Certified No: GEDA/AUTHO/08/2020/7929,GHU/99/31/GUE/1196/9018/K1

MASS ENERGY CONSULTANT

ENERGY AUDITOR AUTHORIZED BY GEDA & GOVT.OF GUJ.

Better ways to save energy

Office: 186, Bahucharnagar Soc., Opp. Hari Om Mill, Ved Road, Surat - 395004.
Email: - mass_encon@ymail.com Contact Mobile: 9277857948
www.massenergyconsultant.in

ENERGY AUDIT CERTIFICATE

This is to certify that **Mass Energy Consultant** conducted a comprehensive energy audit of **M R Desai Arts and EELK Commerce College, Chikhli** during the academic year 2024-2025. The audit, which took place from Date to Date, was carried out to identify potential areas of energy savings, enhance energy efficiency, and recommend sustainable solutions in alignment with the college's commitment to building a greener future.

MASS ENERGY CONSULTANT SURAT

REGARDS

FOR MASS ENERGY CONSULTANT

PROPRIETOR

MASS ENERGY CONSULLTANT

2.5 Power and Harmonics Details

Location	Date & Time	Vrms			Irms			Vthd %			Ithd %			PF	Power			Hz
		R	Y	B	R	Y	B	R	Y	B	R	Y	B		Kw	Kva	Kvar	
GEB Main	07-09-2024 11:42:22	390.8	390.4	394.5	26.6	30.2	30.4	2.2	2.2	2.1	7.4	7.8	10.1	0.920	17.7	19.2	-7.5	50.1
	07-09-2024 11:42:52	391.4	390.4	394.4	26.6	30.2	31.0	2.3	2.3	2.1	7.5	7.9	10.1	0.920	17.8	19.3	-7.5	50.1
	07-09-2024 11:43:22	392.1	390.1	394.0	26.6	27.9	31.9	2.3	2.3	2.1	7.4	7.9	9.9	0.950	18.1	19.1	-5.6	50.1
	07-09-2024 11:43:52	393.2	390.9	393.9	26.7	23.3	32.6	2.3	2.3	2.1	7.5	6.9	9.7	0.990	18.3	18.4	-2.0	50.1
	07-09-2024 11:44:22	393.2	391.9	394.3	26.7	23.3	32.0	2.4	2.4	2.2	7.4	6.9	9.9	0.990	18.1	18.3	-2.3	50.1
	07-09-2024 11:44:52	393.2	392.0	394.3	26.7	23.3	32.1	2.3	2.4	2.1	7.4	6.9	9.8	0.990	18.1	18.3	-2.5	50.1
	07-09-2024 11:45:22	393.5	392.4	394.7	26.7	23.2	32.4	2.4	2.4	2.2	7.6	7.0	9.9	0.990	18.2	18.4	-2.1	50.1
	07-09-2024 11:45:52	393.5	393.0	395.0	26.7	22.9	30.6	2.4	2.4	2.2	7.6	7.0	10.0	0.980	17.7	17.9	-2.5	50.1
	07-09-2024 11:46:22	393.2	394.9	396.4	26.7	23.0	23.8	2.3	2.4	2.2	7.4	7.0	9.8	0.940	15.4	16.4	-5.4	50.1
	07-09-2024 11:46:52	393.3	394.8	396.6	26.7	22.9	23.7	2.4	2.4	2.2	7.4	7.0	9.8	0.940	15.4	16.3	-5.4	50.1
	07-09-2024 11:47:22	392.2	393.7	396.9	26.7	28.5	23.7	2.3	2.3	2.2	7.5	8.2	10.0	0.880	15.5	17.5	-8.2	50.1
	07-09-2024 11:47:52	392.4	394.1	397.3	26.7	29.6	23.6	2.3	2.3	2.2	7.4	7.9	9.8	0.870	15.4	17.7	-8.7	50.1
	07-09-2024 11:48:22	393.5	394.8	397.7	26.7	29.7	23.6	2.3	2.3	2.2	7.5	8.0	9.5	0.870	15.4	17.8	-8.9	50.1
	07-09-2024 11:48:52	393.6	394.7	397.5	26.9	29.7	23.6	2.3	2.3	2.1	7.4	8.1	9.6	0.870	15.5	17.9	-8.9	50.1
	07-09-2024 11:49:22	393.7	394.8	397.7	27.0	29.7	23.5	2.3	2.3	2.2	7.3	8.1	9.5	0.870	15.5	17.9	-8.9	50.1
	07-09-2024 11:49:52	393.9	394.8	398.0	27.0	29.7	23.6	2.3	2.3	2.2	7.4	8.0	10.2	0.870	15.5	17.9	-8.9	50.1
	07-09-2024 11:50:22	394.2	394.7	398.1	27.1	29.7	23.7	2.3	2.3	2.2	7.5	8.1	9.7	0.870	15.6	17.9	-8.9	50.1
	07-09-2024 11:50:52	396.1	395.9	398.5	26.7	24.5	23.6	2.4	2.4	2.1	7.5	8.0	9.4	0.920	15.4	16.8	-6.4	50.1
	07-09-2024 11:51:22	396.3	396.1	398.5	27.0	22.9	23.7	2.4	2.4	2.1	7.5	7.1	9.5	0.940	15.5	16.5	-5.6	50.1
	07-09-2024 11:51:52	395.6	395.0	397.9	27.1	24.0	23.6	2.3	2.3	2.1	7.3	7.0	9.6	0.930	15.5	16.7	-6.0	50.0
	07-09-2024 11:52:22	394.4	393.6	397.9	27.1	29.5	23.6	2.2	2.2	2.1	7.4	6.0	9.5	0.870	15.5	17.9	-8.8	50.0
	07-09-2024 11:52:52	394.4	393.8	398.2	27.0	29.5	23.7	2.2	2.3	2.1	7.3	5.9	9.6	0.870	15.5	17.8	-8.8	50.0
	07-09-2024 11:53:22	390.8	391.1	394.8	34.7	37.3	31.1	2.2	2.3	2.1	7.2	5.9	9.4	0.900	20.4	22.7	-9.9	50.0
	07-09-2024 11:53:52	390.1	389.4	392.9	35.1	37.9	37.7	2.4	2.3	2.2	6.2	5.1	8.3	0.940	22.7	24.3	-8.5	50.0
	07-09-2024 11:54:22	390.0	388.9	392.5	35.0	37.9	38.7	2.2	2.2	2.0	6.0	5.1	8.2	0.940	23.0	24.5	-8.2	50.0
	07-09-2024 11:54:52	390.4	389.8	392.7	34.9	35.3	39.3	2.2	2.3	2.1	6.1	5.4	8.1	0.960	23.2	24.1	-5.6	50.0
	07-09-2024 11:55:22	391.7	391.4	392.9	34.7	31.4	39.5	2.2	2.3	2.1	6.0	6.5	8.3	0.990	23.3	23.4	-1.8	50.0
	Average	**393.0**	**392.9**	**395.9**	**28.3**	**28.4**	**28.5**	**2.3**	**2.3**	**2.1**	**7.2**	**7.1**	**9.5**	**0.925**	**17.5**	**18.9**	**-6.4**	**50.0**
	Maximum	**396.3**	**396.1**	**398.5**	**35.1**	**37.9**	**39.5**	**2.4**	**2.4**	**2.2**	**7.6**	**8.2**	**10.2**	**0.990**	**23.3**	**24.5**	**-1.8**	**50.1**
	Minimum	**390.0**	**388.9**	**392.5**	**26.6**	**22.9**	**23.5**	**2.2**	**2.2**	**2.0**	**6.0**	**5.1**	**8.1**	**0.870**	**15.4**	**16.3**	**-9.9**	**50.0**
OBSERVATION:	**Active filter is needed to install where averege current harmonics is above 15% and voltage harmonics is above 5%. There is no any action require in your plant. Reference IEEE 519 : 2014**																	

ENERGY AUDIT REPORT
OF
M/S M R DESAI ARTS & EELK COMMERCE COLLEGE

YEAR OF AUDIT REPORT: SEPTEMBER 2024

ADDRESS: AT & POST-CHIKHLI, VANSDA ROAD, TA.-, CHIKHLI, DIST.-NAVSARI-396521.

PREPARED BY

M/S MASS ENERGY CONSULTANT

CERTIFIED ENERGY AUDITOR BY BEE GOV. OF INDIA

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AUTHORIZED ENERGY AUDITOR BY GEDA & GOVT. OF GUJ.

INTRODUCTION

CLIENT DETAILS

DESCRIPTION	DATA
Project Name :	M/s M R Desai Arts And EELK Commerce College
Project Location :	At & Post-Chikhli, Vansda Road, Ta.-Chikhli, Dist.-Navsari, Navsari-366521.
Contact Person :	Dr. Riyaz A Tai
Phone No. :	9879654584
Email Id :	riyaztai786@gmail.com
Type of Institute :	College
Purpose of Consumer :	Institute
Energy Source :	Electricity
Consumer No.	13901022465
Energy Audit Period :	September-24
Proposed Energy Saving In Terms Of Unit In Kwh	36686
Proposed Money Saving In Terms Of Rs.	286154
Proposed Investment In Rs.	1045000
Proposed CO2 Emissions Reduction In Ton Per Year	30

ENERGY AUDIT TEAM INFORMATION

DESCRIPTION	DATA
Energy Audit Firm :	**MASS ENERGY CONSULTANT** Administration Office : 186, Bahuchar Nagar, Opp. Hari Om Mill, Ved Road, Surat, Gujarat-395004.
Energy Audit Team :	Mr. Suresh Rathod (BE Electrical, CEA from BEE) EA-9218 Mr. Bhavesh B Shyora (BE Electrical)

INDEX OF AUDIT REPORT

INDEX OF AUDIT REPORT

FORWARD

In today's highly competitive market, the best way to survive for any institutional, commercial, industrial and residential buildings is to utilize various resources to their optimum capacity and to carry out all the institutional activities in the cost- effective way. It is heartening to note that the industries like commercial and residential have firmly in identified the role of energy audit to supplement their efforts in this direction as one of the means to become cost effective. This is true especially with consideration of the cost of energy and availability. On the other side, if the adverse situation due to consistent power shortage is taken in to account, there is essential need for the rational use of energy either in the form of electric power, or steam in the form of heat. The integrated approach towards energy optimization and conservation is necessitated due to appreciable rise consumption as well as in the cost of fuel, the basic energy input.

It is heartening to note that the management of **M/s M R Desai Arts And EELK Commerce College** has rightly identified very important role of energy audit in maintaining and improving the institute economy. As a first step in this direction, the audit of institute areas, where electrical energy is consume continuously has been consider essential to initiate steps to conserve this vital input.

M/s MASS ENERGY CONSULTANT, Surat was entrusted the said work of energy audit by **M/s M R Desai Arts And EELK Commerce College, Chikhli, Navsari** with an object of optimizing their in-institute energy consumption by evolving appropriate conservation measures in energy utilization practices. Towards this, the field study was carried out during the months of September-24, and the report has been prepared.

Scope of Energy Audit work was as per the following broad frame work.

1 Electrical Load Management
2 Study Of Electrical Utility Systems
3 Electrical Energy Application Areas
4 Energy Generation
5 Energy Conservation Opportunities
6 Estimated Costs And Payback for Expenditure

The report, prepared after extensive studies, comprises of Executive Summary, Study of Energy Consumption pattern for different purposes, findings for wastage of energy and recommendation for implementation, etc. It is felt that with the implementation of the recommendations made in the report, the institute will set an example in this vital area of Energy Conservation and will become a model for the other institute in similar areas.

ACKNOWLEDGEMENT

M/s MASS ENERGY CONSULTANT, take this opportunity to convey their sincere gratitude to management of **M/s M R Desai Arts And EELK Commerce College** for providing them an opportunity to deal with a very important aspect of energy audit to identify the grave areas. The work of energy audit also includes suggesting various measures for energy conservation in a cost-effective way.

Our special thanks are due to following person for giving us necessary input to carry out this very vital exercise of energy audit.

Principal	:	Dr. F H Desai
Co-Ordinator	:	Dr. Riyaz A Tai
Electrical Incharge	:	Mr. Ankit Patel

We are also indebted to the management for providing an invaluable co-operation and support during the course of energy audit. We also acknowledge with thanks the active participation and co-operation by all other officers and executives of various departments, who had actively participated while collecting the data and conducting the field survey, without which this audit would not have been more meaningful.

We once again wish to put on record our deep appreciation for the whole hearted co-operation and guidance extended to our execution team for the meaningful and successful completion of the study.

EXECUTIVE SUMMARY

SR. NO.	SCHEMES	ANNUAL SAVED KWH/KG	ANNUAL SAVINGS RS.	INVESTMENT RS.	PAYBACK PERIOD IN MONTH
1	INSTALL LED TUBE LIGHTS IN PLACE T8 TUBE LIGHTS.	763	5953	5000	10.1
2	INSTALL BLDC CEILING FANS IN PLACE OF CONVENTIONAL CEILING FANS.	7123	55561	240000	51.8
3	INSTALL ROOF TOP SOLAR PLANT	28800	224640	800000	42.7
TOTAL		**36686**	**286154**	**1045000**	**43.8**

***Above calculations are based on given working hours of equipment. It may vary according to actual working hours.**

SR. NO.	OVERALL REMARKS	DETAIL
1	Avg. Annual Electrical Bill In Rs.	**205818**
2	Max. Annual Saving Possible In Rs.	**61514**
3	Overall Percentage Energy Savings.	**29.9**

CHAPTER-1

ELECTRICAL ENERGY CONSUMPTION & BILL ANALYSIS

1.1 INTRODUCTION

1.1.1 This section of the report describes the in-depth analysis of receipt and consumption of electrical energy **By M/s M R Desai Arts And EELK Commerce College** to know overall pattern. Presented below is the analysis of electricity bills and power demand.

1.2 SOURCES OF ELECTRICAL ENERGY AND DISTRIBUTION

1.2.1 The institute has connection with 1 services which contract demand is 20 KW. Power is received through 11 KV HT Dakshin Gujarat Vij Company Limited overhead transmission lines laid from Sub-station and is stepped down to 433 V through power/distribution transformer. Which is the property of DGVCL and maintained by DGVCL. The LT power is distributed to different institute areas through transformers.

1.3 OVERVIEW OF ELECTRICAL ENERGY CONSUMPTION PATTERN

1.3.1 The detailed analysis of DGVCL power billing for the last 6 months are placed in the 1.5, Which shows the data like actual demand established, Energy consumed, Unit rate/ KWh of electrical energy, etc.

1.4 PLANT LOAD FACTOR CALCULATION

$$\text{Plant Load Facor} = \frac{\text{(Monthly Total kWh consumption) x 100}}{\text{(Monthly MD Recorded x Power Factor x 24 Hrs x No. of days/month)}}$$

1.5 ELECTRIC BILL ANALYSIS

ELECTRIC COMPANY NAME: Dakshin Gujarat Vij Company Ltd. (DGVCL)								
SERVICE NO :		DGGP379294		CONTRACT DEMAND			20	KW
MONTH & YEAR	ACT. MAX DEMAND KW	ENERGY CONSUMED KWH	ENERGY CHARGE RS.	FUEL CHARGE RS.	ELECTRI-CITY DUTY RS.	TOTAL BILL AMOUNT RS.	UNIT COST RS/KWH	PLANT LOAD FACT.
Apr-24	15.0	2731	10640	7783	2778	21651	7.9	20.3
May-24	14.2	2079	8100	5925	2115	16210	7.8	15.5
Jun-24	12.1	1853	7226	5281	1886	14463	7.8	13.8
Jul-24	13.0	1592	6208	4537	1622	12437	7.8	11.8
Aug-24	11.2	2443	9527	6962	2484	19043	7.8	18.2
Sep-24	11.6	2457	9558	6985	2492	19105	7.8	18.3
AVG.	**12.9**	**2193**	**8543**	**6246**	**2230**	**17152**	**7.8**	**16.3**

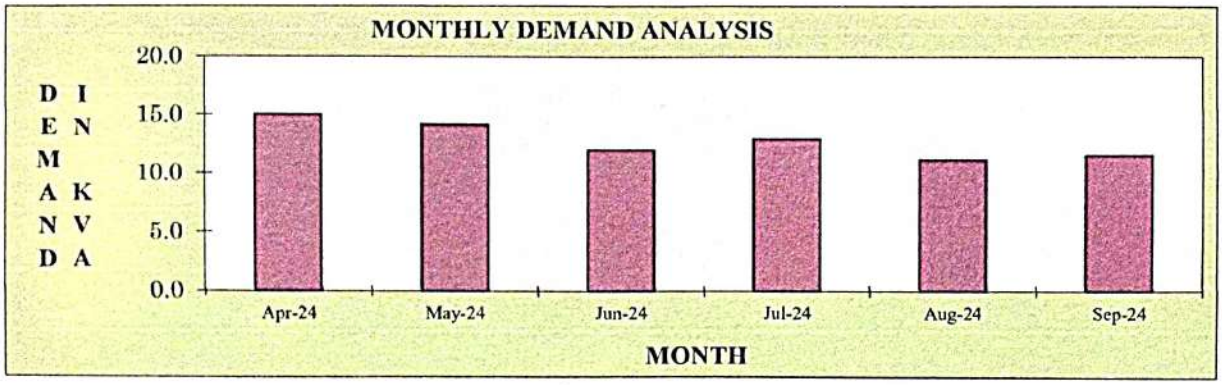
Summary of analysis is given in Table.1 here under

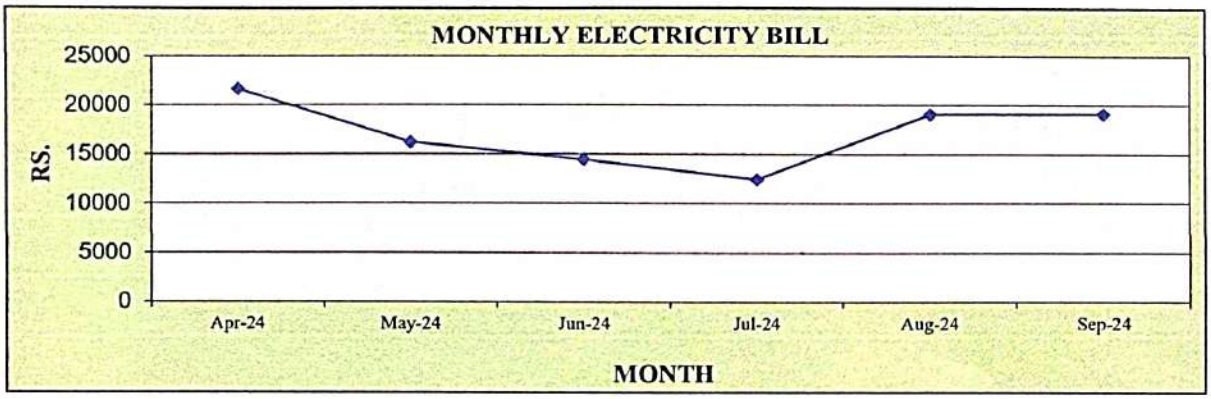
BILL ITEM DESCRIPTION	UNIT	VALUE
Contract Demand	KW	20
Minimum Billing Demand (85%)	KW	17
Variation in Demand	KW	11.2 To 15
Average Billing Demand	KW	13
Variation In Plant Load Factor	%	11.8 % To 20.3%
Average Plant Load Factor	%	16.3
Average Monthly Electric Units	KWh	2193
Average Monthly Energy Charge	Rs.	8543
Average Monthly Fuel Charge	Rs.	6246
Average Monthly Ele. Duty	Rs.	2230
Average Monthly Bill	Rs.	17152
Average Unit Rate	Rs. / kWh	7.8

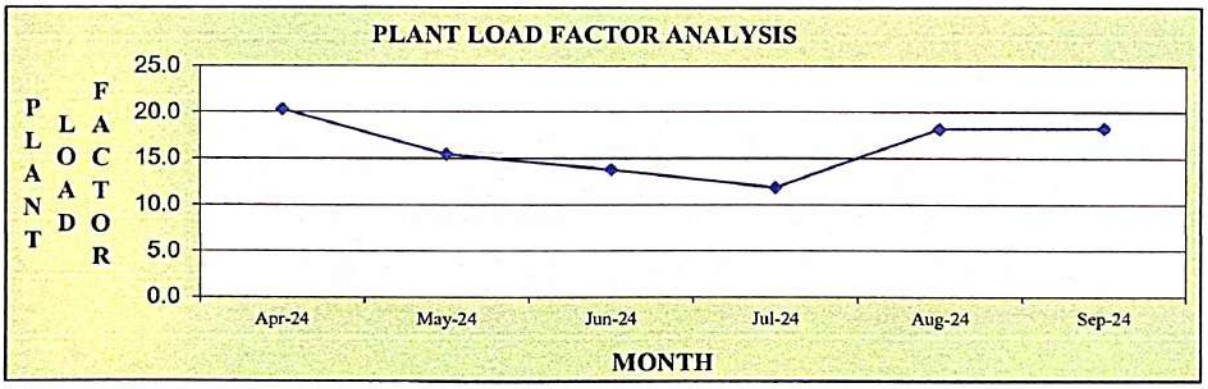
1.5.1 Contract Demand Analysis:

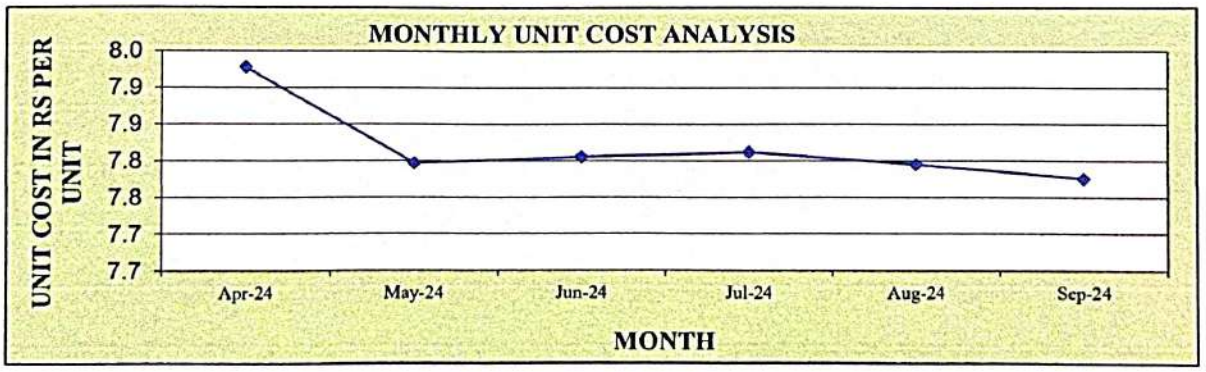
The graph says average billing demand is 13 KW. After analysis it is observed that is proper contract demand.

1.6 POWER BILL ANALYSIS GRAPHS









CHAPTER- 2

ELECTRICAL DISTRIBUTION NETWORK

2.1 INTRODUCTION

2.1.1 This section of the report projects insight into main electrical power distribution network. Its working parameters, observations on load pattern on transformers, power distribution boards, in-plant power factor, study of harmonics, etc.

2.2 POWER METERING AND MONITORING

2.2.1 The existing metering arrangement observed on L.T. side of the incoming power supply, the supplier of electric power, is a sealed trivector-meter to measure various components. The accuracy and calibration of the meter has been checked at regular intervals.

2.2.2 There is provision of separates energy meters on individual power Distribution boards to monitor the energy consumption, which is definitely a very vital essential requirement to supplement the efforts to conserve electric energy. Without proper monitoring the trends continuously, it would not be possible to achieve to goal of energy saving. It is emphasized to install energy meters and other monitoring meters like KW meter, PF meter, etc. on the PDBs phase wise staring with highly loaded PDBs.

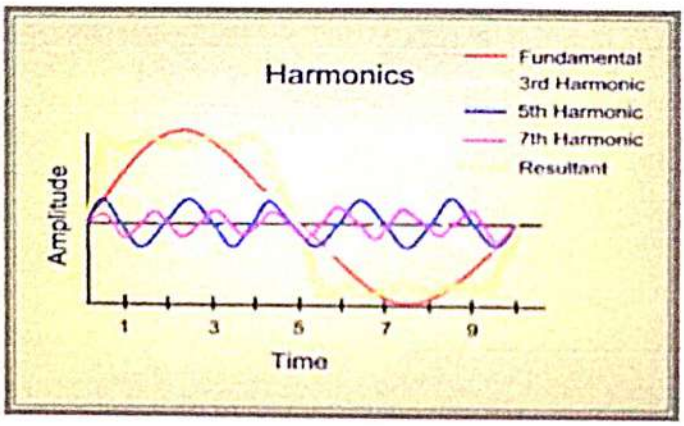
2.3 ELECTRICAL DISTRIBUTION NETWORK

Sr. No.	Name Of Out Going Feeder	Measure Operating Parameter			
		Voltage	Current	Power factor	Power KW
1	GEB Main Incomer	394	29.0	0.926	18.3

2.4 SURVEY OF HARMONICS IN THE SYSTEM

2.4.1 Introduction

In any alternating current network, flow of current depends upon the voltage applied and the impedance (resistance to AC) provided by elements like resistance of inductive and capacitive nature. As value of impedance in above devices is constant,they are called linear whereby the voltage and current relation is of linear nature.



While diodes, silicon controlled rectifiers, PWM systems, thyristors, induction and arc furnaces are also deployed for various requirements and due to their varying impedance characteristic, these Non Linear devices cause distortion in voltage and current waveforms which is of increasing concern in recent times. Harmonics occurs as spikes at intervals which are muptiples of supply frequency and these distort the pure sine wave form of supply voltage & current.

Harmonics are multiples of Fundamental frequency of electrical power system.If the fundamental frequency is 50 Hz,then 5th harmonic is five times 250 Hz.Similarly, 7th harmonic is seven times the fundamental frequency 350 Hz and so on for higher order harmonics.

2.4.2 Problems Due to Harmonics

Some Problems are easy to detect; others exist and persist because harmonics are not suspected. Higher RMS current and voltage in the system are caused by harmonic currents, Which can result in any of problems listed below:

1. Blinking of Incandenscent Lights - Transformer Saturation
2. Capacitor failure - Harmonic Resonance
3. Circuit Breakers tripping - Inductive Heating and Overload
4. Conductor Failure - Inductive Heating
5. Electronic equipment shutting down - Voltage Distortion
6. Flickering of Fluorescent Lights - Transformer Saturation
7. Fuses Blowing for No apparent Reason - Inductive Heating and Overload
8. Motor failures (overheating) - Voltage Drop
9. Neutral conductor and terminal failures - Additive Triplen currents
10. Electromagnetic Load failures - Inductive Heating
11. Overheating of Metal Enclosures - Inductive Heating
12. Power Interference on voice communication - Harmonic Noise
13. Transfromer failures - Inductive Heating

2.4.3 Overcoming Harmonics

Tunes Harmoinc filters consisting of capacitor bank and reactor in series are designed and adopted for suppressing harmonics,by providing low impedance path for harmonic component.The Harmonic filters connected near the equipment generating harmonics help to reduce THD to acceptable limits.

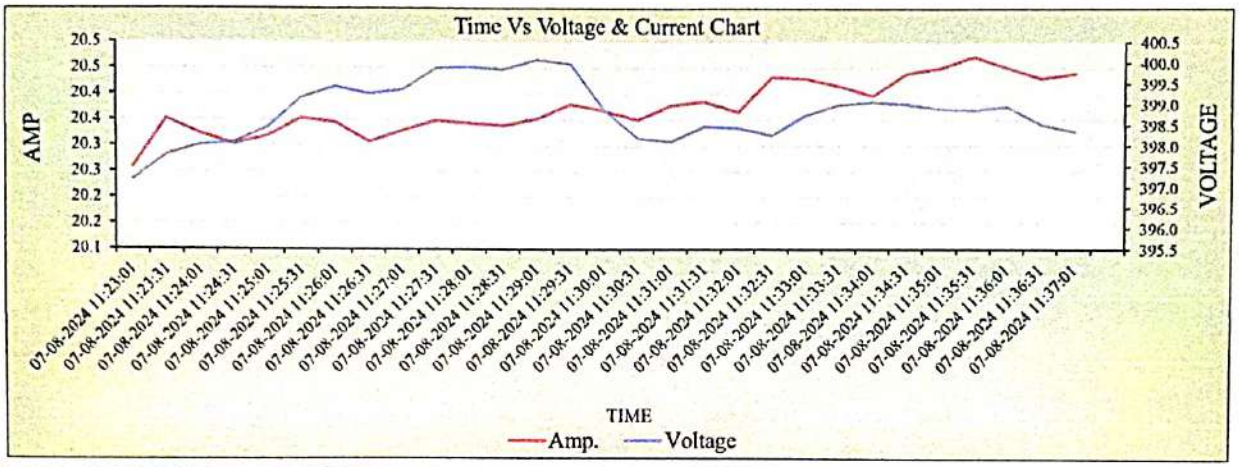
2.4.4 Analysis of Harmonics

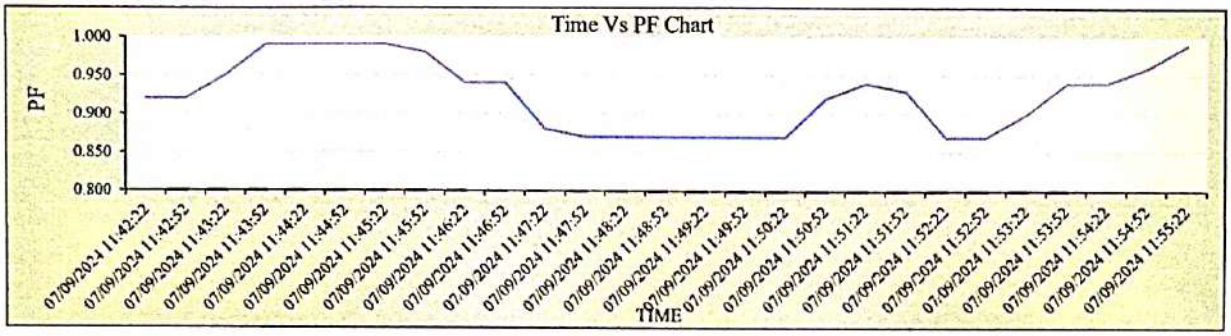
As already mentioned elsewhere in the report, the production plant depends totally on the power supply from the power grid. Moreover, as no variable speed drive is working in the plant, the presence of Harmonics is almost negligible. Hence, The harmonics are measured in the system for this particular plant is shown in **Annexure 0.2**.

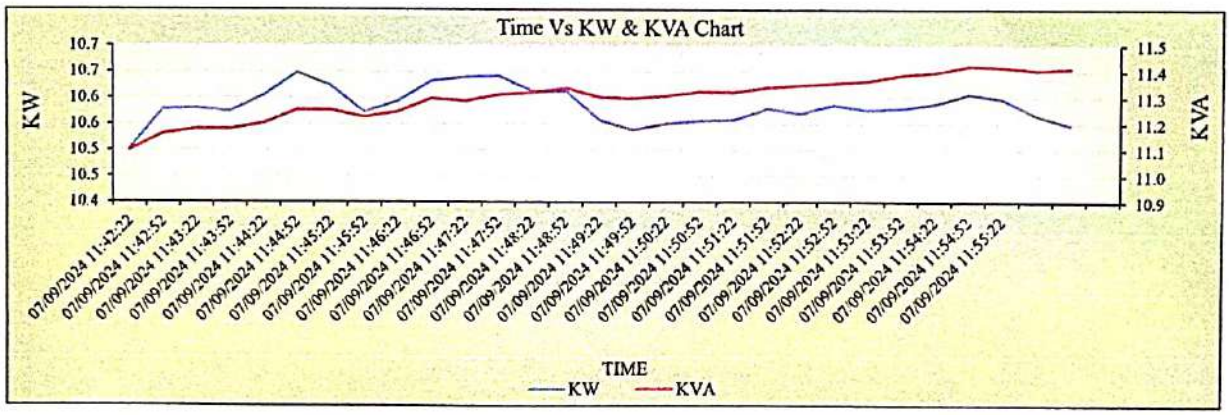
2.5 Power and Harmonics Details

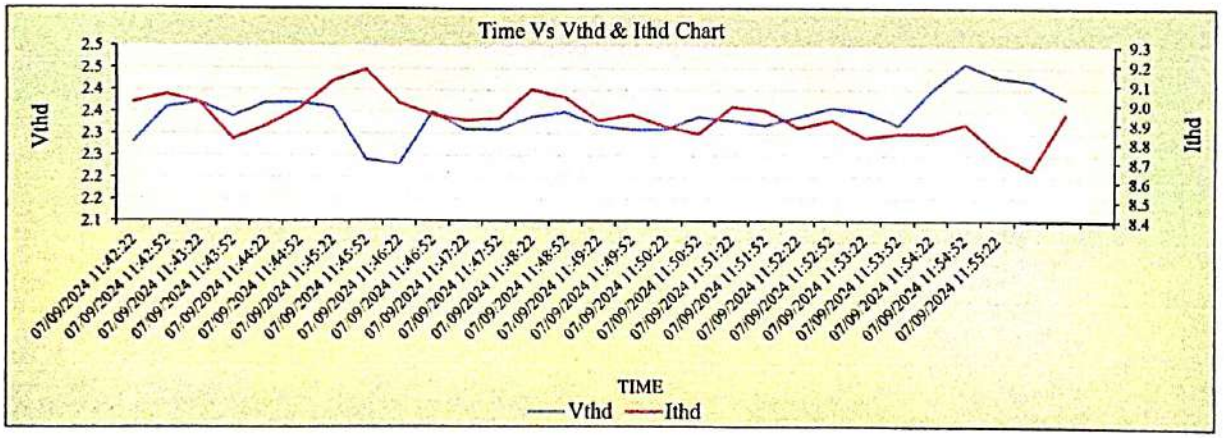
Location	Date & Time	Vrms			Irms			Vthd %			Ithd %			PF	Power			Hz
		R	Y	B	R	Y	B	R	Y	B	R	Y	B		Kw	Kva	Kvar	
GEB Main	07-09-2024 11:42:22	390.8	390.4	394.5	26.6	30.2	30.4	2.2	2.2	2.1	7.4	7.8	10.1	0.920	17.7	19.2	-7.5	50.1
	07-09-2024 11:42:52	391.4	390.4	394.4	26.6	30.2	31.0	2.3	2.3	2.1	7.5	7.9	10.1	0.920	17.8	19.3	-7.5	50.1
	07-09-2024 11:43:22	392.1	390.1	394.0	26.6	27.9	31.9	2.3	2.3	2.1	7.4	7.9	9.9	0.950	18.1	19.1	-5.6	50.1
	07-09-2024 11:43:52	393.2	390.9	393.9	26.7	23.3	32.6	2.3	2.3	2.1	7.5	6.9	9.7	0.990	18.3	18.4	-2.0	50.1
	07-09-2024 11:44:22	393.2	391.9	394.3	26.7	23.3	32.0	2.4	2.4	2.2	7.4	6.9	9.9	0.990	18.1	18.3	-2.3	50.1
	07-09-2024 11:44:52	393.2	392.0	394.3	26.7	23.3	32.1	2.3	2.4	2.1	7.4	6.9	9.8	0.990	18.1	18.3	-2.5	50.1
	07-09-2024 11:45:22	393.5	392.4	394.7	26.7	23.2	32.4	2.4	2.4	2.2	7.6	7.0	9.9	0.990	18.2	18.4	-2.1	50.1
	07-09-2024 11:45:52	393.5	393.0	395.0	26.7	22.9	30.6	2.4	2.4	2.2	7.6	7.0	10.0	0.980	17.7	17.9	-2.5	50.1
	07-09-2024 11:46:22	393.2	394.9	396.4	26.7	23.0	23.8	2.3	2.4	2.2	7.4	7.0	9.8	0.940	15.4	16.4	-5.4	50.1
	07-09-2024 11:46:52	393.3	394.8	396.6	26.7	22.9	23.7	2.4	2.4	2.2	7.4	7.0	9.8	0.940	15.4	16.3	-5.4	50.1
	07-09-2024 11:47:22	392.2	393.7	396.9	26.7	28.5	23.7	2.3	2.3	2.2	7.5	8.2	10.0	0.880	15.5	17.5	-8.2	50.1
	07-09-2024 11:47:52	392.4	394.1	397.3	26.7	29.6	23.6	2.3	2.3	2.2	7.4	7.9	9.8	0.870	15.4	17.7	-8.7	50.1
	07-09-2024 11:48:22	393.5	394.8	397.7	26.7	29.7	23.6	2.3	2.3	2.2	7.5	8.0	9.5	0.870	15.4	17.8	-8.9	50.1
	07-09-2024 11:48:52	393.6	394.7	397.5	26.9	29.7	23.6	2.3	2.3	2.1	7.4	8.1	9.6	0.870	15.5	17.9	-8.9	50.1
	07-09-2024 11:49:22	393.7	394.8	397.7	27.0	29.7	23.5	2.3	2.3	2.2	7.3	8.1	9.5	0.870	15.5	17.9	-8.9	50.1
	07-09-2024 11:49:52	393.9	394.8	398.0	27.0	29.7	23.6	2.3	2.3	2.2	7.4	8.0	10.2	0.870	15.5	17.9	-8.9	50.1
	07-09-2024 11:50:22	394.2	394.7	398.1	27.1	29.7	23.7	2.3	2.3	2.2	7.5	8.1	9.7	0.870	15.6	17.9	-8.9	50.1
	07-09-2024 11:50:52	396.1	395.9	398.5	26.7	24.5	23.6	2.4	2.4	2.1	7.5	8.0	9.4	0.920	15.4	16.8	-6.4	50.1
	07-09-2024 11:51:22	396.3	396.1	398.5	27.0	22.9	23.7	2.4	2.4	2.1	7.5	7.1	9.5	0.940	15.5	16.5	-5.6	50.1
	07-09-2024 11:51:52	395.6	395.0	397.9	27.1	24.0	23.6	2.3	2.3	2.1	7.3	7.0	9.6	0.930	15.5	16.7	-6.0	50.0
	07-09-2024 11:52:22	394.4	393.6	397.9	27.1	29.5	23.6	2.2	2.2	2.1	7.4	6.0	9.5	0.870	15.5	17.9	-8.8	50.0
	07-09-2024 11:52:52	394.4	393.8	398.2	27.0	29.5	23.7	2.2	2.3	2.1	7.3	5.9	9.6	0.870	15.5	17.8	-8.8	50.0
	07-09-2024 11:53:22	390.8	391.1	394.8	34.7	37.3	31.1	2.2	2.3	2.1	7.2	5.9	9.4	0.900	20.4	22.7	-9.9	50.0
	07-09-2024 11:53:52	390.1	389.4	392.9	35.1	37.9	37.7	2.4	2.3	2.2	6.2	5.1	8.3	0.940	22.7	24.3	-8.5	50.0
	07-09-2024 11:54:22	390.0	388.9	392.5	35.0	37.9	38.7	2.2	2.2	2.0	6.0	5.1	8.2	0.940	23.0	24.5	-8.2	50.0
	07-09-2024 11:54:52	390.4	389.8	392.7	34.9	35.3	39.3	2.2	2.3	2.1	6.1	5.4	8.1	0.960	23.2	24.1	-5.6	50.0
	07-09-2024 11:55:22	391.7	391.4	392.9	34.7	31.4	39.5	2.2	2.3	2.1	6.0	6.5	8.3	0.990	23.3	23.4	-1.8	50.0
	Average	**393.0**	**392.9**	**395.9**	**28.3**	**28.4**	**28.5**	**2.3**	**2.3**	**2.1**	**7.2**	**7.1**	**9.5**	**0.925**	**17.5**	**18.9**	**-6.4**	**50.0**
	Maximum	**396.3**	**396.1**	**398.5**	**35.1**	**37.9**	**39.5**	**2.4**	**2.4**	**2.2**	**7.6**	**8.2**	**10.2**	**0.990**	**23.3**	**24.5**	**-1.8**	**50.1**
	Minimum	**390.0**	**388.9**	**392.5**	**26.6**	**22.9**	**23.5**	**2.2**	**2.2**	**2.0**	**6.0**	**5.1**	**8.1**	**0.870**	**15.4**	**16.3**	**-9.9**	**50.0**
OBSERVATION:	**Active filter is needed to install where averege current harmonics is above 15% and voltage harmonics is above 5%. There is no any action require in your plant. Reference IEEE 519 : 2014**																	

2.6 POWER MESUREMENTS ANALYSIS GRAPHS









CHAPTER-3

PERFORMANCE OF ELECRTICAL EQUIPMENT

3.1 INTRODUCTION

This section deals with the measurement of major electrical parameters of electrical equipment like motors, lighting, etc, which generally consume around 78-80 % of total electrical energy energy consumed in the plant. The major parameters measured are voltage, current, power (kW), power factor, etc. Measurement of Harmonics is also covered in this section.

3.2 MOTOR LOSSES

Power Losses in a motor are that portion of the input power that becomes heat rather than driving the load. These losses can be divided into two categories-

* Fixed Loses
* Variable Losses

Fixed losses are assumed to be constant at all conditions of motor loading from no load to full rated load. This is not exactly true, but it is nearly so, and little significant error is created by this approximation. Fixed losses include magnetic core losses (hysteresis and eddy current) and mechanical friction losses (bearing friction, brush friction, and air friction or windage).

Variable Losses are those that vary with the load on the motor and thus with the motor current. These losses increase as the load on the motor, and therefore the current drawn by the motor, increase. They are primarily the power lost in the resistance of the motor windings and are often called copper losses, or I2R losses.

Variable losses also include stray load losses such as minor variations in fixed losses with load and speed and other small miscellaneous losses. Variable losses are approximately proportional to the square of the motor load current.

Motor Efficiency is the output of the motor divided by the electrical input to the motor, usually expressed as a percentage power or work output is input losses.

$$\text{Efficiency (\%)} = \frac{\text{Watts output} \times 100}{\text{Watts Input}}$$

$$= \frac{746 \times HP \times 100}{E \times I \times PF}$$

$$= \frac{\text{Input - Losses} \times 100}{\text{Input}}$$

3.3 CONVERSION OF DELTA TO STAR CONNECTION

The induction motor with a percentage loading below 50% would operate at lower efficiency in delta mode. This efficiency at low loading can be improved by converting delta connection into star connection. The reported savings due to this conversion varies from around 3% to 10% because the rated output of motor drops to $1/3^{rd}$ of delta configuration without affecting performance and the percent loading increases as compared to delta mode. This option does not require any capital investment and is one of the least cost options available for the energy conservation in induction motors.

Though the margin of saving due to this option is low, but as the plant installations normally have hundreds of motors, converting most of the under loaded motors in the plant would result into considerable savings

Some motors operate on step loading and some on continuously variable load. The motors which operate on step loading, techno-economic feasibility of Delta-Star Automatic Change-over Switch is to be worked out (e.g. a machine with an induction motor performs three operations in its operating cycle resulting into motor loading of 25%, 40% & 80%; in such cases permanent delta to star conversion is not possible. An automatic delta-star change-over controller could be installed there. It will connect the motor in star mode in 25% & 40% motor load operations; and in delta mode in 80% load operation). For the applications where starting torque requirement is high but otherwise the load is low, Automatic Delta to star Converter can give significant energy savings.

The motors which operate on continuously variable load, feasibility of installing Soft-Starter/Energy Saver is to be worked out.

This option of permanent Delta to Star conversion cannot be implemented for the loads where starting torque requirement is very high. While implementing permanent Delta to Star conversion, care should be taken to decrease the setting of over load protection relay to $2/3^{rd}$ of the delta setting. The individual motor load study is shown in table.

3.4 MOTOR LOAD SURVEY

The number of motors in the plant is very large. Measurement of operating parameters in respect of almost all the motors was carried out and the date is placed as Annexure- 3. 1. the data is for the motors, which are normally run for more then 8 hours a day. Effort was made to even start the standby equipment driven by the motor so as to collect maximum detail.

Basic Formula For Power

KW=1.732*Volt.*Amp* Cos@/1000
Where,
Cos@=Power Factor

3.5 PERFORMANCE OF MOTORS

SR. NO.	TITLE	Motor KW	Capt. Lit.	MEASURED PARAMETERS				Remarks
				VOLT	AMP.	P.F.	KW	
All Floor AC Load								
	Ground Floor							
1	Office	Carrier	2.0 Ton	232	7.4	0.999	1.7	
All Floor Computer & Xerox M/c Load								
2	Dell	6 Nos	24"	230	0.36	0.999	0.08	
3	HP	6 Nos	24"	229	0.48	0.999	0.11	
4	Xerox M/c	3 Nos	-	230	0.81	0.998	0.19	
All Pumps Load								
5	Nr. Puen House	2	2880	405	2.5	0.817	1.4	
6	Nr. Library	2	2880	405	2.3	0.812	1.3	
7	Nr.Indoor Stadium	2	2880	405	2.5	0.817	1.4	

OBSERVATION :	**As per Load vs Efficiency graph, motor efficiency maximum at between 70 to 100% load. Reference Buerue of Energy Efficiency Books No.3, Chapter No.3.2. Motors below 50% Load Factor can be convert in Star and can save power from 5 to 10%. But it should be do under observation of atleast one to two hours. High starting torque motor should be required to take care for convert delta to star.**

CHAPTER - 4

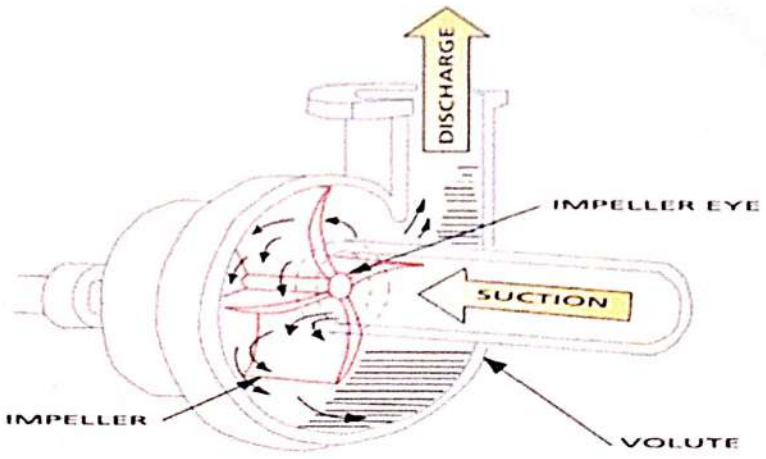
PUMPS AND PUMPING SYSTEM

Pump Types

Pumps come in a variety of sizes for a wide range of applications. They can be classified according to their basic operating principle as dynamic or displacement pumps. Dynamic pumps can be sub-classified as centrifugal and special effect pumps. Displacement pumps can be sub-classified as rotary or reciprocating pumps.

Centrifugal Pumps

The centrifugal pump is generally the most economical followed by rotary and reciprocating pumps. Although, positive displacement pumps are generally more efficient than centrifugal pumps, the benefit of higher efficiency tends to be offset by increased maintenance costs. Since, worldwide, centrifugal pumps account for the majority of electricity used by pumps, so the focus of this chapter is on centrifugal pump.

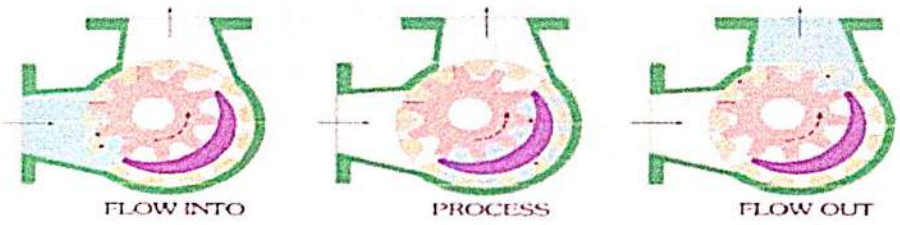


A centrifugal pump is of a very simple design. The two main parts of the pump are the impeller and the diffuser. Impeller, which is the only moving part, is attached to a shaft and driven by a motor. Impellers are generally made of bronze, polycarbonate, cast iron, stainless steel as well as other materials. The diffuser (also called as volute) houses the impeller and captures and directs the water off the impeller.

A centrifugal pump is not positive acting; it will not pump the same volume always. The greater the depth of the water, the lesser is the flow from the pump. Also, when it pumps against increasing pressure, the less it will pump. For these reasons it is important to select a centrifugal pump that is designed to do a particular job.

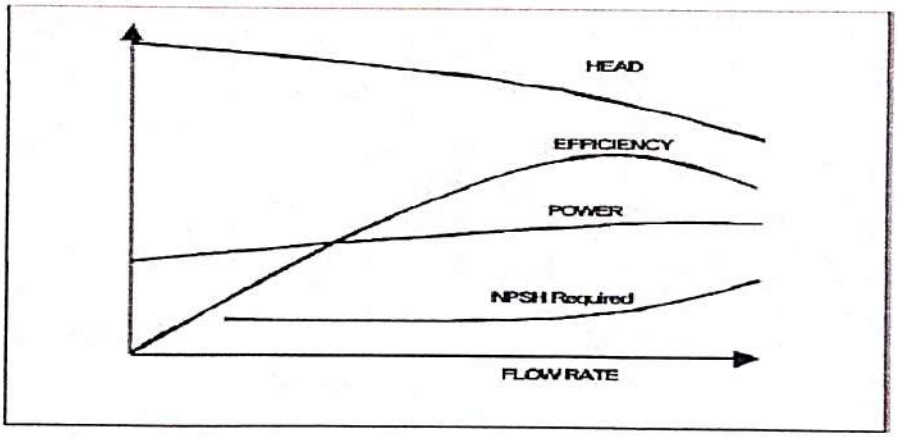
Working Principle

In centrifugal pump, Water enters the center (eye) of the impeller and exits the impeller with the help of centrifugal force. As water leaves the eye of the impeller a low-pressure area is created, causing more water to flow into the eye. Atmospheric pressure and centrifugal force cause this to happen. Velocity is developed as the water flows through the impeller spinning at high speed. The water velocity is collected by the diffuser and converted to pressure by specially designed passageways that direct the flow to the discharge of the pump, or to the next impeller should the pump have a multi-stage configuration.



The pressure (head) that a pump will develop is in direct relationship to the impeller diameter, the number of impellers, the size of impeller eye, and shaft speed. Capacity is determined by the exit width of the impeller. The head and capacity are the main factors, which affect the horsepower size of the motor to be used. The more the quantity of water to be pumped, the more energy is required.

The pump generates the same head of liquid whatever the density of the liquid being pumped. The actual contours of the hydraulic passages of the impeller and the casing are extremely important, in order to attain the highest efficiency possible. The standard convention for centrifugal pump is to draw the pump performance curves showing Flow on the horizontal axis and Head generated on the vertical axis. Efficiency, Power & NPSH Required (described later), are also all conventionally shown on the vertical axis, plotted against Flow, as illustrated in Fig.



4.1 PUMPS DETAILS

Sr.No.	Name Of Pump	Motor Hp	Motor Rated Power KW	Measured Power KW	PUMP TECHNICAL DATA			% Valve Open	MEASURED DATA			
					Type Of Pump	Rated Flow M3/Hr	Disc. Head Mtr		Flow M3/Hr	Suction Head Hs Mtr	Discharge Head Hd Mtr	Total Head Hd+Hs Mtr
1	Nr. Puen House	2	1.5	1.4	Submercible	NA	NA	100	9	0.0	28	28.0
2	Nr. Library	2	1.5	1.3	Submercible	NA	NA	100	8	0.0	26	26.0
3	Nr.Indoor Stadium	2	1.5	1.4	Submercible	NA	NA	100	10	0.0	25	25.0

4.2 MEASURED PARAMETERS OF PUMPS AND ITS PERFORMANCE

Sr. No.	PUMP	Measured Power KW	Flow M3/Hr	Total Head H Mtr	Liquid Density Kg/M	Pump Eff. %
1	Nr. Puen House	1.4	9.0	28.0	1000	61.3
2	Nr. Library	1.3	8.0	26.0	1000	54.5
3	Nr.Indoor Stadium	1.4	10.0	25.0	1000	60.8

4.3 ANALYSIS OF PUMPS

4.3.1 During audit we have observed that all pumps efficiency found good.

Sr. No.	PUMP	Meas. Power KW	EFFI.	STD EFF	% SAVING	KW SAVED
1	Nr. Puen House	1.4	61.3	60.0	-1.3	-0.02
2	Nr. Library	1.3	54.5	60.0	5.5	0.07
3	Nr.Indoor Stadium	1.4	60.8	60.0	-0.8	-0.01

4.3 General Energy saving opportunities in Pumps:

* Ensure adequate NPSH at site of installation
* Ensure availability of basic instruments at pumps like pressure gauges, flow meters.
* Operate pumps near best efficiency point.
* Modify pumping system and pumps losses to minimize throttling.
* Adapt to wide load variation with variable speed drives or sequenced control of multiple units.
* Stop running multiple pumps - add an auto-start for an on-line spare or add a booster pump in the problem area.
* Use booster pumps for small loads requiring higher pressures.
* Increase fluid temperature differentials to reduce pumping rates in case of heat exchangers.
* Repair seals and packing to minimize water loss by dripping.
* Balance the system to minimize flows and reduce pump power requirements.
* Avoid pumping head with a free-fall return (gravity); Use siphon effect to advantage:
* Conduct water balance to minimise water consumption.
* Avoid cooling water re-circulation in DG sets, air compressors, refrigeration systems, cooling towers feed water pumps, condenser pumps and process pumps.
* In multiple pump operations, carefully combine the operation of pumps to avoid throttling
* Provide booster pump for few areas of higher head
* Replace old pumps by energy efficient pumps
* In the case of over designed pump, provide variable speed drive, or downsize / replace impeller or replace with correct sized pump for efficient operation.
* Optimise number of stages in multi-stage pump in case of head margins.
* Reduce system resistance by pressure drop assessment and pipe size optimisation

CHAPTER-5

LIGHTING SYSTEMS

Lighting is an essential service in all the industries. The power consumption by the industrial lighting varies between 2 to 10% of the total power depending on the type of industry. Innovation and continuous improvement in the field of lighting, has given rise to tremendous energy saving opportunities in this area.

Lighting is an area, which provides a major scope to achieve energy efficiency at the design stage, by incorporation of modern energy efficient lamps, luminaries and gears, apart from good operational practices.

Basic Terms in Lighting System and Features

Lamps

Lamp is equipment, which produces light. The most commonly used lamps are described briefly as follows:

• Incandescent lamps:

Incandescent lamps produce light by means of a filament heated to incandescence by the flow of

• Reflector lamps:

Reflector lamps are basically incandescent, provided with a high quality internal mirror, which follows

• Gas discharge lamps:

The light from a gas discharge lamp is produced by the excitation of gas contained in either a tubular

The most commonly used discharge lamps are as follows:

* Fluorescent tube lamps (FTL)
* Compact Fluorescent Lamps (CFL)
* Mercury Vapor Lamps
* Sodium Vapor Lamps
* Metal Halide Lamps

Luminaries

Luminaries is a device that distributes, filters or transforms the light emitted from one or more lamps. The luminaries includes, all the parts necessary for fixing and protecting the lamps, except the lamps themselves. In some cases, luminaries also include the necessary circuit auxiliaries, together with the means for connecting them to the electric supply. The basic physical principles used in optical luminaries are reflection, absorption, transmission and refraction.

Control Gear

The gears used in the lighting equipment are as follows:

* Ballast:

A current limiting device, to counter negative resistance characteristics of any discharge lamps. In case of fluorescent lamps, it aids the initial voltage build-up, required for starting.

These are used for starting high intensity Metal Halide and Sodium vapor lamps.

I luminance

This is the quotient of the aluminous flux incident on an element of the surface at a point of surface containing the point, by the area of that element.

The lighting level produced by a lighting installation is usually qualified by the luminance produced on a specified plane. In most cases, this plane is the major plane of the tasks in the interior and is commonly called the working plane. The luminance provided by an installation affects both the performance of the tasks and the appearance of the space.

Lux (lx)
This is the illuminance produced by a luminous flux of one lumen, uniformly distributed over a surface area of one square metre. One lux is equal to one lumen per square meter.

Luminous Efficacy (lm/W)
This is the ratio of luminous flux emitted by a lamp to the power consumed by the lamp. It is a reflection of efficiency of energy conversion from electricity to light form.

Colour Rendering Index (RI)
Is a measure of the degree to which the colours of surfaces illuminated by a given light source confirm to those of the same surfaces under a reference illuminent; suitable allowance having been made for the state of Chromatic adaptation.

Lamp Types and Their Features
The Table shows the various types of lamp available along with their features.

Table Luminous Performance Characteristics of Commonly Used Luminaries

TYPES OF LAMP	LUMENS/WATT		COLOUR. REND. INDEX	TYPICAL APPLICATION	LIFE Hrs.
	RANGE	AVG			
Incandescent	8 TO 18	14	Excellent	Homes, restaurants, general lighting, emergency lighting	1000
Fluorescent Lamps	46-60	50	Good w.r.t. coating	Offices, shops, hospitals, homes	5000
Compact fluorescent lamps (CFL)	40-70	60	Very good	Hotels, shops, homes, offices	8000-10000
High pressure mercury (HPMV)	44-57	50	Fair	General lighting in factories, garages, car parking, flood lighting	5000
LED	30-90	60	Excellent	General lighting in all Field	50000
Halogen lamps	18-24	20	Excellent	Display, flood lighting, stadium exhibition grounds, construction areas	2000-4000
High pressure sodium (HPSV) SON	67-121	90	Fair	General lighting in factories, ware houses, street lighting	6000-12000
Low pressure sodium (LPSV) SOX	101-175	150	Poor	Roadways, tunnels, canals, street lighting	6000-12000

Petroleum, Chemical and Petrochemical works

AREA	LUX LEVEL
Exterior walkways, platforms, stairs and ladders	30-50-100
Exterior pump and valve areas	50-100-150
Pump and compressor houses	100-150-200
Process plant with remote control	30-50-100
Process plant requiring occasional manual intervention	50-100-150
Permanently occupied work stations in process plant	150-200-300
Control rooms for process plant	200-300-500
Pharmaceutical manufacturer	
Grinding, granulating, mixing, drying, tableting, sterilizing, washing	300-500-750
preparation of solutions, filling, capping, wrapping, hardening	300-500-751
Fine chemical manufacturers	
Exterior walkways, platforms, stairs and ladders	30-50-100
Process plant	50-100-150
Fine chemical finishing	300-500-750
Inspection	300-500-750
Offices	
General offices	300-500-700
Conference rooms,executive offices	300-500-700
Computer and Data preparation rooms	300-500-700
Computer work station	300-500-700
Workshop	
general	200-300-500
Workbench	300-500-700
Counter	200-300-500
Stores	200-300-500
Generals Plants	
Control panels	200-300-500
Boiler house basements	50-100-150
Boiler houses,platforms,area around burners	50-100-150
Controlrooms	200-300-500
Switch rooms,meter room,HV substations	100-150-200
Relay and telecommunication rooms	200-300-500
Desel generator rooms,compressor rooms	100-150-200
Pump houses,water treatment plant	100-150-200
Battery rooms,rectifiers	50-100-150
Coal plant,conveyors,unloading hoppers,ash handling unit,dust hopper outlets	50-100-150

5.1 PERFORMANCE ANALYSIS OF LIGHTING SYSTEM

5.1.1 INTRODUCTION

This section of the report presents the measured data in respect of the plant, offices and area lighting system and measures to reduce the energy consumption.

5.1.2 PLANT, OFFICE AND ILLUMINATION

At present, the illumination in almost all the plant areas, offices, workshop, utility area, storage etc. are arranged by led lamps, led tubelights, led fox and led street lights for area lighting.

Illumination level was measured in different areas is placed as Annexure – 8.1. In all areas, the illumination level was rather lesser than the requirement as per prevailing standard for that specific area and facility.

5.1.3 ENERGY SAVING IN LIGHTING

Illumination system uses only led tubelight and led fox fixture. There are already system make new replace flurocent tubelight will be led tubelight. So we appreciate this decision. There are some no any possibility in lighting system.

5.2 ANALYSIS OF LIGHTING

SR. NO.	DESCRIPTION OF WORKING AREA	TYPE OF LIGHTING	NUMBER OF FIXTURES	WATT OF EACH FIXTURE	TOTAL WATTS	WORKING HOURS
	Ground Floor					
1	Room No.-1 To 20	LED Tubelight	141	20	2820	
		T8 Tubelight	20	40	800	
2		Ceiling Fan	128	70	8960	
3	Campus Street Light	LED Fox	21	30	630	
		TOTAL	**310**		**13210**	
OBSERVATION :		**Most Of lightings are led efficient lightings.**				

5.3 INSTALL LED TUBE LIGHTS IN PLACE T8 TUBE LIGHTS.

TITLE	**INSTALL LED TUBE LIGHTS IN PLACE T8 TUBE LIGHTS.**		
BACKGROUND	WE HAVE SEEN THAT THERE ARE LIGHTING FITTING WITH 40 WATT T8 TUBE LIGHT. THERE IS POWER LOSS IN THIS AREA.		
PRINCIPAL	WE CAN INSTALL LED TUBE LIGHTS IN PLACE OF T8 TUBE LIGHTS FOR SAVING PURPOSE.		
DETAILS	TOTAL FITTING	20	NO'S
	EXI FITTING POWER	40	WATT
	PROPO. FITTING POWER	20	WATT
	SAVE POWER	20	WATT/FITTING
	TOTAL WATT	360	PER DAY
	ANNUAL SAVED UNIT	763	UNIT/ANNUM
	SAVING HRS	8	HRS/DAY
	WORKING DAYS	265	DAYS/ANNUM
	COST OF UNIT	7.8	RS/KWH
COST ANALYSIS	ANNUAL MONEY SAVING	5953	RS/ANNUM
	INVESTMENT	5000	RS
	PAYBACK PERIOD	: INVEST. x 12 / ANNUAL SAVING	
		10.1	MONTHS
REMARKS	**THE PRICE OF ONE LED TUBE LIGHT IS 250 RS.**		

5.4 INSTALL BLDC CEILING FANS IN PLACE OF CONVENTIONAL CEILING FANS.

TITLE	**INSTALL BLDC CEILING FANS IN PLACE OF CONVENTIONAL CEILING FANS.**		
BACKGROUND	WE HAVE SEEN THAT THERE ARE 128 NOS CONVENTIONAL CEILING FANS IN COLLEGE AT DIFFERENT LOCATION. SO, THERE IS MUCH AMOUNT OF ELECTRICITY IS WASTED IN THIS AREA.		
PRINCIPAL	WE CAN INSTALL BLDC 28 WATT CEILING FANS FOR ENERGY SAVING PURPOSE.		
DETAILS	TOTAL FITTING	80	NOS
	EXI FITTING POWER	5600	WATT
	PROPO. FITTING POWER	2240	WATT
	SAVE POWER	3360	WATT
	TOTAL WATT	26880	
	ENERGY SAVING	7123	KWH/ANNUM
	SAVING HRS	8	HRS/DAY
	WORKING DAYS	265	DAYS/ANNUM
	COST OF UNIT	7.8	RS./KWH
COST ANALYSIS	ANNUAL MONETARY SAVING	55561	RS./ANNUM
	INVESTMENT	240000	RS.
	PAYBACK PERIOD	INVEST. x 12 / ANNUAL SAVING	
		51.8	MONTHS
REMARKS	**THE PRICE OF BLDC CELING FAN IS 3000 RS PER FAN.**		

5.5 General Energy saving opportunities in Lighting

*** Installation of energy efficient fluorescent lamps in place of "Conventional" fluorescent lamps.**

Energy efficient lamps are based on the highly sophisticated tri-phosphor fluorescent powder technology. They offer excellent colour rendering properties in addition to the very high luminous efficacy.

*** Installation of Compact Fluorescent Lamps (CFL's) in place of incandescent lamps.**

Compact fluorescent lamps are generally considered best for replacement of lower wattage incandescent lamps. These lamps have efficacy ranging from 55 to 65 lumens/Watt. The average rated lamp life is 10,000 hours, which is 10 times longer than that of a normal incandescent lamps. CFL's are highly suitable for places such as Living rooms, Hotel lounges, Bars, Restaurants, Pathways, Building entrances, Corridors, etc.

*** Installation of metal halide lamps in place of mercury / sodium vapour lamps.**

Metal halide lamps provide high color rendering index when compared with mercury & sodium vapour lamps. These lamps offer efficient white light. Hence, metal halide is the choice for colour critical applications where, higher illumination levels are required. These lamps are highly suitable for applications such as assembly line, inspection areas, painting shops, etc. It is recommended to install metal halide lamps where colour rendering is more critical.

*** Installation of High Pressure Sodium Vapour (HPSV) lamps for applications where colour rendering is not critical.**

High pressure sodium vapour (HPSV) lamps offer more efficacy. But the colour rendering property of HPSV is very low. Hence, it is recommended to install HPSV lamps for applications such street lighting, yard lighting, etc.

*** Installation of LED panel indicator lamps in place of filament lamps.**

Panel indicator lamps are used widely in industries for monitoring, fault indication, signaling, etc. Conventionally filament lamps are used for the purpose, which has got the following disadvantages:

* High energy consumption (15 W/lamp)
* Failure of lamps is high (Operating life less than 10,000 hours)
* Very sensitive to the voltage fluctuations Recently, the conventional filament lamps are being replaced with Light Emitting Diodes (LEDs).

The LEDs have the following merits over the filament lamps.

* Lesser power consumption (Less than 1 W/lamp)
* Withstand high voltage fluctuation in the power supply.
* Longer operating life (more than 1,00,000 hours)

It is recommended to install LEDs for panel indicator lamps at the design stage.

*** Light distribution**

Energy efficiency cannot be obtained by mere selection of more efficient lamps alone. Efficient luminaires along with the lamp of high efficacy achieve the optimum efficiency. Mirror-optic luminaires with a high output ratio and bat-wing light distribution can save energy.

* Low bay, for heights less than 5 metres.
* Medium bay, for heights between 5 - 7 metres.
* High bay, for heights greater than 7 metres.

System layout and fixing of the luminaires play a major role in achieving energy efficiency. This also varies from application to application. Hence, fixing the luminaires at optimum height and usage of mirror optic luminaries leads to energy efficiency.

*** Light Control**

The simplest and the most widely used form of controlling a lighting installation is "On-Off" switch. The initial investment for this set up is extremely low, but the resulting operational costs may be high. This does not provide the flexibility to control the lighting, where it is not required.

Hence, a flexible lighting system has to be provided, which will offer switch-off or reduction in lighting level, when not needed. The following light control systems can be adopted at design stage:

*** Grouping of lighting system, to provide greater flexibility in lighting control**

Grouping of lighting system, which can be controlled manually or by timer control.

*** Installation of microprocessor based controllers**

Another modern method is usage of microprocessor / infrared controlled dimming or switching circuits. The lighting control can be obtained by using logic units located in the ceiling, which can take pre-programme commands and activate specified lighting circuits. Advanced lighting control system uses movement detectors or lighting sensors, to feed signals to the controllers.

*** Optimum usage of daylighting**

Whenever the orientation of a building permits, day lighting can be used in combination with electric lighting. This should not introduce glare or a severe imbalance of brightness in visual environment. Usage of day lighting (in offices/air conditioned halls) will have to be very limited, because the air conditioning load will increase on account of the increased solar heat dissipation into the area. In many cases, a switching method, to enable reduction of electric light in the window zones during certain hours, has to be designed.

*** Installation of "exclusive" transformer for lighting**

In most of the industries, lighting load varies between 2 to 10%. Most of the problems faced by the lighting equipment and the "gears" is due to the "voltage" fluctuations. Hence, the lighting equipment has to be isolated from the power feeders. This provides a better voltage regulation for the lighting. This will reduce the voltage related problems, which in turn increases the efficiency of the lighting system.

*** Installation of servo stabilizer for lighting feeder**

Wherever, installation of exclusive transformer for lighting is not economically attractive, servo stabilizer can be installed for the lighting feeders. This will provide stabilized voltage for the lighting equipment. The performance of "gears" such as chokes, ballasts, will also improved due to the stabilized voltage.

This set up also provides, the option to optimise the voltage level fed to the lighting feeder. In many plants, during the non-peaking hours, the voltage levels are on the higher side. During this period, voltage can be optimised, without any significant drop in the illumination level.

*** Installation of high frequency (HF) electronic ballasts in place of conventional ballasts**

New high frequency (28-32 kHz) electronic ballasts have the following advantages over the traditional magnetic ballasts:

* Energy savings up to 35%
* Less heat dissipation, which reduces the air conditioning load
* Lights instantly
* Improved power factor
* Operates in low voltage load
* Less in weight
* Increases the life of lamp

The advantage of HF electronic ballasts, out weigh the initial investment (higher costs when compared with conventional ballast). In the past the failure rate of electronic ballast in Indian Industries was high. Recently, many manufacturers have improved the design of the ballast leading to drastic improvement in their reliability. The life of the electronic ballast is high especially when, used in a lighting circuit fitted with a automatic voltage stabilizer.

INSTALL ROOF TOP SOLAR PLANT

TITLE	**INSTALL ROOF TOP SOLAR PLANT**		
BACKGROUND	AS PER GOVERNMENT OF GUJARAT ROOFT TOP SOLAR PLANT POLICY FOR COMMERCIAL CAN INSTALL 100% OF YOUR POWER CONSUMTION PATTERN		
PRINCIPAL	INSTALL 20 KW SOLAR PANELFOR SERVICE NO. DGGP79294 GETTING BENEFIT IN ENERGY SAVING		
DETAILS	AVERAGE MONTHLY CONSUMPTION	3029	KWH/MONTH
	SANCTIONED LOAD	20	KW
	PROPOSED. KW PANEL	20	KW
	PROPOSED GENERATION OF UNITS	28800	KWH/YR
	PROPOSED SAVING IN RS	224640	RS/ YR
COST ANALYSIS	ANNUAL MONEY SAVING	224640	RS/YR
	INVESTMENT	800000	RS
	PAYBACK PERIOD	: INVEST. x 12 / ANNUAL SAVING	
		42.74	MONTHS
REMARKS	**THE PRICE OF SOLAR PANEL IS 40,000 RS PER KW. RATE MAY BE VERY ACCORDING TO MARKET VALUE OF SOLAR PANEL.**		

CO2 REDUCTION

TITLE	**PROPOSED CO2 EMISSIONS BY APPLYING THIS SCHEMES.**		
BACKGROUND	WE CAN HELP TO MAKE BETTER ENVIRONMENT IN TERMS OF CO2 REDUCTION BY APPLYING THESE SCHEMES IN PLANT.		
PRINCIPAL	WE CAN REDUCE CO2 EMISSIONS.		
DETAILS	PROPOSED KWH REDUCTION PER YEAR	36686	KWH PER YEAR
	PROPOSED CO2 OF KWH REDUCTION PER YEAR	30193	KG PER YEAR
	TOTAL CO2 REDUCTION PER YEAR	30	TONE PER YEAR
REMARKS			

SR. NO.	GENERAL OTHER SAVING OPPORTUNITIES
1	Replace 1 and 3 star AC with Energy efficient 5 Star AC.
2	Install IE3 motors inplace of old motors.
3	Install iot (internet of things) system on more than 50 hp electrical motors.
4	Check air filter of air compresssor regularly.
5	Change in Human behavior is one of major actions towards the saving energy in the plant.
6	Keep the AC's Temperature at set point of 26 Degree for getting saving in the energy consumption.

List Of Energy Efficient Equipment Suppliers

Product/ Equipment	Contact Details Of Suppliers
Internal Electrical System Installation	**Shiv Shakti Enterprise** A-18, Shyam Arcade, Opp. Gangotri Circle, Nikol, Ahmedabad-382350, Gujarat. Email: vkbhojani23@gmail.com Contact No.- +91 8128935045/ +91 9687777252
	Rudra Shakti Sunray Energy Solutions B-211, Royal Plaza, Opp. Patel Park Soc., Nr. Bapasitaram BRTS, Yogi Chowk, Simadagam Road, Varachha, Surat-395010, Gujarat. Email: rsses@rediffmail.com/ rsses.surat@gmail.com Contact No.- +91 7046899658/ +91 94081 24375
Thermal Heating Systems	**Thermax Limited** No. 14, Thermax House, Pune Mumbai Road, Wakdewadi, Pune-411003, Maharashtra. Contact No.- +91 9327916776
	Industrial Boilers Limited 227-228, Vapi Industrial Township, G.I.D.C., Vapi, Gujarat-396195. Email: vapi@indboilers.com Contact No.- +91-7228006668 / +91-260-2432899
	Rajdeep Boiler Pvt. Ltd. I/17-18-19, Road No. 6(I/A), G.I.D.C., Sachin, Surat - 394230, Gujarat, India. Email: info@rajdeepboiler.co.in Contact No.- +91 90998 98985/ +91 261 2399722
Thermic Fluid Cooling Coil System	**Innductotherm India Pvt. Ltd.** Plot No. SM-6, Road No.11 Sanand-II, Industrial Estate, BOL Village, Sanand, Ahmedabad- 382170, Gujarat. Email: sales@inductothermindia.com Contact No.- +91 932 798 0564 / +91 271 762 1000 / Sales +91 937 457 8586
Capacitors And APFC Panels	**Dhananjay Techno-Logics** L13, D.G Point Complex, Nr. Hanuman Mandir, Parvat Patia Char Rasta, Surat, Gujarat. Email: dhananjaytechno@yahoo.com Contact No.- +91 9265574353/ +91 9328028576

Product/ Equipment	Contact Details Of Suppliers
Automation, Panel Meters, Magnatic Water Flow meters	**Radiant Solutions** G-303, U.U.N., Sahakari Sangh Commercial Complex, Nr. Divyabhaskar Press, Central Road No. 10, Udhna, Surat-394210. Email: radiantsolution2012@gmail.com Contact No.- +91 9099914317 / + 91 9687214320
	R S Automation Plot No. 4304/3, Road No. 43A, G.I.D.C., Sachin, Surat, Gujarat. Contact No.- +91 9099960710 / +91 9879207240
	MG Microtech Automation Shop No. 107, 1st Floor, Ashoka Shoping Complex, Nr. SBI Bank, G.I.D.C., Pandesara, Surat, Gujarat. Contact No.- +91 7016248612
Water Pumps And Pumping System	**Aqua Machineries Pvt. Ltd.** Survey No. 504/1-2, 442/2, Nr. Haridarshan Estate, Nr. Express Highway, Ramol, Ahmedabad-382445, Gujarat. Email: marketing@aquapumps.com Contact No.- +91 7878255323
	Active Engineering Co. Plot No. 69/3, Shed No. C-2/A-3, Nr. Torrento Ghar Ghanti, Phase-I, C Road, G.I.D.C. Vatva, Ahmedabad-382445, Gujarat. Email: info@activeseals.com Contact No.- +91 9328819300
Steam Prv And Steam Traps	**Innovative Enerpro Pvt. Ltd.** 271, Krishna Industrial Estate, Kapodara Cross Road, Nr. Kapodara Tapi River Bridge, Off Varachha Road, Surat-395006, Gujarat. Email: info@ienerpro.com Contact No.- +91 9824145754 / 079-48925528
Lobe Blower	**Airzon Technologies Pvt. Ltd.** Survey No. 566/B, B/h Maize Produst, Nr. Zora Primary School, Singarwa, Kathwada, Bhuvaldi, Ahmedabad-382430, Gujarat. Email: sales@airzon.net Contact No.- +91 8980020218

Product/ Equipment	Contact Details Of Suppliers
Turbo Blower	**Usha Neuros** Survey No. 70, P.O. Bhayla, Bavla-Bagodara Highway, Tal. Bavla, Ahmedabad-382220, Gujrat. Email: sales@ushaneuros.com Contact No.- +91 9924796007
Star Delta Automatic Starters	**Advanced Microtech** 705, Titanium One, Nr. Rajpath Club, S G Highway, Ahmedabad-380054, Gujarat. Email: micrompd@gmail.com Contact No.- +91 90160 23800
Cogg Belt And Pully System	**Pathybalaji Agencies** No. 3/3, Sri Devi Nagar, Bharathiyar Road, Ganapathy, Coimbatore-641006. Contact No.- +91 90160 23800
HVLS Fans, BLDC And Energy Efficient Fan	**Trimurti Agency** 8, Tulsivrund Society, Opp. Rajwadu Hotel, Malav Talav Road, Jivrajpark, Ahmedabad-51, Gujarat. Email: trimurtiagency99@gmail.com Contact No.- +91 9512043718 / +91 9725070139
Lighting Systems And LED Lighting	**H D Enterpprise** 208, 1st floor, rangavdhut soci., Nr.Punagam b.B.R.T.S. junction, Canal road, Surat-395010 Contact no. +91 99094 37120
	Mastermind Enterprise No. 30, Prime Arcade, Jyoti Nagar, Surat-395009, Gujarat. Contact No.- +91 8264542950
	Chatur Lights Unit No. 108, Parmar Industrial Mall, Gokhiware Range Office, Vasai Road East, Palghar-401208, Maharashtra. Email: sales@chatur-lights.com Contact No.- +91 8779381831
	Crompton Greaves Ltd. Lighting Business Group, 405, Concorde, RC Dutt Road, Baroda – 390007, Gujarat.
Fire And Safety Tools	**A B Enterprise** B-18, Super Dimond Market, Varachha Road, Surat, Gujarat. Contact No.- +91 98254 19997