “Knowledge is Power” is pre-eminently enshrined to ignite and enlighten the minds of the youngsters through education by dispelling the darkness of ignorance.

TNC offers 21 courses across 8 streams. TNC campus is spread over 8 Acres. Additional campus facilities such as Auditorium, Canteen, and Computer Lab, Counseling, Library, Placement, Sports, Grounds, NSS, NCC, Conference Room and Placement Office are also available.

### **ENERGY AUDIT TEAM**

| <b>Name</b>             | <b>Designation</b>        | <b>Department</b> | <b>College</b> |
|-------------------------|---------------------------|-------------------|----------------|
| Dr. R. Vijayalakshmi    | HOD & Assistant Professor | Physics           | TNC            |
| Mrs. S. Revathi         | Assistant Professor       |                   |                |
| Dr. R. Raja             | Assistant Professor       |                   |                |
| Mrs. V. Srimathi        | Laboratory Assistant      |                   |                |
| And Final Year Students |                           |                   |                |

### **NEED OF ENERGY AUDIT**

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 Electrical Audit of college buildings showed that the load of electrical equipment's been significant and should be taken some

necessary step for reducing energy conservation. Today, energy conservation plays a very important role for energy conserving because energy consumption is increasing day by day but the natural resources are not increasing and also production is cannot meet the consumption. People should aware about energy conservation and reduce energy consumption by adopting modern technologies.

An energy audit is an inspection, survey and analysis of energy flows, for energy conservation in a building, process or system to reduce the amount of energy input into the system without negatively affecting the output(s). The task of energy audit undertaken by Thiruthangal Nadar College has objective to identify energy saving & conservation opportunity with electrical network & equipment load study with measurement & conservation opportunity to save input energy cost.

### **EXPERIMENTAL AND DATA COLLECTION:**

**The energy audit was conducted from 01.06.2022 to 31.05.2023 & reviewed implementation of energy saving & conservation opportunity already identified as well as quantified it.**

- 1) Inventory of various electrical load.
- 2) TNEB bill study & working out average cost of power.
- 3) Identification of various energy conservation measures & saving opportunity.

In this present report, college electricity audit has been executed and verified. Physics department student teams headed by a Faculty was formed and allotted for data collection and the entire campus was surveyed in the same way for the audit. In this survey, Main Block, Science Block, Commerce Block, Corporate Block and Common Areas were involved. In all building, each and every room was examined to note, the no. of fans, tube lights, computer, instrument AC, etc. The electrical equipments that were put forth for the energy audit include practical laboratory, instrument, fans, air conditioners, Computers and etc., for this study.

We've calculated the exact contribution of energy consumption with respect to units consumed by each of the equipment such as, lights, fans, computers, instruments and etc., in comparison with the total

requirement of electricity. We've studied all these above mentioned electrical equipments by collecting exact data from our survey. The Survey details are given elaborately, as below.

### **Calculation of Energy Consumption in kWh**

Electric energy or power consumption can be calculated using the following basic formula.

Energy Consumption in Watt-hours = Power Rating in Wattage x Time in Hours

$$E = P \times t \quad \dots \quad (\text{Wh})$$

“Wh” is a small unit to measure the energy usage. To convert it to the basic electricity unit i.e. 1000 Watts per hour = 1kWh = 1 Unit of electricity, we divide it by 1000 i.e.

$$E = P \times t \div 1000 \quad \dots \quad (\text{kWh})$$

Where:

- E = Electric Energy (Consumed power in kWh)
- P = Power in Watts
- t = Time in hours per day

### **Daily Energy Consumption**

$$\text{Power Consumption}_{(\text{Daily})} = \text{Power Usage}_{(\text{Watts})} \times \text{Time}_{(\text{Hours})}$$

**Example:** An 80 watts fan used for 4 hours daily. The daily watt hour and kilowatt hour consumption is as follows.

- Daily power usage in Wh = 70W x 5 Hours = 350 Wh / day
- Daily power usage in kWh = 350 Wh /1000 = 0.35 kWh / day





|  |                 |                 |                 |                |                 |                |                |               |                |               |                |                |                 |                |               |
|--|-----------------|-----------------|-----------------|----------------|-----------------|----------------|----------------|---------------|----------------|---------------|----------------|----------------|-----------------|----------------|---------------|
| Corp. Block Class Rooms                | 45              | 10              | 68              | 16             |                 |                |                |               |                |               |                |                |                 |                | 1             |
| IQAC Cell                              | 4               | 6               | 4               | 1              | 1               |                |                |               | 3              | 2             |                | 1              |                 |                | 1             |
| Main Gate & Parking                    | 1               | 7               | 16              | 9              |                 |                |                |               |                |               |                |                |                 | 5              |               |
| <b>Total Quantity</b>                  | <b>696</b>      | <b>472</b>      | <b>610</b>      | <b>75</b>      | <b>22</b>       | <b>1</b>       | <b>3</b>       | <b>2</b>      | <b>398</b>     | <b>26</b>     | <b>2</b>       | <b>9</b>       | <b>10</b>       | <b>180</b>     | <b>8</b>      |
| <b>Total power consume in 1 hr (W)</b> | <b>48720</b>    | <b>9440</b>     | <b>21960</b>    | <b>1500</b>    | <b>33000</b>    | <b>8000</b>    | <b>6000</b>    | <b>84</b>     | <b>3383</b>    | <b>650</b>    | <b>2800</b>    | <b>731.25</b>  | <b>14920</b>    | <b>2700</b>    | <b>680</b>    |
| <b>Total power consume in 5 hr (W)</b> | <b>243600</b>   | <b>47200</b>    | <b>109800</b>   | <b>7500</b>    | <b>165000</b>   | <b>40000</b>   | <b>30000</b>   | <b>420</b>    | <b>16915</b>   | <b>3250</b>   | <b>14000</b>   | <b>3656.25</b> | <b>14920</b>    | <b>13500</b>   | <b>3400</b>   |
| <b>Consumption in 1 month (W h )</b>   | <b>4872000</b>  | <b>944000</b>   | <b>2196000</b>  | <b>150000</b>  | <b>3300000</b>  | <b>800000</b>  | <b>600000</b>  | <b>8400</b>   | <b>338300</b>  | <b>65000</b>  | <b>280000</b>  | <b>73125</b>   | <b>838400</b>   | <b>270000</b>  | <b>68000</b>  |
| <b>Consumption in 12 month (W h )</b>  | <b>58464000</b> | <b>11328000</b> | <b>26352000</b> | <b>1800000</b> | <b>39600000</b> | <b>9600000</b> | <b>7200000</b> | <b>100800</b> | <b>4059600</b> | <b>780000</b> | <b>3360000</b> | <b>877500</b>  | <b>10060800</b> | <b>3240000</b> | <b>816000</b> |

**Total Power Requirement of All Instrument per month = 14,803.225KW**

**Total Power Requirement of All Instrument per year (June - May) = 1,77,638.7 KW**

### **EB POWER CONSUMPTION:**

Total electricity units utilizes by college (All data collected in between 01 June 2022 to 31 May 2023)

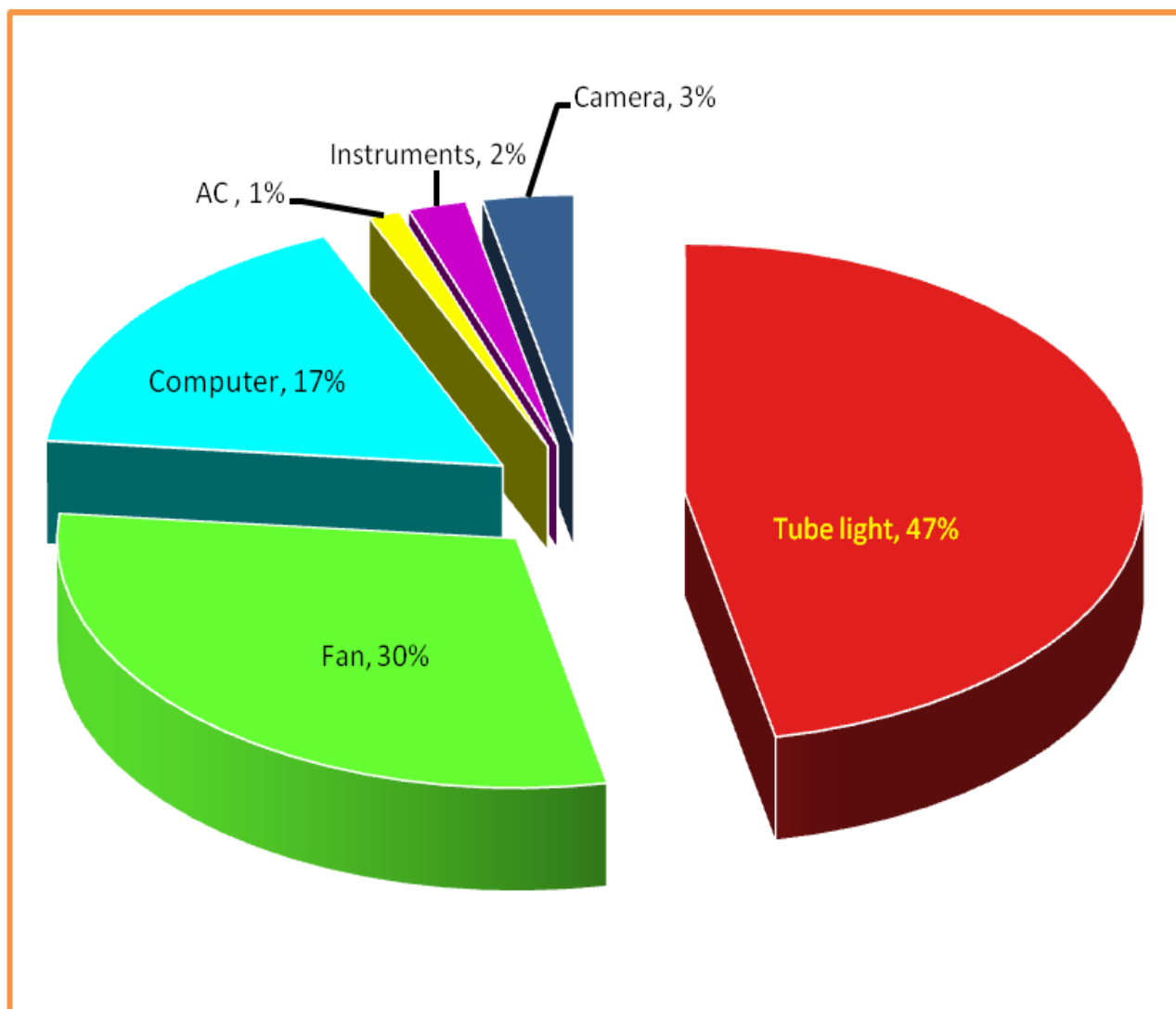
#### **POWER CONSUMPTION OF ELECTRICITY BOARD (2022 – 2023)**

| <b>S.No.</b>                                | <b>Month</b>       | <b>Consumption Unit (KW)</b> |
|---|--------------------|------------------------------|
| 1.  | June - July (2022) | 34230                        |
| 2.  | Aug - Sep (2022)   | 31920                        |
| 3.  | Oct - Nov (2022)   | 30126                        |
| 4.  | Dec - Jan (2023)   | 25320                        |
| 5.  | Feb - March (2023) | 29041                        |
| 6.  | April - May (2023) | 30292                        |
| <b>Total Power Consumption in Yearly</b>    |                    | <b>1,80,929</b>              |
| <b>Average Power Consumption in monthly</b> |                    | <b>15,077.4</b>              |

### **Results and discussion:**

An energy audit is an analysis of a facility, indicating how and where that facility can reduce energy consumption and save energy costs. Its insight to energy efficiency and conservation can lead to significant savings on the Institution's utility bill. In an attempt of this, we have collected data by considering the total no. of tube lights, fans, computers, printers, A.C's and other electrical instruments together with the electrical unit that each of the equipment would consume.

In our college, most of the instruments required 2% out off the total energy, that is, AC required 1%, Camera + monitor consumes 3%, while some other equipment's like the computer required 17%, Fans required 30% and tube light required 46%. The total required energy for our entire Institution was **14,803.225KW** and the Fig. 1 predicts the contribution of tube lights, fans, computers, printers, AC's, Camera Monitors and other instruments in total use of energy allocation percentage wise.



**Fig. 1 Contribution of tube light, fan, computer, AC, Camera Monitor and instrument in total use of energy**



**Fig. 2 Electricity units for two months (June 2022 – May 2023)**

Variation in electricity units is due to different programs, local environment, functions. Fig. 2 predicts the variations of the Electricity units for two months (June 2022 – May 2023).

### **Energy Saving through LED:**

Total No. of conventional Tube Lights in Campus = 656

Conventional Tube Light average power = 36 W.

LED Tube Light average power = 20 W.

Difference in power saved per Tube Light =  $(36-20) \text{ W} = 16 \text{ W}$ .

Total Power saving =  $610 * 16 \text{ W} = 9760 \text{ W} = 9.7 \text{ kW}$ .

Average Use of Tube Light per year =  $270 * 8 \text{ h} = 2160 \text{ h}$ .

Energy saved per year =  $9.7 * 2160 \text{ kWh} = 20952 \text{ kWh}$ .

Saving in Rs. per year =  $20952 * 9.5 = \text{Rs.}199044$

LED tube light average cost = Rs. 450

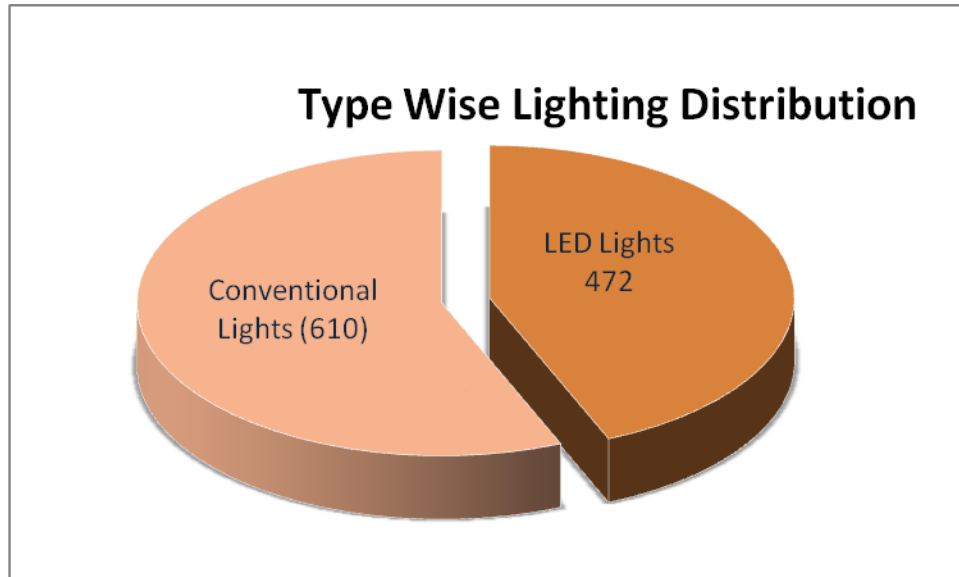
Total cost of replacing all conventional tube lights =  $610 * 450 = \text{Rs.} 274500$ .

Payback time =  $(274500/199044) = 1.37 \text{ yrs}$ .

Hence, the payback time for replacing all conventional tube lights of the campus with LEDs is around 1.37yrs

### Type Wise Lighting Distribution:

| Type                | Quantity    | kW Load      | % Load |
|---------------------|-------------|--------------|--------|
| LED Lights          | 472         | 9440         | 21.3 % |
| Conventional Lights | 610         | 21960        | 78.7 % |
| <b>Total</b>        | <b>1082</b> | <b>31400</b> |        |



### **Recommendation:**

It was felt that the energy auditing would be more effective if the data were collected over a year and then the average power consumed per month by every block were calculated. However, based on the present auditing results and discussions, the department would like to offer the following suggestions for minimizing electrical power wastage and for saving electrical power within Thiruthangal Nadar Campus.

- Switch to Solar power usage. Install energy saving solar-powered lights wherever possible.
- Switch to energy-efficient light bulbs like LED and CFL.
- Use Star labelled /Star rated electrical appliances in all the places.
- Use power savers (Capacitor banks) to reduce the inductive load.
- Ensure proper earthing in every block. Check weather neutral wire has been properly connected to the ground.
- Create awareness among staff and students about the importance of energy savings.
- Educate them not to leave electrical appliances in standby mode or sleeping mode for a long time, to use lights, fans, etc. only when they are needed and turn off PCs, printers, fans, lights, photocopiers and other standby appliances at the wall at the end of each day.

- Have separate control or switch for each electrical appliance.
- Install automatic light sensors or timed sensors on outdoor lighting.
- Appoint an Energy Manager.
- Implement the first nine suggestions in one block and study the energy saving.

### **Conclusion:**

As far concerning the energy audit, electricity audit is main concern regarding educational institution. We have collected data by considering the tube light, fan, computer, printer, A.C and instruments. The total required energy is **14,803.225KW**. Energy Consumption through all devices is **15,077.4** Unit /Month.