Investigation on Energy Conservation Opportunities in Transformers and Other Electrical Utilities in M/S PRICOL LTD (Plant-I)

A Project Report

Submitted by

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of
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BONAFIDE CERTIFICATE

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Conduct	:	GOOD
Performance	:	GOOD

With warm regards,

For **PRICOL LTD.,**

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...TUNITIES IN TRANSFORMERS, UNDERGROUND TRANSMISSION CABLES, PRESSURIZED AIR SYSTEMS,

LIGHTING SYSTEMS IN PRICOL [PLANT-I]".

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ABSTRACT

In today's world of fierce competition, energy is very precious and without it human life cannot be imagined. As we are developing new gadgets, accordingly the consumption of electricity is going up day by day. Every year the demand of electricity is increasing by 9 percent, while production is not increasing in the same ratio. Due to this reason, the gap between demand and supply is constantly increasing. Now time has come to take some concrete efforts to conserve energy. Most of the energy saving techniques does not require any capital investment. Few techniques that require capital investment have attractive payback period. The energy auditing is an important tool in energy conservation. The objectives of this project are to conserve electrical energy in **M/S PRICOL Ltd**.

The following areas are selected for energy conservation,

- **Transformers:**

  In Transformers, switching it off during light load periods and during holidays attains energy conservation.

- **Underground Transmission Cables:**

  In underground transmission cables, drop in voltage and specific loss of cable are observed and steps to conserve energy are taken.

- **Pressurized Air Systems:**

  In the pressurized air system, timer is used for switching it off when not in use and leakage losses are found out and arrested.

- **Lighting systems:**

  In the case of lighting systems, using voltage stabilizers for reducing feeder voltage after finding peak current attains energy conservation.

The required Parameters like size of cables, length of cables, voltage drop in cables, energy consumed in Transformers (shift wise), ratings of motors, hours of use in Pressurized Air Systems and peak current values are measured and the Permissible Loss values are calculated. The calculated value is compared with the practical values and the methods to reduce these losses are implemented.

ஆய்வுச்சுருக்கம்

போட்டிகள் நிறைந்த இன்றைய உலகத்தில் ஆற்றல் என்பது மிகவும் விலை உயர்ந்த ஒன்றாக கருதப்படுகிறது. ஆற்றல் இல்லாத நமது வாழ்க்கையை கற்பனை செய்து கூட பார்க்க முடியாது. நவீன தொழில் நுட்பங்கள் வளர்ந்து கொண்டே வருவதால், மின்னாற்றலின் பயன்பாடும் நாளுக்குநாள் பெருகிக்கொண்டே வருகிறது. மின்னாற்றலின் தேவையானது ஒவ்வொரு வருடமும் 9 சதவிகிதம் அதிகரித்துக் கொண்டே வந்தாலும் உற்பத்தியின் அளவானது அந்த அளவிற்கு உயரவில்லை. இக்காரணத்தினால் மின்னாற்றலின் தேவைக்கும், அதன் அளவிற்கும் இடையேயுள்ள இடைவெளி அதிகரித்துக் கொண்டே வருகிறது. இப்பொழுது நாம் ஆற்றலை சேமிக்க உரிய நடவடிக்கைகளை எடுக்க வேண்டிய கட்டாயத்தில் இருக்கிறோம். பெரும்பான்மையான ஆற்றல் சேமிப்புத் தொழில் நுட்பங்களுக்கு மூலதனம் தேவையில்லை. ஒரு சில தொழில் நுட்பங்களில் நாம் செய்யும் மூலதனத்தை மிகக் குறுகிய காலத்திலேயே திரும்ப பெற்றுக் கொள்ள முடியும். ஆற்றல் ஆய்வறிக்கை, ஆற்றல் சேமிப்புக்கு முக்கியமான கருவியாக உள்ளது. இத்திட்ட ஆய்வின் இலக்கானது **M/s.பிரிக்கால் லிமிடெட்**, தொழிற்சாலையில், மின்னாற்றலை சேமிப்பதே ஆகும். பின்வரும் பகுதிகள் ஆற்றல் சேமிப்பிற்காக தேர்ந்தெடுக்கப்பட்டுள்ளன.

மின்மாற்றி :

விடுமுறை நாட்களிலும், குறைந்த பளு இருக்கும் நேரங்களிலும் ஆற்றல் சேமிப்பிற்காக மின்மாற்றியின் இணைப்புகள் துண்டிக்கப்படுகின்றன.

தரைக்குக் கீழ் அமைக்கப்படும் கம்பிவடங்கள் :

மின்னழுத்தச் சரிவு மற்றும் கம்பிவடங்கள் மூலமாக ஏற்படும் இழப்புகள் கண்டறியப்பட்டு, ஆற்றல் சேமிப்பிற்கான வழிமுறைகள் மேற்கொள்ளப்படுகின்றன.

காற்றழுத்த அமைப்பான்கள் :

காற்றழுத்த அமைப்பான்கள் உபயோகத்தில் இல்லாதபோதும், அவற்றில் கசிவு இழப்பு ஏற்படும்போதும் அந்த இழப்புகள் கண்டறியப்பட்டு நிறுத்து கடிகாரம் (Timer) மூலமாக அவற்றின் இணைப்புகள் துண்டிக்கப்படுகின்றன.

ஒளியியல் அமைப்பான்கள்:

பெரும் மின்னோட்டம் கண்டறியப்பட்ட பிறகு மின்னழுத்தத்தைக் குறைப்பதற்காக மின்னழுத்த நிலைநிறுத்தி பயன்படுத்தப்படுவதால் ஆற்றலானது சேமிக்கப்படுகிறது.

கம்பிவடங்களின் அளவு, நீளம், மின்னழுத்தச் சரிவு மின்மாற்றிகள் உபயோகிக்கும் ஆற்றலின் அளவு, மோட்டார்களின் தரவரிசை, காற்றழுத்த அமைப்பான்கள் பயன்படுத்தப்படும் நேரம், மற்றும் பெரும மின்னோட்டம் ஆகிய மதிப்பீடுகள் அளந்தறியப்பட்டு அவற்றின் இழப்பீடு மதிப்புகளும் கணக்கிடப்படுகின்றன. அவ்வாறு கணக்கிடப்பட்ட மதிப்புகள், சோதனை மூலம் கண்டறியப்பட்ட மதிப்புகளோடு ஒப்பிடப்படுவதோடு இழப்பீடுகளைக் குறைப்பதற்கான வழிமுறைகளும் மேற்கொள்ளப்படுகின்றன.

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CHAPTER - 1

ENERGY CONSERVATION

1.1 INTRODUCTION:

Now-a day's awareness has been created about the energy conservation throughout the world. The conservation of energy in industries is high when compared to domestic utilization. The Indian industries are highly energy intensive and its energy efficiency is poor when compared to that of other industrialized countries. There is considerable scope for improving energy efficiency in industries dealing with iron and steel, chemicals, cements, paper and pulp, fertilizers, textile etc. efforts to promote energy conservation by such industries could lead to substantial reduction of their cost of production, making them more competitive globally.

As 1KWH saved at the user-end could means a relief of 2-4KW of the generation capacity. Energy conservation offers the least cost option for bridging the ever-widening gap between demand and supply of energy. The industrial sector is a major energy-consumer in India and uses about 50% of total commercial energy available in the country. The level of energy consumption is very high in fertilizer and sugar industries. Energy Conservation is the need of the hour that is compelling the world to heap takes serious steps to avert loss of energy.

Energy Scenario in India needs careful evaluation. It is not surprising that the per energy consumption is very low despite with the Rate of development activity.

1.2 The Electrical Scenario in India:

- The electrical energy demand in the country has been rising at the rate of 9% p.a
- Generating capacity has increased at the rate of 6% p.a
- The gap between demand and generating capacity has been widening by 3%p.a
- The setting up of generating capacity costs approximately Rs.5 crores / MV and the leads times are long.

- Virtually all regions of the country are facing acute power shortages.

The gap between demand and supply can only be bridged by two ways:

[a] Conducting suitable energy audit's and conserving energy.

[b] Generating more power in order to meet the demand.

The first option is more viable since it involves less manpower, reduced cost and effective results.

1.3 Energy Conservation in India:

Energy conservation has received attention in India since the mid 70s. The impact of energy conservation efforts are felt at a very low pace as the commercial energy consumption per capita is low in the country and efficient end use devices are costly. Recent rapid increase in energy demand, mainly in the industrial and the service sectors has created a renewed awareness about the economic advantage of energy conservation. Structural changes in the economy have led to expansion of the industrial base in the country, and subsequently the increase in demand for energy. Electricity generation sector has not expanded at a desirable level. Hence awareness has been created in India to conserve energy in domestic sector and industrial sectors.

The scope of this project is to conserve electrical energy in

- Transformers,
- Under Transmission Cables
- Pressurized Air Systems and
- Lighting systems in M/S PRICOL Ltd.

CHAPTER - 2

ABOUT THE COMPANY

- PRICOL

2.1 Company Profile:

Established as Premier instruments and Coimbatore limited in 1974 for manufacturing automobile dashboard instruments and then renamed as Premier Instruments and Controls Limited in 1981.Visualising future of Electronics PRICOL Ventured in to separate Division of electronics in 1980.Then to have Multiproducts, PRICOL diversified into machine tools in 1981, defence in 1988 and Industrial gauges in 1989.

2.2 About the Organization:

The company Premier Instruments and Controls Limited Coimbatore, more popularly known as PRICOL was setup in the year 1974 and is now a multi engineering multi customer concern, within a short span of time the company has grown to the leadership in the field of automatic instruments.

2.2.1 Plants:

Pricol industries have four plants situated at different places. They are

Plant 1: Periyanaicken Palayam – Coimbatore.

Plant 2: Gurgayaon – Haryana.

Plant 3: Chinnamatham Palayam – Coimbatore.

Plant 4: Karamadai – Coimbatore.

2.2.2 Collaboration:

The Companies that are collaborated with Pricol are

- Nippon Sekki, USA
- Denso Collaboration, Japan
- Nippon Sekki Company Ltd, Japan.

2.2.3 Divisions:

- Auto division
- Machine Tool division
- Defence division
- Electronics division
- Pumps division

2.3 Pricol Products:

Gauges:

- Electronics Temperature Gauges
- Pressure
- Fuel
- Pressure Transducer

Meters:

- RPM Meter
- Speed Meter
- Odometer
- Ammeter
- Voltmeter

2.4 Plant Maintenance Department:

Pricol considers plant Maintenance as an indispensable part. The PMD in Pricol looks after breakdowns and rectifies them in minimum time. This saves the company from losses. The PMD carries the following four types of maintenance

- Break down maintenance
- Scheduled maintenance
- Preventive maintenance
- Predictive maintenance

2.4.1 Functions of the department:

Plant maintenance carries out the following functions. Each company must have a PMD to check the equipments periodically and maintain them.

- Mechanical maintenance
- Electrical maintenance
- Civil maintenance
- Construction and fabrication activities
- To provide security to the industry
- Perfect maintenance service

This is to keep entire plant neatly also it involves the other functions like

- Workshop
- Fitting shop
- Carpentry
- Painting shop
- Fabrication shop

2.5 Power Distribution Arrangement:

Electric supply from TNEB is obtained from Thekkupalayam feeder at a voltage of 22KV is given to the two-pole structure through a vacuum circuit breaker (VCB). Energy meter is installed to record power consumption. Maximum estimated demand for Pricol is1650KVA. The supply at 22KV is brought to 433v through 3 step down (potential) transformers, two of them having a capacity of 1000Kva.The third one being 500KVA,substation consists of lightening, arresters, insulators, air circuit breakers etc.

Lightening arresters absorbs excessive voltage due to lightening and transformers thus transmit supply to earth. Insulators do not permit current to pass into the body of transformers and it thus increases life of transformers. Air circuit breakers are used to switch on and off the supply. Every thing is done in order to ground fault voltages, thus it protects the person who is working and also equipments.

Pricol has generators having a rating of 1250 KVA, 500KVA, 250KVA to meet the power requirements in case of power failure. Three powerhouses are employed for power distribution. The power from 6-pole structure is given to MV (medium voltage) change over panel through oil (OCB) and air (ACB) circuit Breakers.

In the MV panel either the EB bus bar or generator bus bar is connected to the plant. If both of them are connected at a time short circuit occurs so a unique protection mechanism is provided. It consists of a key only on whose insertion the bus bar gets disconnected. In the event of power failure first the

TNEB bus bars are disconnected and the key is removed. This key is then inserted into the generator bus bar board, so that the generator bus bar board, so that the generator bus bar board, so that the generator feeds the plant. The supply from MV panel goes to the sub switchboard and then to the distribution panel to respective department. The bus coupler, which is a passive switch to convert two different load generating, sets to the same line. The frequency meter used to read the frequency was of vibrating read type.

There is an auto-change over panel, which switches the generator supply automatically after the power failure. This is done by automatic switching off the contactor in EB line towards the diesel generator and hence the generator automatically switches ON. Pricol maintains a very good power factor of 0.98. This is higher than the specification of TNEB and hence overloading of electricity feeder board is prevented. This is done by using capacitive variance compensation.

CHAPTER - 3

TRANSFORMERS

Transformer is a static device used for transferring electrical energy from one circuit to another electrical circuit through out the medium of magnetic field and without any changes in frequency.

3.1 Transformers on no load:

A transformer is said to be on no load, if the primary is connected to alternating voltage leaving the secondary terminals open, the applied voltage will cause flow of alternating current in the primary.

3.2 Transformers on load:

A Transformer is said to on load, when its secondary is connected to a load. The magnitude and phase of full load secondary w.r.t secondary terminal voltage depends on the type of load.

3.3 Losses in a transformer:

3.3.1. No load loss (iron loss)

A. Hysteresis loss:

When the magnetic material is subjected to reversal of flux, power is required for the continuous reversal of molecular magnets. This power is dissipated in the form of heat and is known as hysteresis loss. These losses are minimized by using silicon steel material for the construction of core.

B. Eddy current losses:

Since the flux in a transformer core is alternating, it links with the magnetic material of the core. This induces e.m.f in the core and circulates eddy currents. Power is required to maintain these eddy currents. This power is dissipated in the form of heat and is known as eddy current losses. These losses are minimized by making the core of thin laminations

3.3.2. Load loss (copper loss)

Copper loss occurs in both the primary and secondary windings due to their ohmic resistance. The currents in the primary and secondary windings vary according to the load; these losses vary according to the load and are known as variable losses. The losses vary as the square of load current.

3.3 Efficiency of a transformer:

$$\text{Transformer efficiency, } \eta = \frac{\text{output power}}{\text{I nput power}}$$

$$= \frac{\text{Output power}}{(\text{Output power} + \text{iron loss} + \text{copper loss})}$$

3.4 Voltage regulation of a transformer:

At a constant supply voltage, the change in secondary terminal voltage from no-load to full load with respect to no-load voltage is called voltage regulation of the transformer. The overview of the Transformer is shown in Figure 3.1

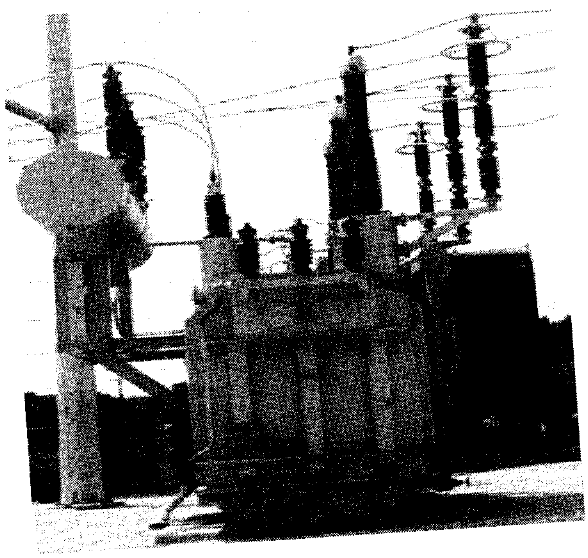

FIG 3.1 TRANSFORMER – OVERVIEW

3.5 Tests on transformer:

3.5. 1 Open circuit tests

This test is carried out to determine the no-load loss or iron loss and no load current. The high voltage is left open circuited and rated voltage is applied to the low voltage side. The wattmeter registers only core loss in the transformer as secondary is open circuited. Copper losses are negligible.

3.5.2 Short circuit test

This test is carried out to determine the following

- Copper losses at full load or at any desired load
- Equivalent impedance, resistance and leakage resistance of the transformer referred to the winding in which the measuring instruments are connected. The secondary is short circuited by an ammeter. A very small rated voltage applied to primary winding, because of this, core loss is very small and hence, wattmeter registers only copper losses in both the windings.

3.6 Energy saving Opportunities in Transformers:

The following points are to be considered for saving the energy:

- One or two Transformers may be disconnected on holidays or in periods of low load. Many industries are doing this routinely. When on after long periods of non-use, transformer oil condition must be checked; especially in monsoon, this must be done.
- Unlike motors, etc. transformers have higher efficiency at part loads. When more than one unit is available, if may be worthwhile sharing load.
- If the transformer capacity is larger than normal load, the efficiency is likely to be marginally better; however, this does not mean that capacity should be deliberately provided.
- As the load losses depend on the value of load current, improvement of P.F on the load side would reduce the transformer losses.

In this project, transformers are switched off, during holidays and light load periods.

3.7 Energy Conservation details in transformer (PRICOL):

In PRICOL, there are there transformers (2*1000 KVA, 1*500 KVA) of rated capacities. But the maximum estimated demand for PRICOL is 1650 KVA; a case study was made by measuring energy consumption per hour with/without transformer losses. Through careful analysis, 500KVA transformer is switched off from 17:30 to 07:00 i.e. 13.5 hrs during working days and 37.5 hrs during partially working days (Sundays and national holidays) .So by doing so, Energy conservation was attained.

3.7.1 For partially working days (Sundays and National Holidays):

Approximately saved units	=	5.07/hr
Number of hours switched OFF	=	37.05
Number of Days operated	=	61
Amount per Unit	=	6.50
Energy Saved	=	5.07x 37.5x 61x6.50
	=	**Rs 75,384.56/-**

3.7.2 For working days:

Approximately saved units	=	9.55/hr
Number of hours switched OFF	=	13.5
Number of Days operated	=	243
Amount per Unit	=	6.50
Energy Saved	=	9.55x13.5x 243x6.50
	=	**Rs 2, 03,637.04/-**
Total amount saved/annum:	=	**Rs 75,384.56/ + Rs 2, 03,637.04/-**
	=	**Rs2, 79,021.60/-**

These energy Details of Transformers are shown in the Tables from 3.1 to 3.5.

TABLE 3.1 ENERGY DETAILS OF TRANSFORMER FOR 2500 KVA CAPACITY

S.No	Date		Time		Energy consumption of transformer (without losses)	Energy consumption of transformer (with losses)
	From	To	From	To		
1	24-12-05	26-12-05	17:00	08:00	25645.60	26700
2	26-12-05	27-12-05	17:00	08:00	11822.60	12580
3	27-12-05	28-12-05	17:00	08:00	11741.40	12500
4	28-12-05	29-12-05	17:00	08:00	10309.20	11100
5	29-12-05	30-12-05	17:00	08:00	11230	11580
6	30-12-05	31-12-05	17:00	08:00	11427.20	12040

TABLE 3.2 ENERGY LOSS OF TRANSFORMER FOR 2500 KVA CAPACITY

S.No	Date		Energy loss found in transformer (KWH)	Energy consumption Per hour (without Transformer losses)	Average Current
	From	To			
1	24-12-05	26-12-05	1054.40	659.579	933.49
2	26-12-05	27-12-05	757.40	788.17	1118.89
3	27-12-05	28-12-05	758.60	782.76	1111.20
4	28-12-05	29-12-05	790.80	687.28	975.67
5	29-12-05	30-12-05	350	748.67	1062.81
6	30-12-05	31-12-05	612.40	761.81	1081047

TABLE 3.3 ENERGY DETAILS OF TRANSFORMER FOR 2000 KVA CAPACITY

S.No	Date		Time		Energy consumption of transformer (without losses)	Energy consumption of transformer (with losses)
	From	To	From	To		
1	24-01-06	25-01-06	17:30	07:00	9767.60	10060
2	25-01-06	27-01-06	17:30	07:00	15127.80	15820
3	27-01-06	28-01-06	17:30	07:00	9792	10220
4	28-01-06	30-01-06	17:30	07:00	22430.40	
5	30-01-06	31-01-06	17:30	07:00	9244.80	9860

TABLE 3.4 ENERGY LOSS OF TRANSFORMER FOR 2000 KVA CAPACITY

S.No	Date		Energy loss found in transformer (KWH)	Energy consumption Per hour (without Transformer losses)	Average Current
	From	To			
1	24-01-06	25-01-06	292.40	723.53	1004.20
2	25-01-06	27-01-06	692.20	403.408	572.68
3	27-01-06	28-01-06	428	725.33	1029.68
4	28-01-06	30-01-06	769.60	598.14	849.12
5	30-01-06	31-01-06	615.20	684.80	972.14

TABLE 3.1 ENERGY DETAILS OF TRANSFORMER FOR 2000 KVA

S.NO	DATE		TIMINGS		ENERGY CONSUMPTION PER HOUR WITHOUT TRANSFORMER LOSSES		AVERAGE CURRENT (A)		ENERGY LOSSES IN TRANSFORMERS		THEORETICAL VALUE OF POWER	EXPECTED VALUE OF POWER PER HOUR
	FROM	TO	FROM	TO	2500 KVA	2000 KVA	2500 KVA	2000 KVA	2500 KVA	2000 KVA		
1	24-12-05	26-12-05	17:00	08:00	659.58		933.49		1054.40		959.18	5.07
	28-01-06	30-01-06	17:30	07:00		598.14		849.12		769.20		
2	26-12-06	30-12-05	17:00	08:00	3768.69		5350.04		3269.2		3064.74	9.55
	30-01-06	03-02-06	17:30	07:00		3532.92		3532.92		2420.40		

CHAPTER - 4

CABLES

4.1 Introduction:

For low voltage distribution in thickly populated area, cables are most useful. The cables have also been designed for high voltage transmission lines, but their use is limited due to their cost.

4.1.1 Cables as compared to overhead lines have the following advantages:

- The cables transmissions are not subject to supply interruption caused by lighting or thunderstorms, birds and other severe weather conditions.
- It reduces accidents caused by the breaking of the conductors.
- Its use does not spoil the beauty of cities.

Thus cables can be used, for transmission and distribution purposes.

4.2 Classification of cables:

Although underground system is costlier and maintenance is difficult, the system of transmitting power with cables is preferred in thickly populated areas and in cities. Cables are usually classified according to the voltage for which they are manufactured. According to the voltage they can be classified as-

- L.T. (Low Tension Cables) up to 1,000 volts.
- H.T. (High Tension cables) up to 11,000 volts.
- S.T. (Super Tension Cables) from 22,000 volts to 33,000 volts.
- Extra High Tension Cables from 33,000 volts to 66,000 volts.
- Oil-filled under pressure and gas pressure cables for 66,000 volts to 1, 32,000 volts. Figure 4.1 shows an overview of cable.

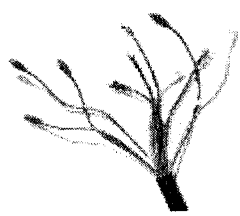

FIG 4.1 OVERVIEW OF CABLES

4.3 Cable conductors:

The conductors of cables (sometime overhead bare copper conductor also) are usually stranded, i.e. it consists of number of strands of wire of circular cross-section so that it may become flexible and carry more current. In the stranded conductor each wire lies on a helix the pitch of which is so adjusted that the cross-section of the cable at right angles to its axis if practically circular.

4.4 Requirements of the cables:

The following are the necessary requirements of the cables:

- The copper or aluminum used should be of such size that the cable should carry the specified load without overheating and should cause a voltage drop within the limits.
- The cable must have the proper thickness of the insulation so as to give high degree of safety and reliability at the voltage for which it is designed.
- All the materials used in the cable manufacture should be such that there should be complete chemical and physical stability throughout.
- The cable must be provided with a mechanical protection so as to withstand the rough use in laying it. The figure 4.2 shown below is the structure of cable.

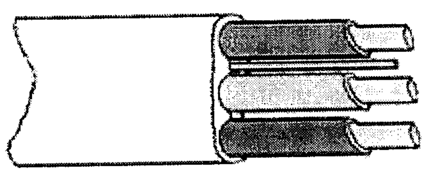

FIG 4.2 STRUCTURE OF CABLE

4.5 Cable construction:

The general construction of the cable is given below:

4.5.1 Core:

All cables have one central core or a number of cores of stranded copper or aluminum conductors having highest conductivity. Generally there are one, two, three or four cores.

4.5 Cable construction:

The general construction of the cable is given below:

4.5.1 Core:

All cables have one central core or a number of cores of stranded copper or aluminum conductors having highest conductivity. Generally there are one, two, three or four cores.

4.5.2 Insulation:

The different insulations used to insulate the conductors are paper, varnished cambric and vulcanized bitumen for low voltages. But mostly impregnated paper is used which is an excellent insulating material. When varnished cambric is used as an insulating material (for low voltage cables) petroleum jelly is applied between the layers of the cambric tape which prevents damage to the insulating tape due to friction when the cables are handled.

4.5.3 Metallic sheath:

A metallic sheath is provided over the insulation so as to prevent the entry of moisture into the insulating material. The metallic sheath is usually of lead or lead alloy and in case of cables having copper as conductor sometimes aluminum is also used for providing metallic sheath.

4.5.4 Bedding:

Over the metallic sheath comes a layer of bedding, which consists of paper tapes compounded with a fibrous material. Also sometimes jute strands or Hessian tape (strong coarse cloth of hemp or jute) is also used for bedding. The purpose of providing the bedding is to protect the metallic sheath from mechanical injury from the armouring.

4.5.5 Armouring:

Armouring is provided to avoid mechanical injury to the cable and it consists of one or two layers of galvanished steel wires or two wires of steel tape.

4.5.6 Serving:

Over and above armouring a layer of fibrous material is again provided which is similar to that of bedding but is called as serving.

4.6 Procedure to calculate Maximum current and voltage drop:

4.6.1 Maximum Current Permitted:

Current Allowed = Number of Runs x Current Rated x Paralleling Factor

4.6.2 Voltage drop (r m s) per km per phase (volts):

Voltage Drop per Km= 3 x k_t x k_{ac} x maximum continuous current rating (Amps)xDC resistance per phase per km (ohms/km)

Where k_t = $[1+a(t_c-t_0)]$

a = 0.00393 for copper and

a = 0.00400 for aluminum

t_c = maximum conductor temperature in 0^oC and 70^0 C for PVC

t_o = 20 °C standard atmosphere

K_{ac} = factor converting DC resistance to AC resistance

4.7 Energy saving Opportunities in Cables:

In most industrial plants, cable losses are in the range of 2 to 4% at peak loads. Only in some plants like coal mines, cement plants, which have large areas, the cables may be long and hence the cable losses may be higher (upto 10%).

Energy saving Opportunities:

- Energy prices are going up faster than those for the general industrial products, including cables. It is therefore worthwhile investing in somewhat larger sizes of cables. This is also helpful at the time of expansion. Replacement of cables may be considered for industrial systems with higher than normal distribution losses.
- Installation of capacitors at the load end of a cable reduces the cable losses.Cable feeders, which lead to circulating currents at light loads, should be switched off. The Specific loss calculation and details of sending end and receiving voltages for all the panels are shown in the tables from 4.1 to 4.10.Bar diagram representation for all the panels are shown in the figures from 4.1 to 4.5.

TABLE 4.1 SPECIFIC LOSS CALCULATION FOR MV CHANGE OVER PANEL -I

S.No	Feeder Name	Number Of Cable (Runs)	Size Of Cable PVCA AL (Sq.mm)	Paralleling Factor	Max current permitted (A)	Length of Cable (m)	Specific Loss of Cable/Km
1	GNR Incomer	2R	185	0.79	371.30	97	13.565
2	Canteen BLD-33	2R	185	0.79	371.30	179	25.033
3	Capacitor No-347	1R	70	1	135	10	2.153
4	D.B-29	1R	35	1	92	67	19.261
5	New Printing	1R	185	1	235	34	4.755
6	SSB-2	2R	185	0.79	371.3	38	5.314
7	BLDNO-145	1R	185	1	235	92	12.866
8	Capacitor No-118	1R	70	1	135	10	2.153
9	Capacitor No-236	1R	70	1	135	10	2.153
10	Printing booth	1R	25	1	76	20	6.566
11	OHBBT South	1R	185	1	235	24	3.356
12	OHBBT North	1R	185	1	235	38	5.314
13	SSB-1	2R	185	0.79	371.3	48	3.713
14	GNR (UG-27)	1R	400	1	335	134	13.049

TABLE 4.2 DETAILS OF SENDING END VOLTAGE AND RECEIVING END VOLTAGE FOR MV CHANGE OVER PANEL -I

S.No	Feeder Name	Sending end Voltage (V)			Receiving end Voltage)		
		Ave	Max	Min	Ave	Max	Min
1	GNR Incomer	400.26	402	399	398	401	395
2	Canteen BLD-33	429.01	435	401	432.1	435	407
3	Capacitor No-347	396.5	397	395	395.5	396	395
4	D.B-29	412.3	395	389	410.5	394	387
5	New Printing	410.32	425	390	412.63	423	390
6	SSB-2	408.23	434	357	411.35	437	360
7	BLDNO-145	409.57	437	383	405.12	434	380
8	Capacitor No-118	396.5	397	395	395.5	396	395
9	Capacitor No-236	396.5	397	395	395.5	396	395
10	Printing booth	414.28	425	390	412.63	423	390
11	OHBBT South	410.23	435	384	413.15	438	386
12	OHBBT North	408.12	432	381	410.82	435	384
13	SSB-1	418.5	438	399	417.5	439	396
14	GNR (UG-27)	400.26	402	399	398.12	400	397

TABLE 4.3 SPECIFIC LOSS CALCULATION FOR MV CHANGE OVER PANEL -II

S.No	Feeder Name	Number Of Cable (Runs)	Size Of Cable PVCA AL (Sq.mm)	Paralleling factor	Maximum current permitted (A)	Length of Cable (m)	Specific Loss of Cable/Km
1	GNR Incomer	3R	185	0.69	486.45	98	13.705
2	150HP COMPR	1R	185	1	235	65	9.090
3	BLD-146	2R	300	0.79	481.9	129	14.448
4	New BLD –146 120 HP	1R	185	1	235	215	30.069
5	SSB-42	3R	185	0.69	486.45	110	15.383
6	Capacitor No-470	1R	70	1	135	10	2.153
7	SSB-11	2R	185	0.79	371.3	85	11.889
8	Capacitor No-471	1R	70	1	135	9	1.938
9	DB-28	1R	50	1	110	190	48.229
10	SSB-10	3R	185	0.69	486.45	88	12.307
11	SSB-5	2R	185	0.79	371.3	72	10.069
12	SSB-40	2R	185	0.79	371.3	126	17.621
13	Capacitor No-471	2R	185	0.79	371.3	9	1.259
14	GNR UG-37	3R	400	0.69	486.45	65	6.329

TABLE 4.4 DETAILS OF SENDING END VOLTAGE AND RECEIVING END VOLTAGE FOR MV CHANGE OVER PANEL -II

S.No	Feeder Name	Sending end Voltage (V)			Receiving end Voltage)		
		Ave	Max	Min	Ave	Max	Min
1	GNR Incomer	400.26	402	399	398	401	395
2	150HP COMPR	401.60	416	370	404.77	419	373
3	BLD-146	410.30	425	386	409.68	419	400
4	New BLD –146 120 HP	409.68	419	400	406.33	413	397
5	SSB-42	403.75	419	382	406.81	423	386
6	Capacitor No-470	396.5	397	395	395	396	395
7	SSB-11	411.60	421	386	414.28	425	390
8	Capacitor No-471	396	397	395	395.5	396	395
9	DB-28	412.3	395	389	410.5	394	397
10	SSB-10	412	414	410	408.5	410	407
11	SSB-5	414.65	421	397	416.38	424	400
12	SSB-40	411.5	413	410	409	410	408
13	Capacitor No-471	396.5	397	395	395.5	396	395
14	GNR UG-37	416.84	419	415	413.12	416	411

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TABLE 4.5 SPECIFIC LOSS CALCULATION FOR MV CHANGE OVER PANEL –III

S.No	Feeder Name	Number Of Cable (Runs)	Size Of Cable PVCA AL (Sq.mm)	Paralleling factor	Maximum current permited (A)	Length of Cable (m)	Specific Loss of Cable /Km
1	GNR UG-29	4R	185	0.62	582.8	97	13.565
2	SSB-41	3R	185	0.69	486.45	157	21.956
3	120 HP COMPR	1R	185	1	235	65	9.09
4	SSB-8	2R	185	0.79	371.3	227	31.746
5	SSB-16	2R	185	0.79	371.3	258	36.081
6	SSB-18	3R	185	0.62	486.45	60	8.391
7	Glass Plate	1R	185	1	235	215	30.069
8	Capacitor No-546	2R	95	0.79	260.7	15	2.851
9	Tool Room	2R	185	0.79	371.3	182	25.452
10	SSB-4	2R	185	0.79	371.3	53	7.412
11	SSB-7	2R	185	0.79	371.3	170	23.774
12	Capacitor No-263	1R	70	1	135	12	2.584
13	GNR Incomer	2R	400	0.79	529.3	48	4.675

TABLE 4.6 DETAILS OF SENDING END VOLTAGE AND RECEIVING END VOLTAGE FOR MV CHANGE OVER PANEL -III

S.No	Feeder Name	Sending end Voltage (V)			Receiving end Voltage(V)		
		Ave	Max	Min	Ave	Max	Min
1	GNR UG-29	400.26	402	399	398	401	395
2	SSB-41	405	414	396	407	416	396
3	120 HP COMPR	401.6	416	370	404.77	419	373
4	SSB-8	404.5	413	396	407.5	418	397
5	SSB-16	404.5	417	412	404.5	412	397
6	SSB-18	404	412	396	409	416	402
7	Glass Plate	401.6	416	370	404.77	419	373
8	Capacitor No-546	396.5	397	395	395.5	396	395
9	Tool Room	406.63	413	396	411.11	419	403
10	SSB-4	406	414	396	409	416	399
11	SSB-7	402	413	391	406	414	398
12	Capacitor No-263	396.5	397	395	395.5	396	395
13	GNR Incomer	400.12	405	399	398.65	401	397

TABLE 4.7 SPECIFIC LOSS CALCULATION FOR MV CHANGE OVER PANEL -IV

S.No	Feeder Name	Number Of Cable (Runs)	Size of Cable PVCAAL (Sq.mm)	Paralleling factor	Maximum current permitted(A)	Length of Cable (m)	Specific Loss of Cable/Km
1	GNR Incomer 500 KVA	2R	400	0.79	529.3	16	1.558
2	GNR Incomer1250 KVA	3R	185	0.69	486.45	16	2.238
3	Out going Lighting	2R	300	0.79	481.9	76	8.512
4	GFM Printing	2R	300	0.79	481.9	138	15.455
5	I floor BLD- 146	2R	185	0.79	371.3	146	20.418
6	GNR Incomer 500 KVA	3R	400	0.69	486.45	53	5.1614
7	SSB-39	1R	95	1	165	20	3.8016
8	DB-31	1R	50	1	110	16	4.0612
9	DB-30	1R	70	1	135	14	3.0146
10	DB-277	1R	70	1	135	34	5.2877

TABLE 4.8 DETAILS OF SENDING END VOLTAGE AND RECEIVING END VOLTAGE FOR MV CHANGE OVER PANEL -IV

S.No	Feeder Name	Sending end Voltage (V)			Receiving end Voltage)		
		Ave	Max	Min	Ave	Max	Min
1	GNR Incomer 500 KVA	400.12	405	399	398.65	401	397
2	GNR Incomer 1250 KVA	400.26	402	399	398	401	395
3	Out going Lighting	405.21	415	389	401.89	412	385
4	GFM Printing	401.6	416	390	399.8	413	388
5	I floor BLD- 146	404.81	408	385	401.2	405	381
6	GNR Incomer 500 KVA	416.84	419	415	413.2	416	411
7	SSB-39	400.18	412	388	397.16	409	385
8	DB-31	397.39	400	389	394.28	397	385
9	DB-30	412	414	410	408.5	410	407
10	DB-277	410.32	425	390	412.63	423	390

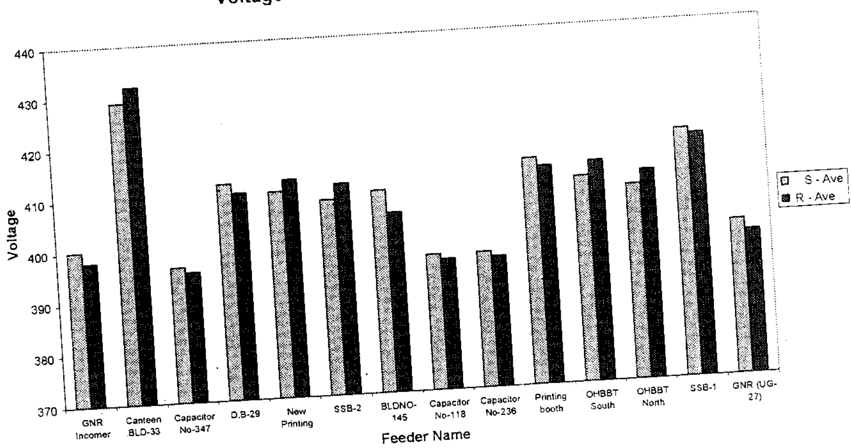
TABLE 4.9 SPECIFIC LOSS CALCULATION FOR AUTO CHANGE OVER PANEL I

S.NO	FEEDER NAME	NUMBER OF RUNS(R)	SIZE OF CABLE (SQ MM)	PARALLELING FACTOR	MAXIMUM CURRENT PERMITTED (A)	LENGTH OF CABLE (M)	SPECIFIC LOSS OF CABLE (V / KM)
1	GNR 500 KVA	2R	185	0.79	371.3	71	9.929
2	New BLD-146	1R	185	1	235	128	17.901
3	LSSB-21	1R	185	1	235	258	36.081
4	LSSB-6	1R	95	1	165	170	32.314
5	DB-7	1R	185	1	235	117	16.362
6	ISDB	1R	35	1	92	82	23.574
7	LSSB-9	1R	95	0.79	165	12	2.28096
8	EB Incomer	2R	400	1	529.3	16	1.558
9	LSSB-25	1R	25	1	76	60	19.699
10	LSSB-144	1R	35	1	92	88	25.295
11	LSSB-43	1R	50	1	110	126	31.983
12	Cooling Tower	1R	70	1	135	20	4.306

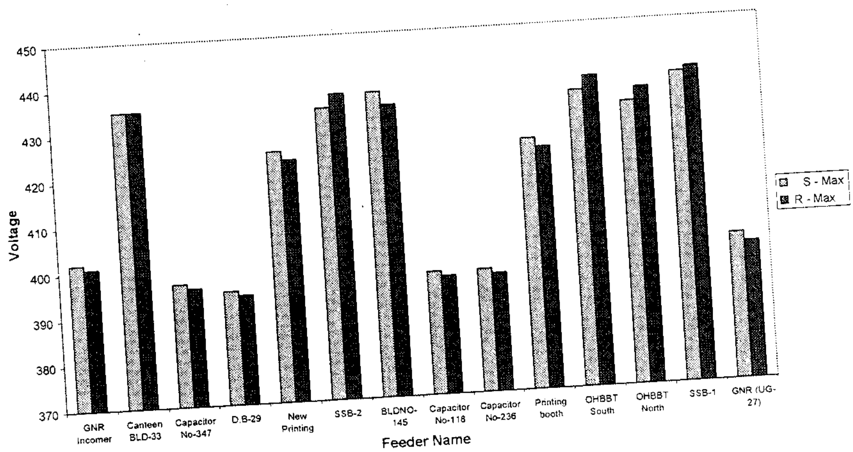
TABLE 4.10 DETAILS OF SENDING END VOLTAGE AND RECEIVING END VOLTAGE FOR AUTO CHANGE OVER PANEL -I

S.No	Feeder Name	Sending end Voltage (V)			Receiving end Voltage)		
		Ave	Max	Min	Ave	Max	Min
1	GNR 500 KVA	399.3	403	396	397.43	401	394
2	New BLD-146	393.46	406	381	391.5	404	379
3	LSSB-21	391.50	403	385	389.2	402	379
4	LSSB-6	395.62	410	391	393.5	408	390
5	DB-7	390.06	408	396	388.6	405	394
6	ISDB	392.53	410	390	391.3	407	387
7	LSSB-9	399.61	407	393	397.6	405	391
8	EB Incomer						
9	LSSB-25	394.6	413	389	392.1	410	387
10	LSSB-144	397.5	415	387	395.2	412	384
11	LSSB-43	399.68	411	383	395.8	409	381
12	Cooling Tower	401.1	413	391	399.6	410	388

Details of Sending end Voltage and Receiving end Voltage for MV Change Over Panel - I (Ave)



Details of Sending end Voltage and Receiving end Voltage for MV Change Over Panel - I (Max)



Details of Sending end Voltage and Receiving end Voltage for MV Change Over Panel - I (Min)

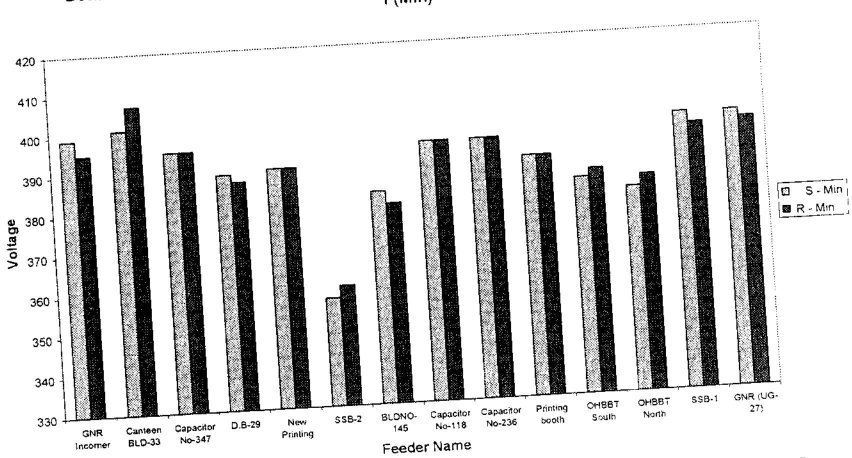
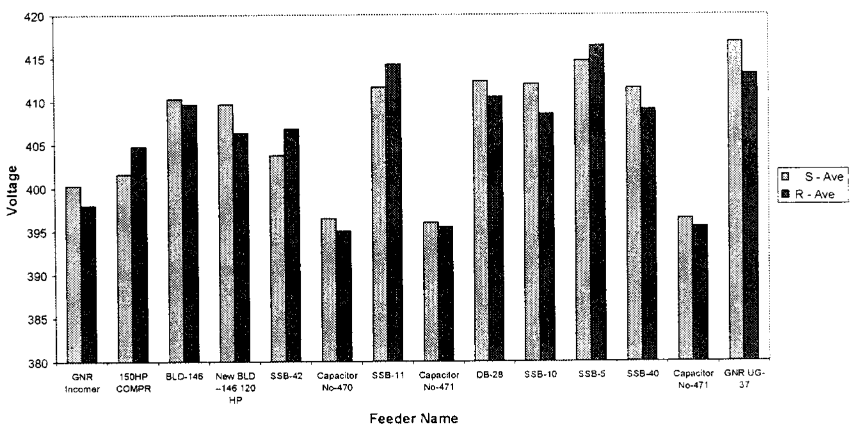
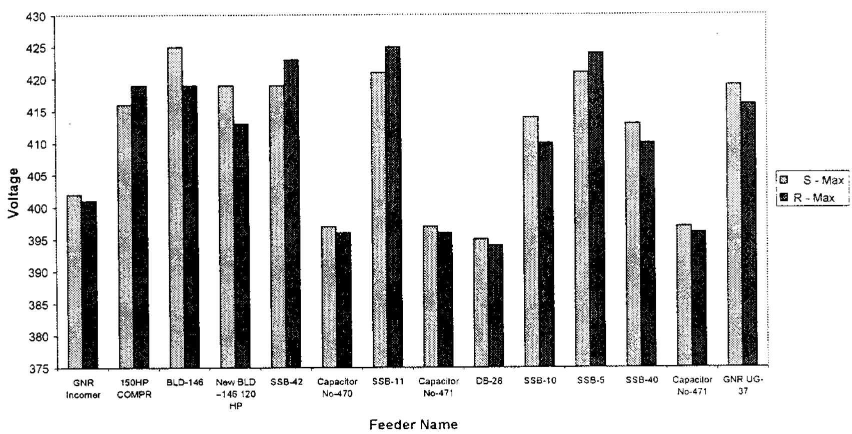


FIGURE 4.1. BAR DIAGRAM REPRESENTATION FOR

Details of Sending end Voltage and Receiving end Voltage for MV Change Over Panel - II (Ave)



Details of Sending end Voltage and Receiving end Voltage for MV Change Over Panel - II (Max)



Details of Sending end Voltage and Receiving end Voltage for MV Change Over Panel - II (Min)

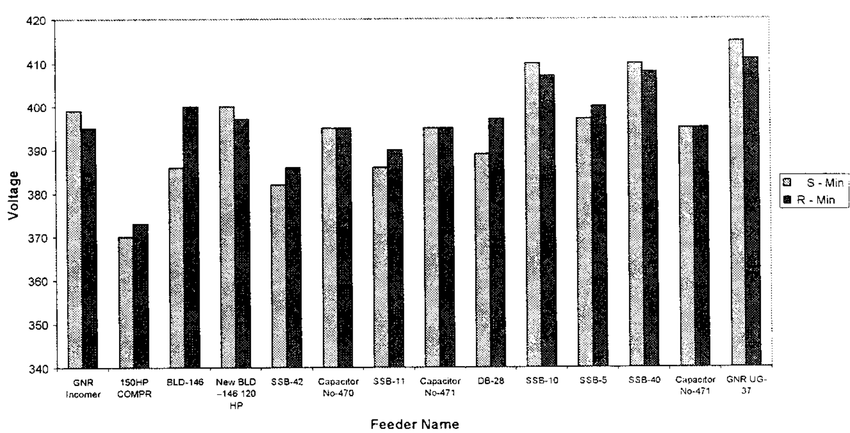
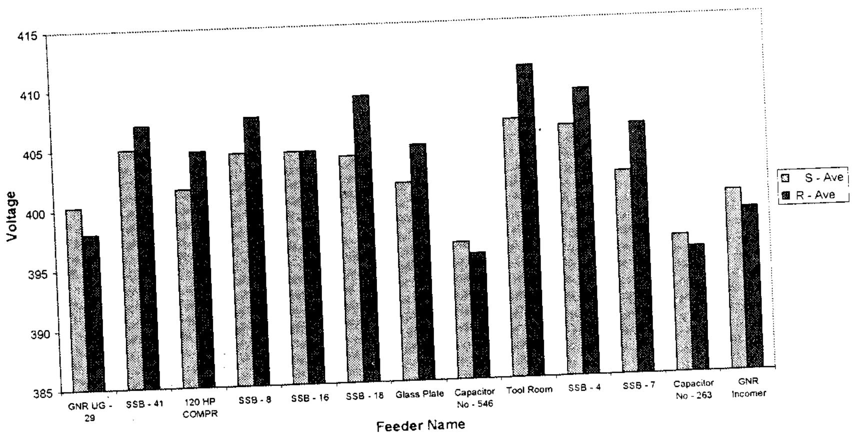
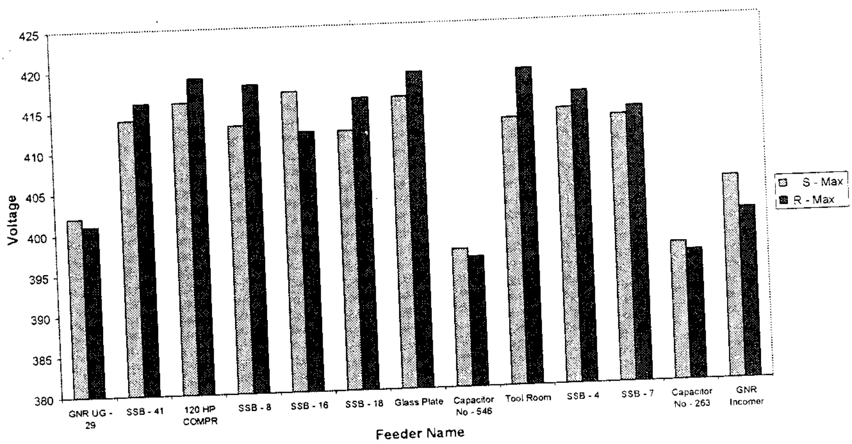


FIGURE 4.2. BAR DIAGRAM REPRESENTATION FOR MV CHANGE OVER PANEL - II

Details of Sending end Voltage and Receiving end Voltage for MV Change Over Panel - III (Ave)



Details of Sending end Voltage and Receiving end Voltage for MV Change Over Panel - III (Max)



Details of Sending end Voltage and Receiving end Voltage for MV Change Over Panel - III (Min)

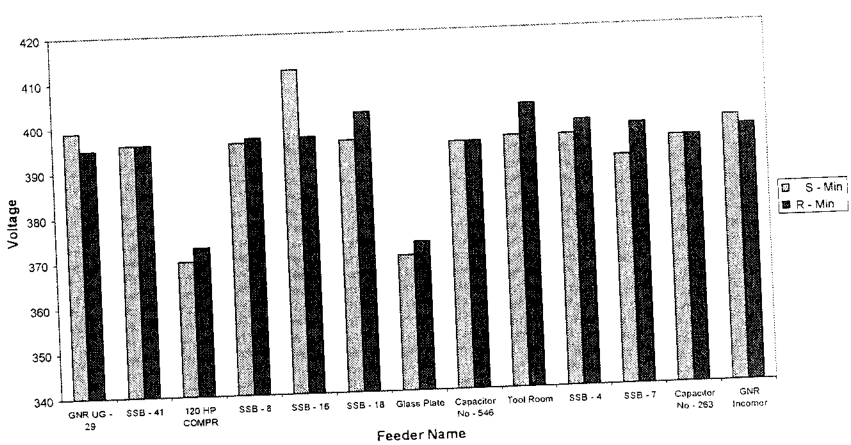
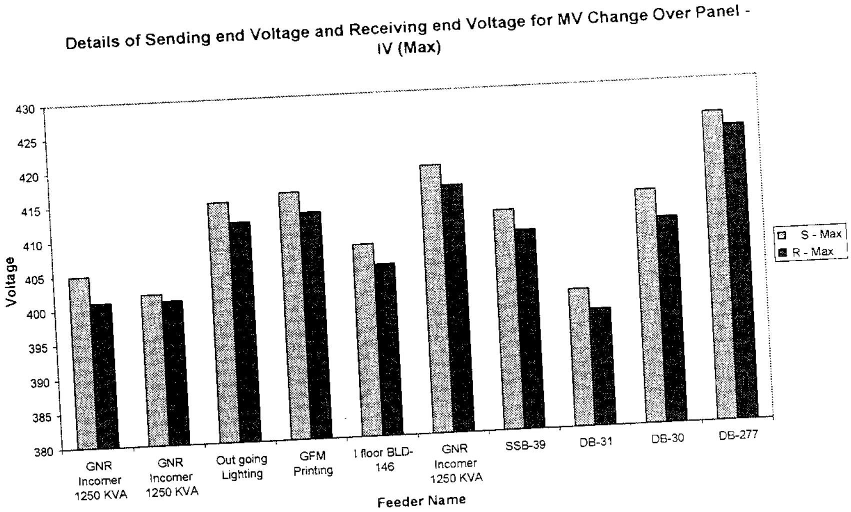
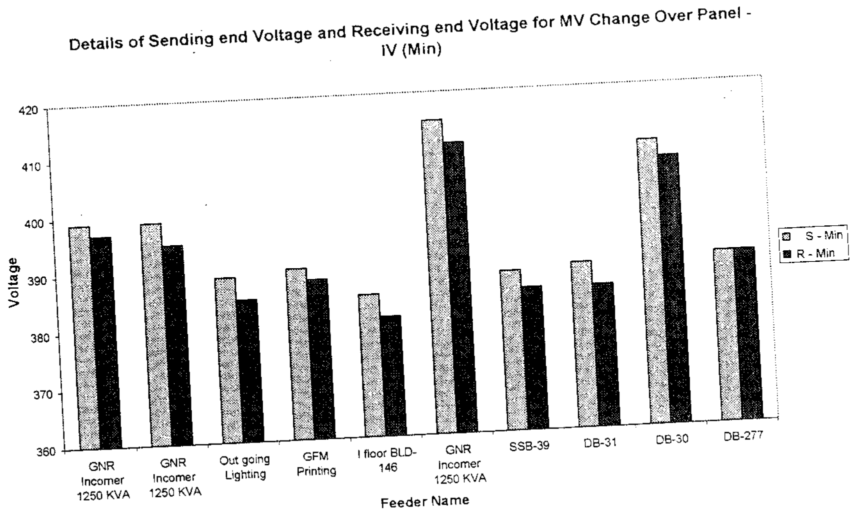


FIGURE 4.3. BAR DIAGRAM REPRESENTATION FOR





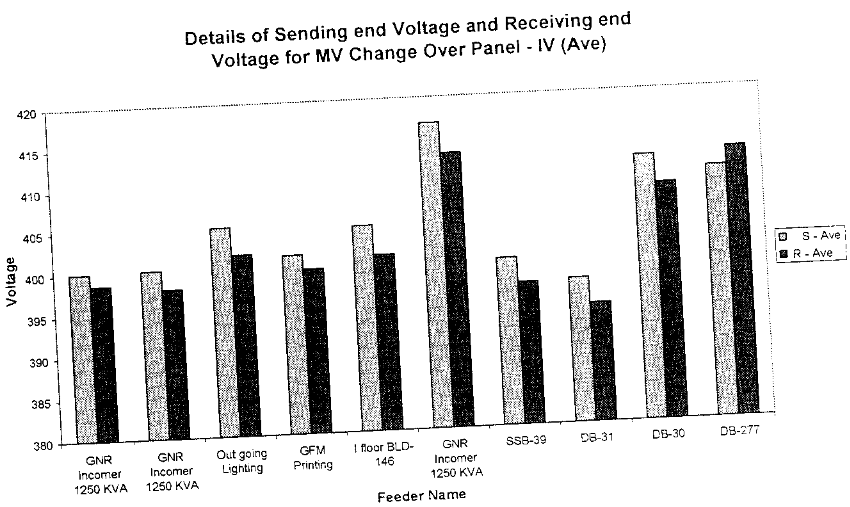


FIGURE 4.4. BAR DIAGRAM REPRESENTATION FOR

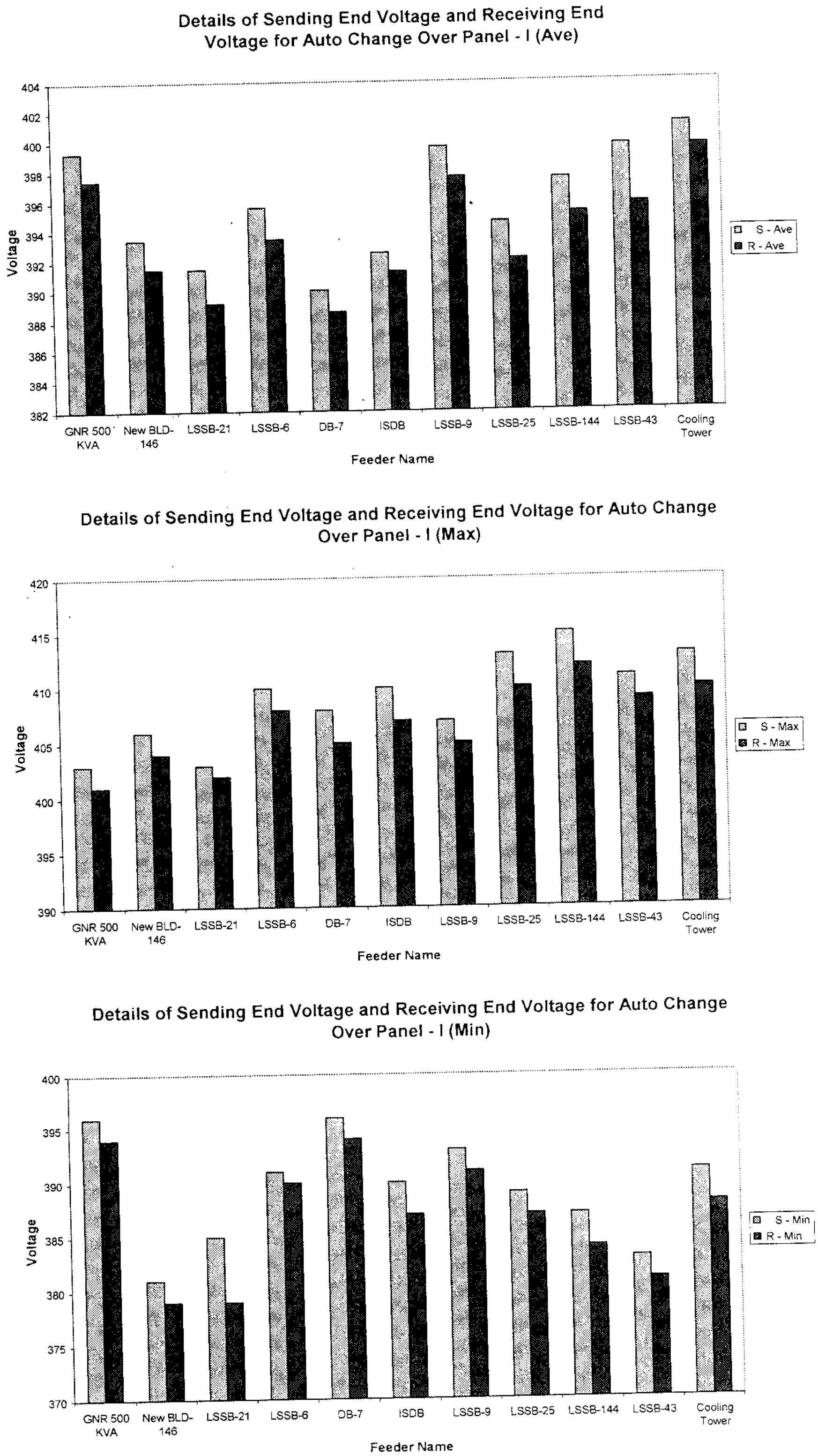


FIGURE 4.5. BAR DIAGRAM REPRESENTATION FOR

CHAPTER - 5

LIGHTING SYSTEMS

5.1 Introduction:

Lighting accounts for less than 5% of the electricity consumption in the most industries. Only in some industrial sectors like textiles and paints, where colour rendering is important, lighting energy consumption may be higher. In commercial building like hotels, hospitals, shopping arcades, office spaces etc, lighting can be major contributed to the energy bill.

5.2 Lighting Measurements:

The light output of lamps is measured in a unit called "lumens". "One lumen" is the flux through a unit solid angle from a uniform point source of one candela. "One candela" is the luminance intensity in the perpendicular direction of the surface of 1/ 6, 00,000 square meter of a black body.

The light output of lamps is measure in "lumens" by a measuring instrument called "goneometer". The light intensity of surface or illuminance is measured in lumens per square meter or lux. Illuminance is measured in an instrument called luxmeter.The luxmeter is a handy, portable instrument, which is useful for energy audits.

5.3 Types of Lamps:

5.3.1 Incandescent Lamps:

Incandescent Lamps produce light by heating a filament to the point of glowing or incandescent. Tungsten filament which has high melting point is the common choice of filament. The life of the lamp is limited by the evaporation rate of the filament. The higher the filament temperature, the higher is the efficiency and more quickly the lamp burns out. Incandescent lamps are the least efficient light source with efficacies ranging from 5 to 25lm/W. Tungsten halogen lamps consist of tungsten coil lamp mounted in cylindrical quartz envelope. Halogen gas filling reacts with tungsten to re-deposit evaporated tungsten.

back onto the wire filament. Tungsten halogen lamps require quartz encasement because of the high temperature of the bulb; the filament of the halogen lamp can be operated at higher temperature to improve efficiency.

5.3.2 Fluorescent lamps:

The fluorescent lamp is a electric discharge device which utilizes a low pressure mercury vapour arc to generate ultra violet and some visible energy. The ultra violet energy is absorbed by a phosphor coat on the inside of the glass tube and converted to visible wavelength. In addition to the small amount of mercury vapour, the fluorescent tube contains an atmosphere of an inert gas, usually argon, krypton, neon, or a mixture of two or more of these gasses. The pressure of these gasses contained in the lamp is very low, usually two to three torr.

Compact fluorescent lamps (CFLs) are now available in different ratings. CFLs are an efficient replacement for incandescent lamps.

5.3.3 High Intensity Discharge Lamps (Mercury Vapour, Sodium Vapour & Metal Halide):

The principle of operation of high intensity discharge lamps is similar. An arc is established between two electrodes, which are only a few inches from each other. These electrodes are held in opposite ends of a small, sealed, translucent or transparent arc tube. The arc tube is then enclosed in an outer bulb.

5.3.4 Mercury Lamps:

In case of High Pressure Mercury Vapour Lamps (HPMV), the inner arc tube contains high purity mercury and argon gas, while the outer bulb contains nitrogen gas, which helps stabilize lamp operation and also block UV radiation. When a circuit is energized the starting voltage is provided to the starting electrode and the main adjacent electrode, creating a short argon arc. This heats up the mercury and vaporizes it.

The ionized mercury decreases the resistance across the main electrodes and causes the main arc to strike.

Metal halide lamps are similar to HPMV lamps in operating principle and physical appearance. The main difference from HPMV lamps is that metal halide lamps contain metallic additives like sodium iodide, scandium iodide, thallium iodide and indium iodide. These iodides partially vaporize to give different colour rendition. These lamps are extremely sensitive to burning position, and produce significantly less light output in horizontal position.

Blended Lamps are high-pressure mercury lamps operating series with resistive ballast; the ballast is a tungsten filament, which is built in the lamp itself, so no external ballast is required. The gas filling is argon with some percentage of nitrogen, at a pressure slightly less than atmospheric pressure. The absence of the external ballast has made this lamp very popular for flameproof areas, as the cost of the luminaries comes down drastically. These are manufactured in rating from 100W to 500W, however in India, only 160W is commonly used.

5.3.5 Sodium vapor lamp:

The arc tube of high-pressure sodium vapour lamps is smaller than that of mercury vapour lamps and hence it cannot accommodate a starting electrode. The arc tube contains xenon gas and a small quantity of sodium-mercury amalgam. The ballast contains a special starting circuit to ionize the xenon gas across the main electrode gap by means of low energy, high voltage pulse on each cycle or half cycle. The Na-Hg amalgam gets partially vaporize at the operating temperature around 1300 C. the main function of mercury gas is to raise the gas pressure and keep the operating lamp voltage within safe limits. This lamp is not sensitive to burning position. As the arc tube is small.

5.3.5 Low Pressure Sodium Vapour Lamps:

The arc tube is 'U' shaped, which is doubled back on itself within its limbs very close together. The electrodes are sealed and mounted in a outer vacuum jacket. The starting gasses Neon with small amounts of Xenon, Argon, or Helium.

The arc is carried through by vaporized sodium under a pressure of 0.005 mm of Hg, producing intense light of yellow-orange colour.

5.4 Energy saving Opportunities in Lighting Systems:

5.4.1Natural Day Lighting:

Natural daylight comprises direct sunlight and sky radiation; the latter is nearly constant through the day. The utility of using natural day lighting instead of electric lighting during the day is well known, but is being increasingly ignored especially in modern air conditioned office spaces and commercial establishments like hotels, shopping plazas etc.

5.4.2 Task lighting:

Task lighting implies providing the required good illuminances only in actual small area where being performed, while the general illuminance of the shop floor or office is kept at a lower level. The concept of Task lighting if sensibly implemented, can reduce the number of general lighting fixtures, reduce the wattage of lamps, save considerable energy and provide better illuminance and also provide aesthetically pleasing ambience.

5.4.3 Selection of High Efficacy Lamps and Luminaries:

The types of lamps used depends upon the mounting height, colour rendering may also be a guiding factor. Considerable development work is being done to improve the effectiveness of luminaries. For tube lights in dust free areas luminaries with mirror optics may be trough type luminaries or recessed luminaries with acrylic covers.

5.4.4 Reduction of Lighting Feeder Voltage:

In many areas nighttime grid voltages are higher than normal; hence reduction in voltage can save energy and also provide the rated light output. Reactors and Transformers for reducing the lighting feeder voltage are being supplied as standard product by some manufacturers. A large number of industries have used these devices and have reported saving to the tune of 5% to 15%.

In my project, the energy savers are used at the feeder end to reduce the electricity bill.

5.5 Energy savings in lighting systems:

The energy saver is used to save substantial amount of electrical energy used for the purpose of discharge lighting. The energy saver employs impedance across the circuit and thus the lamp to supply optimum power to discharge lamps and lighting.

In PRICOL, a study was made in **new building-146,** where the peak current was found to be **30 A.** For 30 A, the cost of energy saver is **Rs 1, 05,000.**

Procedure for calculation:

Power = $1.732 x V_{Lx} I_L x Cos\emptyset$

= 1.732x410x30x0.9

= 19173.80W

= **19.17380KW**

Power consumed for 20 hours = 19.17380x 20

= **383.476 units**

For 300 Days = **115042.81units saved per year**

Total Cost = 115042.81x 6.5

= **Rs 74750/-**

By using energy saver, 10% electricity reduction.

For approximately 400 units,

After 10% reduction,

For 30A, cost of the saver is Rs 1, 05,000/-

For 300 Days = 40x300

= 78,000units saved per year

Total Cost = 78,000 x 6.5

= **Rs 78,000/-**

The payback period is approximately 14 Months.

CHAPTER - 6

PRESSURIZED AIR SYSTEMS

6.1 Introduction:

Pressurized air systems are the system used to maintain humidity and temperature of a room where devices (equipments) can be operated only at the prescribed condition. Moreover, they are one of the most expensive of all plant utilities.

6.2 Classification of Pressurized air systems:

Pressurized air systems can be classified based on functions, distribution and by Ventilation Principle.

6.2.1 By Functions:

- Ventilation - Supply and evacuating of air with the main purpose to keep the atmospheric climate according the requirements
- Climate - Supply and evacuating air with main purpose to keep the temperature and the atmospheric climate according requirements
- Heating or cooling - Recycling system with the main purpose to supply the building with necessary heat or cooling
- Combined system - The functions above more or less combined in one system

6.2.2 By Distribution:

A ventilation system can also be classified by distribution:

- Centralized - A central plant supplies and extract air to and from the whole building
- Decentralized - Each room/area of the building has it's own ventilation unit
- Combined - Both centralized and decentralized systems used Classifying

6.2.3 By Ventilation Principle:

A ventilation system can also be classified by the ventilation principle and air flow

- Displacement air flow through the room - CAV (Constant Air Volume) or VAV (Variable air volume
- Mixed air flow through the room - CAV (Constant Air Volume) or VAV (Variable air volume).

6.2 Working Principle of PAS:

The outside fresh air is sucked into the system and by using filter the air is filtered to make dust free. Then the filtered air is allowed to the spray unit. Here the outside air is cooled and reduces its temperature. Then the humidified air is sent to the room, which lowers the temperature and makes the room humidified. which is prescribed for the devices.

Almost, most systems typically waste 25 to 50 percent of the energy required to generate compressed air that actually provides useful work. Fig 6.1 represents the block diagram of PAS.

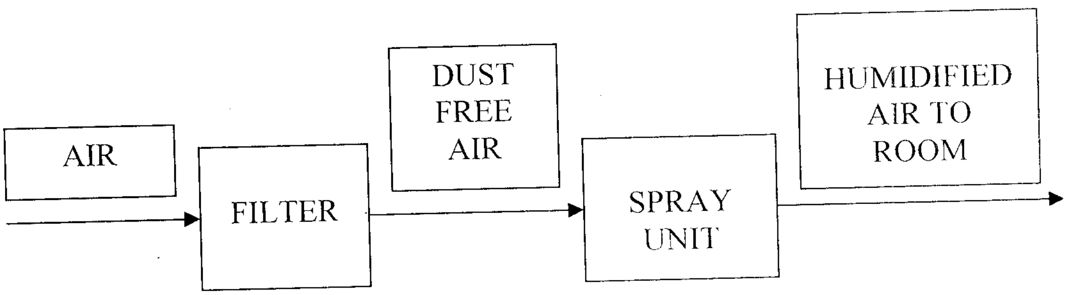


FIG 6.1 BLOCK DIAGRAM REPRESENTATION OF PAS

6.3 Energy Conservation opportunities in PAS:

- Proper maintenance of the system.
- Switch off the system when not in use.
- Usage of required rate of capacity of systems
- Retrofitting the equipment
- Proper system design
- Improved controls

In Pricol, 10 PAS units are used. During the break time (or) lunchtime PAS unit is switched off i.e., for half an hour. First the number of motors used and hours of operation are studied. Later, the number of hours wasted is found and energy loss per day, per month, per year is analyzed.

Procedure for calculation

For Building -15,

- Number of Motors = 1
- Number of Motors used = 1
- Rated capacity = 50 HP (37.30 KW)
- Number of hours used = 12
- Number of hours wasted = 30 Min

Energy Loss = Rated Capacity x Time (KWH)

= 37.30 x 0.5

= 18.65 KWH

Energy Loss Per Day (Rs) = Energy Loss x 6.50

= 18.65 x 6.50

= Rs 121.23/-

Energy Loss Per Month (Rs) = Energy Loss Per Day x 30

= 121.23 x 30

= Rs 3,636.75 /-

Energy Loss Per Year (Rs) = Energy Loss Per Month **x** 365

= 3635.75 x 365

= Rs 43,641/-

Total Energy Loss = 104.44 KWH

Total Energy Loss Per Day = Rs 678.86/-

Total Energy Loss

Per Month = Rs20365.80/-

Total Energy Loss Per Year = Rs 2, 44,389.60/-

The energy details of Pressurized Air System is shown in Table 6.1

TABLE 6.1 ENERGY DETAILS OF PRESSURIZED AIR SYSTEMS

S.NO	FEEDER NAME	NUMBER OF MOTORS	NUMBER OF MOTORS USED	NUMBER OF HOURS USED	NUMBER OF HOURS WASTED	RATED CAPACITY (HP)	RATED CAPACITY (HP)	ENERGY LOSS= CAPACITY * TIME (KWH)	ENERGY LOSS PER DAY (Rs)	ENERGY LOSS PER MONTH (Rs)	ENERGY LOSS PER YEAR (Rs)
1	TYPE-7	1	1	10	30 Min	40	29.84	14.92	96.98	2909.40	34912.80
	TYPE-7	2	2	10	60 Min	15	11.19	11.19	72.74	2182.05	26184.50
2	BLD-15 (I Floor)	1	1	12	30 Min	50	37.30	18.65	121.23	121.23	43641
3	BLD-15 (II Floor)	1	1	12	30 Min	50	37.30	18.65	121.23	121.23	43641
4	BLD-26 (I Floor)	2	2/1	10	30 Min	15	11.19	5.595	36.37	36.37	13092.30
5	BLD-26 (II Floor)	2	2/1	15	30 Min	15	11.19	5.595	36.37	1091.03	13092.30
6	P&S -5	2	2/1	25	30 Min	25	18.65	9.325	60.61	1818.38	21820.50
7	P&S-3	2	1	15	30 Min	15	11.19	5.595	36.37	1091.03	13092.30
8	DWS	2	1	15	30 Min	15	11.19	5.595	36.37	1091.03	13092.30
9	QI	1	1	25	30 Min	25	18.65	9.325	60.61	1818.38	21820.50

CHAPTER-7

FUTURE SCOPE OF STUDY / CONCLUSION

7.1 FUTURE SCOPE OF STUDY:

In this project, switching off 500 KVA Transformer had saved energy. But it is possible to switch off 1000 KVA transformer which could save 3 times the amount of energy by the former.

In the case of cables, only voltage drop was analyzed but loss in energy can also be studied to conserve energy. In the case of Pressurized Air systems, the unit was switched off for only half an hour but studies can be made to switch off for longer period. In the case of Lighting Systems, the energy saver was implemented to one building but it can be done to other buildings.

More over, the energy conservation technique can be used to other utilities for the benefit of the company.

7.2 CONCLUSION:

The benefits of energy audits and energy conservation are inter- related and its outcome shall form the basis for detailed and complete evaluation of the system, which is need of hour.

By implementation of energy conservation programme on Transformers, Underground Transmission Cables, Pressurized Air Systems and Lighting Systems, considerable amount of energy can be saved and the operating cost for the industry could be reduced.

As a result in PRICOL, amount of units saved,

Transformers:

Energy saved for partially working days = 5.07 units / hr

Energy saved for partially working days = 9.55 units /hr

Pressurized Air Systems:

Total energy saved = 104.4 units / day

Lighting systems:

Total energy saved = 40 units / day

Total amount saved per year = Rs 601411.20/-

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