

# STUDY ON TRANSMISSION ENERGY LOSSES AND FINDING THE HAZARDS USING WHAT IF ANALYSIS

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## Abstract

Reducing electricity consumption in an educational institution is a very typical. This paper presents a detailed review of energy consumption in an educational institution. To determine the electrical cable loss is identified strategies to save electrical energy. This electrical energy audit presents the result of a preliminary audit carried out on 3 large building blocks of a famous educational institute in Salem district. Growing populations and educational institutions in our country create huge needs for electrical energy. Transmitting electrical energy through an underground cable leads to energy loss. An electrical consumption is a fundamental first step toward reducing utility bills in a preparing check list and what if analysis. By analyzing a college blocks major components including the building envelope, Class rooms, Computers, Electrical and Electronic laboratories and library, as well as of these components.

**Keywords:** Energy Consumption, Energy loss, Energy cost.

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## 1. INTRODUCTION

Energy conservation is the need of the world. We can consume electrical energy by reducing loss in the transmission of electrical energy. Loss of electrical energy is high in the low transmission line when compared to the high tension transmission line. So reducing the loss in the low transmission line will play a vital role in saving electrical energy. Reducing electrical consumption has an environmental benefit to the earth. Indian government implements supports for energy conservation and for energy audit. In India most of the consumer using underground cable for transmits electrical energy. Find out the loss in the underground cable is very difficult; it consists of so many factors. To find out the energy loss energy audit is to be done.

1. Study and analysis of electrical consumption.
2. Identify the energy loss in UG cable.
3. Find out reduction of loss and waste of cost.

## 2. LITERATURE REVIEW

Energy consumption is the systematic process of identifying, analyzing and controlling to project underground cable loss. An energy audit is the procedure by means of which it is possible to analyze the energy balance of a system. The energy audit, limited to the heating plants of the factory, of an industrial site devoted to the production of luxury cars is described. It has been demonstrated how the energy audit enables to collect information which are very useful to define a factory energy model by means of which the energy balance of the site is analyzed. By means of the factory energy model it is possible to study the impact of possible improvements of the site in order to achieve the mitigation of its environmental impact and to reduce energy costs. [1]. This study presents novel data regarding daily and

seasonal electricity consumption trends from 22 commercial dairy farms in Ireland. On average, a total of 31.73m was required to produce 1 kg of ms, of which 20% was direct and 80% was indirect electrical energy [2].

## 3. NEED FOR ENERGY AUDIT

The educational institution has energy loss in underground cable daily. Energy loss must to be reduce in underground cable and cable loss calculated by using check list and what if analysis.

## 4. ELECTRICAL LOSSES AND OVERALL EFFICIENCY

Electrical energy is transmitted across long distances by high-tension power lines by TNEB, and the higher the voltage, converted in the medium voltage. Our institution gets power 110kw at 440v from the electricity board. That 110kw at 440v received at institution power house. The electrical power wheeled from the power house to the institution through a 200 meter underground cable. The cable used for transmission is aluminium 185square millimeter. Normally aluminium having more resistance when compared when compare with copper.

5. CONTROL DIAGRAM

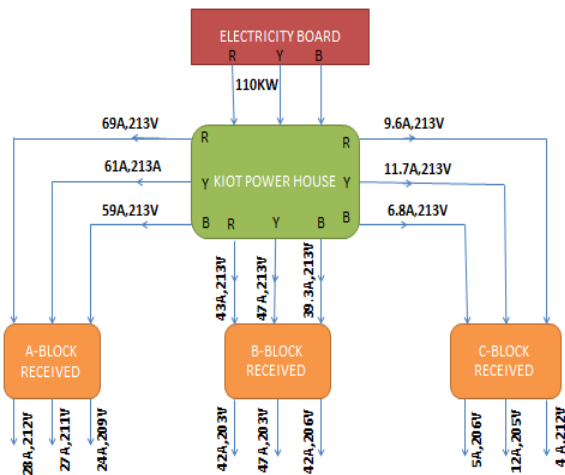


Fig 1 Energy flow diagram

(TNEB) electricity board injects the 110kw power to educational institution’s power house. Power house have the control panel board. That control panel board distributes the power via underground cable to the institution’s various

blocks. Each cable have some resistance which results in to electrical energy loss. In A block there is 427watts energy loss. In B block there is 1175.1watts loss. In C block there is 167.6watts loss. So totally there is 1769.7watts of power has been lost in wheeling of power through underground cable hence the total loss per day is 42kilo watt hour and for 360 days in 15289.2kwh.

6. WHAT IF ANALYSIS METHODOLOGY

Table1. General electrical hazards identification using what if analysis

What if	Consequences/ hazards	Safeguard	Recommendation
1. What if the gas in the gas circuit breaker is leaked?	Circuit breaker will damage due to excessive heat dissipation between contacts in case of leakage of the gas in the circuit breaker.	Monitor the gas pressure in the circuit breaker at the interval of one hour.	Document should be maintained for the inspection of circuit breakers.
2. What if the electrical supply lines of an apparatus is not provided with sufficient rating of insulation?	Short circuit, excess of heat dissipation between conductors will occur if the insulation for electrical equipment is not sufficiently provided.	Supply line should be insulated properly with proper insulation range.	Standard insulation wires should be installed for the electrical equipment's.
3. What if the electrical supply lines of an apparatus is not provided with sufficient rating of over voltage?	Equipment's winding may damage while high voltage occurs during surges.	Provide the over voltage sensing device.	Over voltage protection device should be installed.
4. What if the electrical supply lines of an apparatus is not provided with sufficient rating of mechanical strength?	1. Due to electromagnetic force between conductors structures may get damage. 2. Life of the supply line will reduce.	Proper installation of electrical supply line at standard rating.	Measuring of cable rating for an equipment then install it.
5. What if resistance level goes beyond the specified level?	Leakage current will not pass to the earth and electronic equipment may malfunction.	Measure the earth resistance value periodically,	Watering the earth pits periodically. Maintain earth resistance value at specified limit.
6. What if the electrical supply lines of an apparatus is not provided with sufficient rating of fault current?	Entire supply line may get damaged if fault occurs. System will be unstable	The electrical supply lines should be installed at specified rating.	Circuit can be installed to disconnect the supply line during fault current.
7. What if the standards and codes (NEC, BIS) of the electrical equipment's are not followed?	Leads to electrical accident, equipment failure and Chances for fatal accidents.	Electrical equipment's are installed only based on safety standards.	Follow the Indian electricity rules during the installation of electrical equipment's.
8. What if personal protective equipment is not followed for works related with electricity?	The workers may in direct contact with live lines and may get electrocuted. Chances for fatal accidents.	Worker should use the PPE while working with the electrical equipment's.	Provide the proper Personal Protective Equipment for the worker.

Table1 is the general technique used for determine the hazards in transmission cable lines. Educational institution spends more money for electrical energy to run the institution. Finding the electrical hazard in the UG cable is very critical. Hence we followed the hazard identification technique what if analysis.

1. First form the check list for general questions.
2. Consequence and hazards.
3. Safeguards.
4. Recommendations

These are the 4 steps to identify hazards and rectify those hazards.

## 7. RESULTS AND DISCUSSION

This is the overall energy loss and cost per year. In order to reduce the energy loss we have to find out the cable loss. We take readings in each phase voltage and current. Then we found drop in voltage in each phase. Also the loss current multiply with dropdown voltage gets the total power loss in the circuit.

Calculating the dropdown energy loss in Block A

Example 1

Given data:

V=volts, A= current Amps

Sending end voltage  $V_R = V_Y = V_B = 213$ volts.

Receiving end voltage  $V_r = 212$ v,  $V_y = 211$ v,  $V_b = 209$ v

Sending end current  $I_R = 69$ A  $I_Y = 61$ A  $I_B = 59$ A

Formula for dropdown voltage is

$$dvr = V_R - vr = 213 - 212 = 1v$$

$$dvy = V_Y - vy = 213 - 211 = 2v$$

$$dvr = V_B - vb = 213 - 209 = 4v$$

Energy Loss

$$E1 = I_R * dvr = 1 * 69 = 29w$$

$$E2 = I_Y * dvy = 2 * 61 = 122w$$

$$E3 = I_B * dvr = 4 * 59 = 236w$$

Total Loss

$$\text{Energy Loss in A Block } E = E1 + E2 + E3 = 29 + 122 + 236 = 427 \text{ watts per hour}$$

Similarly in Block B & C energy Loss 1175.1watts & 167.6watts

Total power loss per hour is 1769.7 watts; it worked out into 42.47 units per day.

Blocks	INPUT VOLTAGE			SENDING CURRENT			RECEIVING VOLTAGE			VOLTAGE DROP			ENERGY LOSS			TOTAL LOSS
	VR	VY	VB	IR	IY	IB	Vr	Vy	Vb	dV <sub>r</sub>	dV <sub>y</sub>	dV <sub>b</sub>	E1	E2	E3	TUL
A Block	213	213	213	69	61	59	212	211	209	1	2	4	69	122	236	427
B Block	213	213	213	43	47	39.3	203	203	206	10	10	7	430	470	275.1	1175.1
C Block	213	213	213	9.6	11.7	6.8	206	205	212	7	8	1	67.2	903.6	6.8	167.6

	Power Waste in Cables per hour	1769.7w
	Energy unit waste per day	42.4728kwh
	Cost for wastage per day	Rs. 310.05144
	Cost for month	Rs. 9301.5432
	Cost for year	Rs. 111618.52

## 8. CONCLUSIONS

Electrical transmission energy loss of an educational institution is studied and also what if analyses for electrical equipment's are analyzed. The voltage and current values at various points on an educational institution are identified by using clamp meter and the calculations are done those readings and the energy loss is identified. The main reason for energy loss is the distance from power house to various

blocks of institution is more and the cables are laid improperly i.e. that is cables are not laid in straight route. In order to bring the energy loss down the distance between power house to various blocks must be reduced and the cables should be laid in a straight manner and the aluminium cable may replace with copper cables so as to reduce the loss since copper cables having low resistance when compared with aluminium cable

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