

DETAILED ENERGY AUDIT REPORT

REGIONAL INSTITUTE OF EDUCATION, Sachivalaya Marg, Bhubaneswar March, 2023



Conducted & Prepared by:-

Krishna Engineers & Consultants
Plot No: 4723, Laxmi Vihar, Lane-3,
Sainik School, Bhubaneswar-751005
Email: krishnaenergy2@gmail.com
www.krishnaenergy.com



PREFACE

An energy audit is a study of a facility to determine how and where energy is used and to identify methods for energy savings. There is now a universal recognition of the fact that new technologies and much greater use of some that already exist provide the most hopeful prospects for the future.

The Energy Audit for Regional Institute of Education, Bhubaneswar is being carried out by M/s. Krishna Engineers & Consultants, Bhubaneswar, Odisha as a part of the work for the mile marker towards destination of achieving energy efficiency which will help in enhancing the institution's capacity to improve their energy efficiency, minimize the cost of energy, creating a greener campus and thereby contributing to the mitigation of global climate change.

Krishna Engineers & Consultants, Bhubaneswar, has compiled a list of possible actions for electrical & thermal energy conservation and identified their savings potential. Krishna Engineers & Consultants, Bhubaneswar, looks forward with optimism that the management staff of the RIE, Bhubaneswar shall ensure the maximum execution of the recommendations and the success of this work.

The contents of this report are recommendatory in nature, based on actual observation & studies made and on the data made available to us in the course of our visits to the unit.



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CERTIFICATE

We certify the following

- The Detailed Energy Audit was conducted and DEA Report prepared by experienced Energy Auditors, and Consultants of M/s. Krishna Engineers & Consultants, Bhubaneswar.
- The data collection during conducting energy audit has been carried out diligently and truthfully.
- All data measuring devices used by the auditors are in good working condition, have been calibrated and have valid certificate from the authorized approved agencies and tampering of such devices has not occurred.
- All reasonable professional skill, care and diligence, undertaken in preparing the Energy Audit Report and the contents thereof are a true representation of the facts.
- The Detailed Energy Audit has been carried out in accordance with the prescribed norms of Bureau of Energy Efficiency (BEE) and M/s. Krishna Engineers & Consultants.



**M/s. Krishna Engineers & Consultants
Bhubaneswar**



ABOUT THE CONSULTANT

Krishna Engineers & Consultants is an engineering organization accredited by Bureau of Energy Efficiency (BEE), Govt. of India, Ministry of Power, New Delhi as Energy Service Company (ESCO) and approved consultant / energy audit firm in Government of Odisha. KEC, also rated as Grade-3 Energy Service Company by CARE Ratings, ICRA, CRISIL which indicates good and satisfactory services for energy efficiency and renewable energy projects. KEC also empanelled as Technical Consultant/ ESCO for “Implementation of 4E (End to End Energy Efficiency) Solutions in Micro, Small, & Medium Enterprises (MSME) Units” with ISTSL / SIDBI and different Banks.

KEC is an ISO 9001: 2015 certified Energy Service Company (ESCO) and professionally managed by technocrats of different disciplines. KEC is a proficient company not only conducting energy audit, providing engineering & consultancy services on installation of appropriate and feasible Energy Conservation and Renewable Energy Projects since last 26 years.

Objectives

1. To conduct energy audit, power quality audit, electrical safety audit, water audit in commercial units and industries.
2. To design, supply and implement energy saving equipment for Lights, Fans, AC, Pump, Compressor, Motor, Boiler, Furnace, Kitchen etc.
3. To design, supply and implement power quality solutions and electrical safety projects including earthing system, lightning arrester, surge protection device, harmonics filters, power factor panels etc.
4. To render turnkey consultancy services for installation of Solar, Wind, Biogas and Biomass power projects as EPC.
5. To conduct biomass assessment study, environmental study, feasibility study for solar, biogas, biomass and wind energy projects.
6. To publish Newsletters, pamphlets, magazines and books related to energy.
7. To conduct training program on energy audit, energy efficiency and renewable energy
8. To propagate among the public the energy related knowledge systems.
9. To co -ordinate the present energy studies, activities and analyse the energy relations of development.

Activities:

- i. Rendering Energy Audit, Power Quality Audit, Electrical Safety Audit, Water Audit and turnkey Consultancy Services on Energy Efficiency & Renewable Energy Solutions for Industries, Institutions, Offices, and Commercial Units.
- iv. Preparing Detailed Project Report (DPR), Pre-Feasibility Report, Biomass Assessment Report, Environmental Impact Assessment Report, and Electrical Safety Audit Report etc.
- v. Implementing energy efficiency and renewable energy projects like biogas, solar, biomass, wind, hydro etc. on turnkey basis.



ऊर्जा दक्षता ब्यूरो

(भारत सरकार, विद्युत मंत्रालय)

BUREAU OF ENERGY EFFICIENCY

(Government of India, Ministry of Power)



17/08/ESCO/22 23/4341-420

15th September, 2022

Shri Pramod Hati, CFO
Krishna Engineers & Consultants
Plot No. 4723, Laxmi Vihar, Lane - 3,
Sainik School Area, Bhubaneswar - 751005

Sub: Empanelment of Energy Service Company (ESCO)

Dear Sir,

This has reference to your application for empanelment/ re-empanelment as an Energy Service Company with BEE in response to our advertisement for re-empanelment and fresh empanelment of ESCOs in the month of May, 2022.

Consequent to scrutiny and evaluation of your documents by SEBI accredited Grading Agencies CRISHI / CARE Advisory/ICRA Analytics/SMERA/ IRR Advisory in terms of the approved parameters for evaluation, BEE is pleased to inform that your company Krishna Engineers & Consultants has qualified for empanelment with BEE as a Grade 3 Energy Service Company (ESCO). This empanelment would be effective from 16th August, 2022 and will be valid till 15th August, 2024.

Further, the list of all the empanelled ESCOs along with grade assigned is uploaded on its website (www.beeindia.gov.in) for use by State/Central government/Public Sector agencies as well as by any other agency interested in implementing energy efficiency projects on ESCO mode. Please acknowledge your acceptance to this letter.

Yours faithfully,


(Arijit Sengupta)
Director

स्वच्छ एवं सशुद्धि में ऊर्जा बचाएँ Save Energy for Benefit of Self and Nation

चौथा तल, सेवा भवन, आर० के० पुरान, नई दिल्ली-110 006, वेबसाइट/Website: www.beeindia.gov.in
4th Floor, Sewa Bhawan, R.K. Purani, New Delhi-110 006, टेली/Tel.: 81 (11) 26766700, फैक्स/Fax: 81 (11) 26778352



EXECUTIVE SUMMARY

During the audit it was observed that Regional Institute of Education, Bhubaneswar has major loads such as Light, Fan, Air Conditioners (ACs), Pumps and Office Automation setc. The audit was carried out with an objective to identify the existing electrical and thermal energy consumption by respective equipment, the area of wastage and identify the areas for improvement of the same. This analysis will help to provide necessary recommendations to improve the operations and to prioritize the implementation of cost effective energy conservation measures.

The report highlights the possible energy savings, reduction of Mtoe and reduction of emission (t Co₂) of different loads existing in the institute campus and suitable recommendations for feasible Energy Conservation Measures (ECM), required investment, monetary savings and Payback period calculation.

Overall Benefits after Implementation of recommended EE Measures

Sl No.	Parameters	Unit	Baseline (Before Implementation)	To be (Post-Implementation)	Difference	(% Change)
1	Electrical Energy Used	kWh/Yr	896292	339274	557018	62.15%
2	Diesel Used	Kl/Yr	13750	10162	3588	26.10%
3	LPG Used	Kg/Yr	4800	0	4800	100%
5	Total Energy Cost	Rs./Yr	7962321	2055737	5906584	74.18%
6	Overall Energy Consumption	MTOE/Yr	77.22	29.18	53.52	69.30%
7	Overall CO ₂ Emission	tCO ₂ /Yr	899.40	349.75	549.65	61.11%

The emission and oil equivalent factors

Fuel	Emission (Kg CO ₂)	Oil Equivalent (toe)
Electricity	0.95	0.086
Diesel	2.70	0.01
LPG	2.25	1.162
Firewood	1.80	0.3215
Coal	2.375	0.70



Cost Benefit Analysis - Energy Conservation Measures

Summary of ECM, Investment, Energy Savings and Payback Period										
SI No.	Description of ECM	Estimated Investment	Reduction in Demand	Estimated Annual Savings				Payback Period	Reduction of Emission	Eq. energy Saving
				(Rs.)	kW	(kWh)	Diesel (ltr)			
1	Replacement of old Ceiling Fans, Wall Fans & Exhaust Fans with BLDC Fans	33,18,000	62.93	1,18,048			10,04,448	40	112.15	10.15
2	Retrofitting Microcontroller AC Energy Saver	30,63,000		1,15,741			9,84,817	37	109.95	9.95
3	Retrofitting PIR Sensor for Indoor Lights	1,00,000		5,856			49,829	24	5.56	0.50
4	Retrofitting Automatic Controller for Street Lights	2,00,000		9,373			79,755	30	8.90	0.81
5	Installation of Net Metering Solar Power System	1,00,00,000		3,08,000			26,20,712	46	292.60	26.49
6	Retrofitting of Fuel Saver in DG Set	1,50,000			3,588		3,58,800	5	9.69	0.0359
7	Installation of Biogas Digester	8,00,000				2,400	2,80,224	34	5.40	2.79
8	Installation of Steam Cooking with Solar Water Heater	16,00,000				2,400	5,28,000	36	5.40	2.79
TOTAL		1,92,31,000	62.93	5,57,018	3,588	4,800	59,06,584	39	549.65	53.52



**DETAILS OF REGIONAL INSTITUTE OF EDUCATION,
BHUBANESWAR**

1	Name and Address	Regional Institute of Education Sachivalaya Marg, Bhubaneswar -751022
2	Line of Activity	Educational Institution
3	Contact Details	Prof. S.K.Dash, Head DESM Ph: 8895478337
4	Period of Audit	March, 2023
5	Connected Load (kW)	831.05
6	Maximum Demand (KVA)	280.20
7	Average Power factor (PF)	0.984
8	Annual Energy Consumption (kWh)	864804
9	Annual Energy Consumed through DG Sets (kWh)	31488
10	Total Annual Energy Consumption (kWh)	896292
11	Annual Electricity Cost (Rs)	62,51,371
12	Annual Diesel Cost (Rs)	13,74,950
13	Total Energy Cost (Rs.)	76,26,321
14	Average Cost of Electricity/kWh	8.51



METHODOLOGY

The following energy audit structure is prepared for developing energy efficiency, technological up-gradation and renewable energy projects to be implemented, which is feasible on cost and technology. As part of the audit, a team of Two Energy Auditors, One Energy Experts and One Senior Executive of Krishna Engineers & Consultants had visited the institute, located in Sachivalaya Marg, Bhubaneswar for physical inspection, verifying records & measurement of the installed loads, data collection, monitoring of key parameters, etc.

APPROACH & METHODOLOGY

Krishna Engineers & Consultants has adopted the following methodology:

- i. Collection of historical data pertaining to the consumption of electricity as well as procurement of other fuels like diesel, LPG for last one year.
- ii. Collection of data of all electrical utilities like motors, compressors, pumps, light, fans, Air Conditioners (ACs), office automations and other installations for estimation of load.
- iii. Monitoring of energy related parameters of various equipment using micro-processors controlled portable instruments
- iv. Measuring of operating data with various measuring instruments for equipment such as Light, Pumps, Compressor, Air Conditioners (ACs), Fans, luminaries and etc., installed.
- v. Discussions with operation and maintenance personnel to take note of operating practices and to identify specific problem areas and bottlenecks, if any, with respect to energy consumption and trouble-free operation.
- vi. Analyse the electricity bill and other fuel bills
- vii. Preparing energy balance and identifying the major consuming equipment & machines
- viii. Analyse the performance of major consuming equipment / machines
- ix. Identification and quantification of energy losses.
- x. Identification of suitable energy conservation measures which may reduce energy consumption
- xi. Preparations of Detailed Energy Audit Report including cost benefit analysis for recommended measures.

ENERGY AUDIT INSTRUMENTS USED

The following micro-processor based portable instruments were used for data collection and performance measuring of various equipment during the visit/ audit.

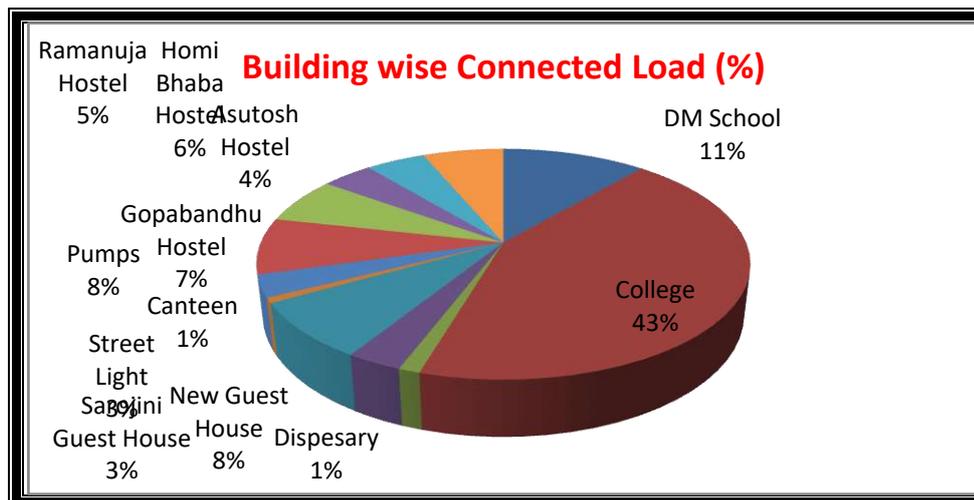
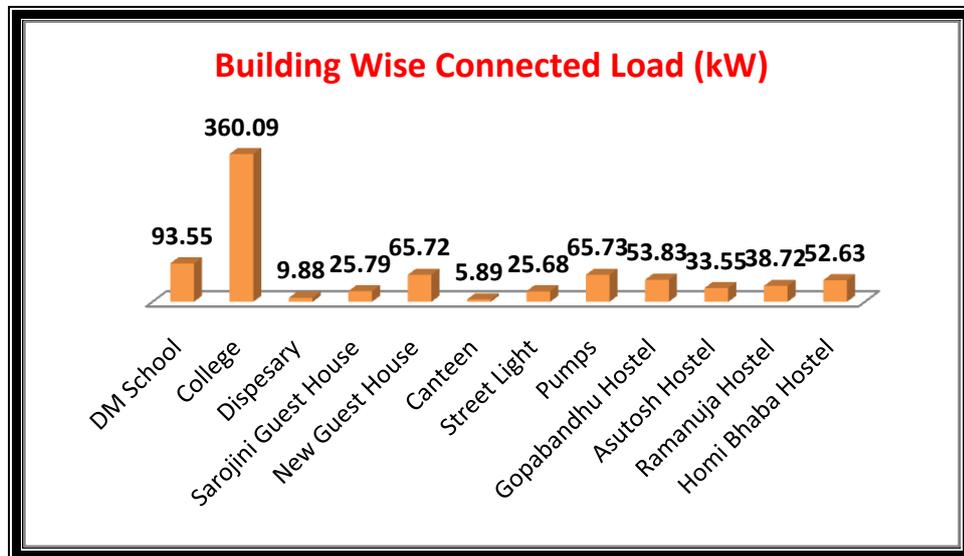
- ✓ Three Phase Power Analyzer
- ✓ Harmonic Analyzer
- ✓ Digital AC Clamp meter – Kyoritsu – 2007
- ✓ Digital Earth Tester – Kyoritsu – 4102
- ✓ Digital Insulation Tester
- ✓ Ultrasonic Flow Meter
- ✓ Power Guard
- ✓ Leakage Current Detector
- ✓ Infrared Thermometer
- ✓ Anemometer
- ✓ Hygrometer



UTILITY SYSTEM ANALYSIS

Distribution of different Connected Load in Different Building

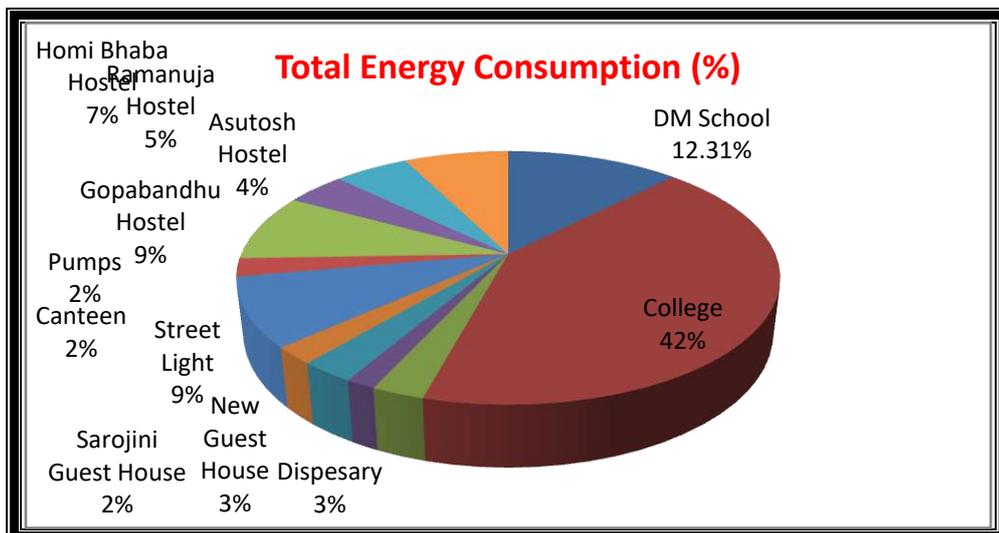
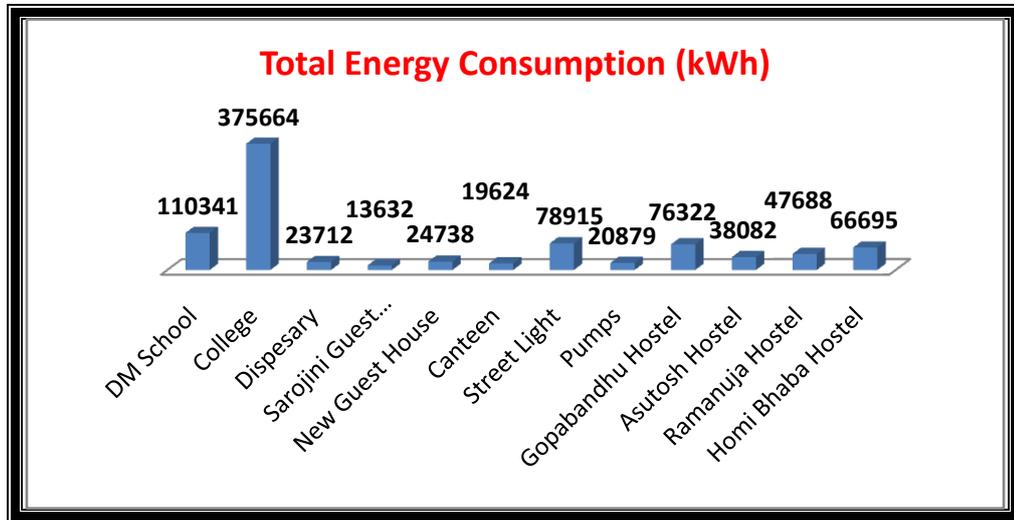
Location	Total Load (kW)	% of Total Load
DM School	93.55	11.26%
College	360.09	43.33%
Dispensary	9.88	1.19%
Sarojini Guest House	25.79	3.10%
New Guest House	65.72	7.91%
Canteen	5.89	0.71%
Street Light	25.68	3.09%
Pumps	65.73	7.91%
Gopabandhu Hostel	53.83	6.48%
Asutosh Hostel	33.55	4.04%
Ramanuja Hostel	38.72	4.66%
Homi Bhaba Hostel	52.63	6.33%
Total	831.05	100%





Energy Consumption in Different Loads in Different Building

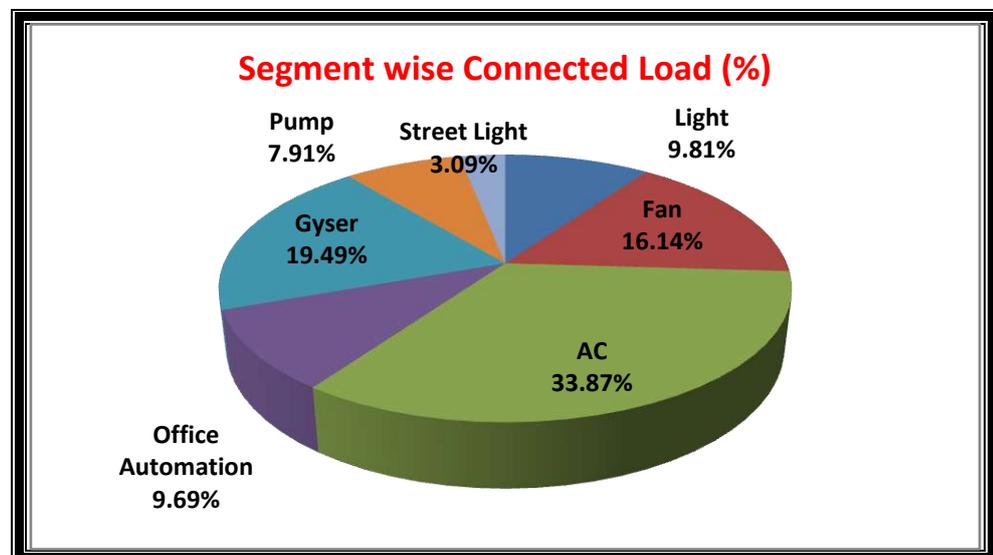
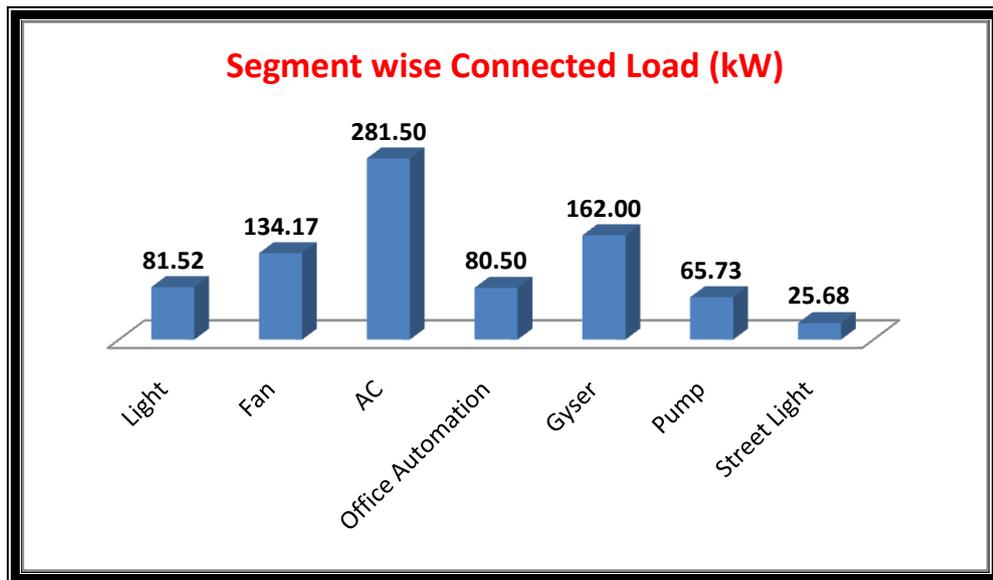
Location	Total Energy Consumption (kWh)	% Total Energy Consumption
DM School	110341	12.31%
College	375664	41.91%
Dispensary	23712	2.65%
Sarojini Guest House	13632	1.52%
New Guest House	24738	2.76%
Canteen	19624	2.19%
Street Light	78915	8.80%
Pumps	20879	2.33%
Gopabandhu Hostel	76322	8.52%
Asutosh Hostel	38082	4.25%
Ramanuja Hostel	47688	5.32%
Homi Bhaba Hostel	66695	7.44%
Total	896291	100%





Segment Wise Connected Load (kW)

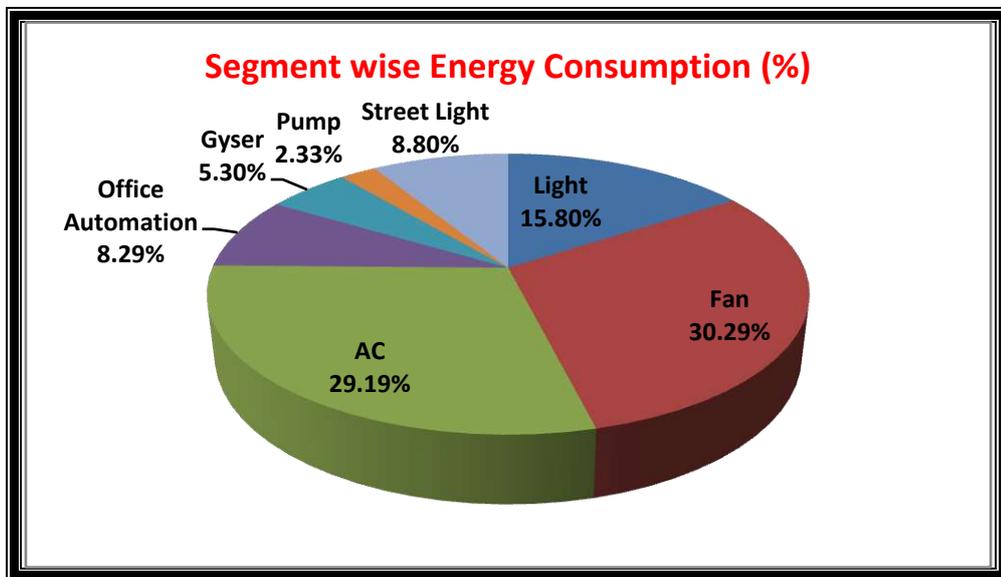
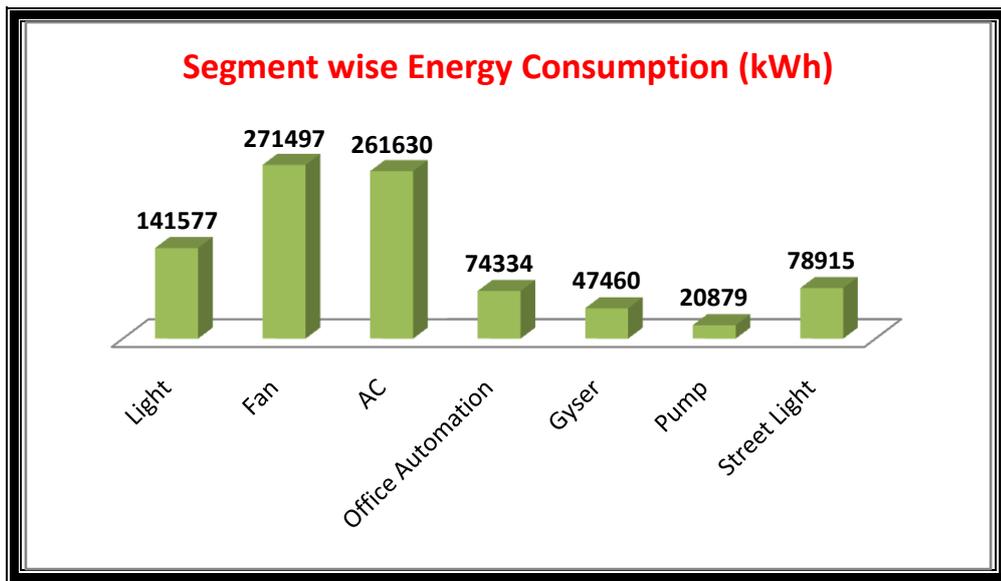
Segment	Total Load (kW)	% of Total Load
Light	81.52	9.81%
Fan	134.17	16.14%
AC	281.50	33.87%
Office Automation	80.50	9.69%
Geyser	162.00	19.49%
Pump	65.73	7.91%
Street Light	25.68	3.09%
Total	831.10	100%





Segment wise Energy Consumption (kWh)

Segment	Total Energy Consumption (kWh)	% Total Energy Consumption
Light	141577	15.80%
Fan	271497	30.29%
AC	261630	29.19%
Office Automation	74334	8.29%
Geyser	47460	5.30%
Pump	20879	2.33%
Street Light	78915	8.80%
Total	896292	100%





Utility Analysis

The above table/graph indicates that energy consumption in fans is higher than any other load, which is about 30.29% of total electricity consumption. The percentage of energy consumption in Air Compressor is 29.19%, in Light is 24.60%, in office automation are 8.29%, in Geyser is 5.30% & Pump 2.33%. The AC, Fans, & Geyser consume more than 65% of total annual energy consumption.

Authority may take appropriate steps for implementation of energy conservation measures in these 3 identified segments (AC, Fans, & Geyser) for achieving sizable quantum of energy saving.

The details of Energy Conservation Measures (ECM) are discussed separately for individual equipment.



MONTHLY ELECTRICITY CONSUMPTION ANALYSIS

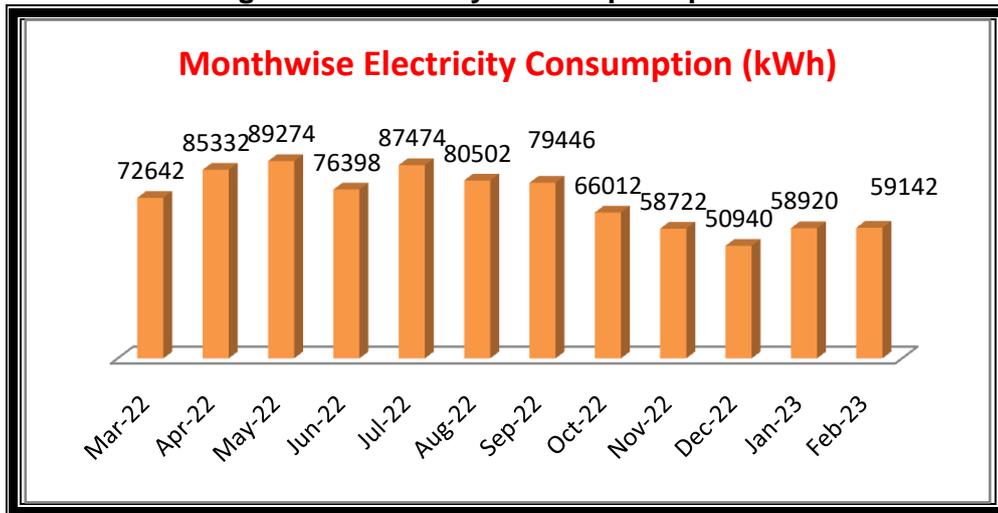
Billing is done based on total units consumed which will be recorded in the energy meter installed. The Monthly Electricity Bills for a period of One Year was studied. The same is tabulated as below: -

Regional Institute of Education
Consumer A/c 80002965665
Transformer Connection: 27/10/21 Own Transformer
Contract Demand: 307.78 KVA

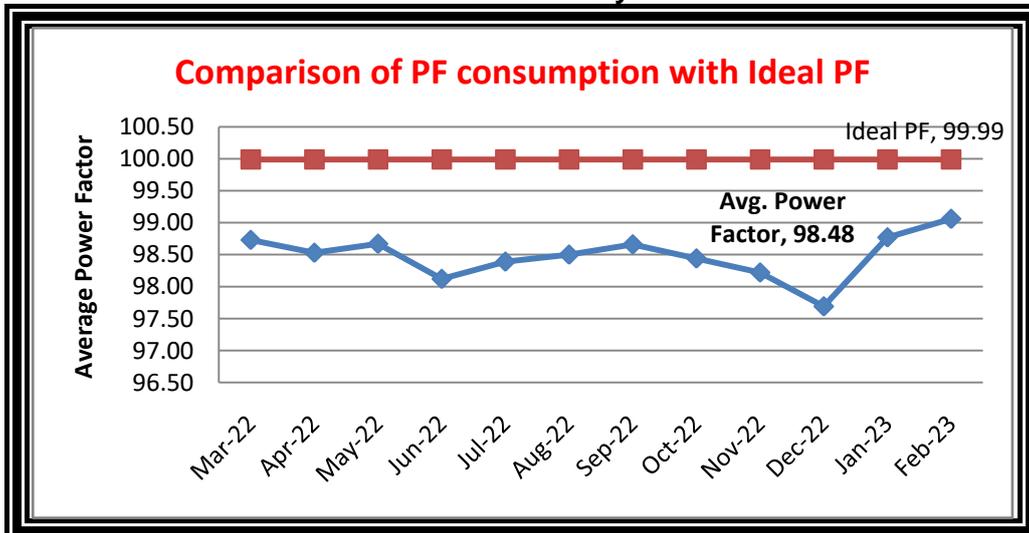
Annual Electricity Bill Analysis									
Month	Energy Consumption		Demand Charged	Actual Demand Consumed	Demand Charges	Power Factor	Average Load Factor	Electricity Charges (Net Payable)	Electricity Cost
	kWh	kVAh	kVA	kVA	(Rs)	(%)	(%)	(Rs.)	(Rs/kWh)
Mar-22	72642	73578	246.22	241.80	61556	98.73	40.90	525681	7.24
Apr-22	85332	86804	256.56	256.56	64140	98.53	46.88	573390	6.72
May-22	89274	90480	280.20	280.20	70050	98.67	43.40	646010	7.24
Jun-22	76398	77862	264.00	264.00	66000	98.12	40.96	560005	7.33
Jul-22	87474	88902	262.32	262.32	65580	98.39	45.55	631120	7.21
Aug-22	80502	81732	241.20	241.20	61556	98.50	45.55	569709	7.08
Sep-22	79446	80526	276.00	276.00	69000	98.66	40.52	575235	7.24
Oct-22	66012	67056	246.22	222.56	61556	98.44	39.78	478462	7.25
Nov-22	58722	59784	246.22	187.44	61556	98.22	44.30	437829	7.46
Dec-22	50940	52146	246.22	135.60	61556	97.69	51.69	385249	7.56
Jan-23	58920	59652	246.22	172.32	61556	98.77	46.53	431985	7.33
Feb-23	59142	59706	246.22	162.48	61556	99.06	54.68	436696	7.38
Total	864804	878228	231.45	225.21	765662	98.48	45.06	6251371	7.25



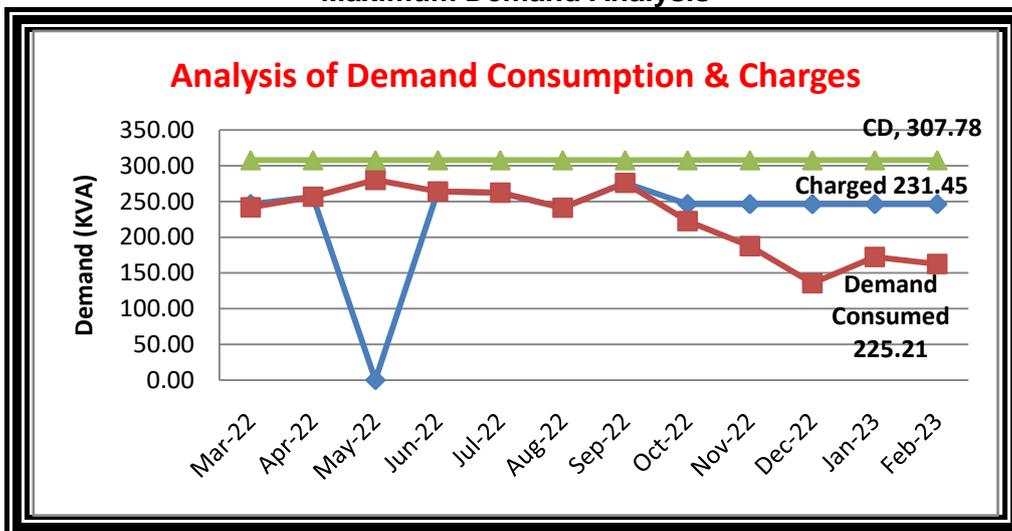
The following is the electricity consumption pattern for the unit



Power Factor Analysis



Maximum Demand Analysis





Energy Consumptions through DG Sets				
Rating (KVA)	Unit Consumed in kWh	Diesel Consumed (Ltr)	Total Diesel Bill (Rs.)	Electricity Cost
300	31488	13750	1375000	43.67

Electricity Bill and DG Set Analysis

From the analysis of collected data, it is observed that the annual energy consumption of electricity is 864804 kWh and annual electricity bill is Rs.6251371/-. The average Cost of electricity is Rs.7.25/kWh, however, the cost of electricity is Rs. 8.51 taking into account fuel consumption for DG operation.

The Minimum power factor is 0.97& maximum power factor is 0.99 with average of 0.98.

The demand consumed is little above the minimum chargeable demand. There is no scope of conservation, but operation should be planned such a way that maximum demand will not cross the minimum chargeable demand.

The Specific Power Generation of DG Sets are 2.29 kWh/Ltr, and hence it can be improved up to 3.6 kWh/Ltr by installing Magnetic Fuel Savers in the external circuits.



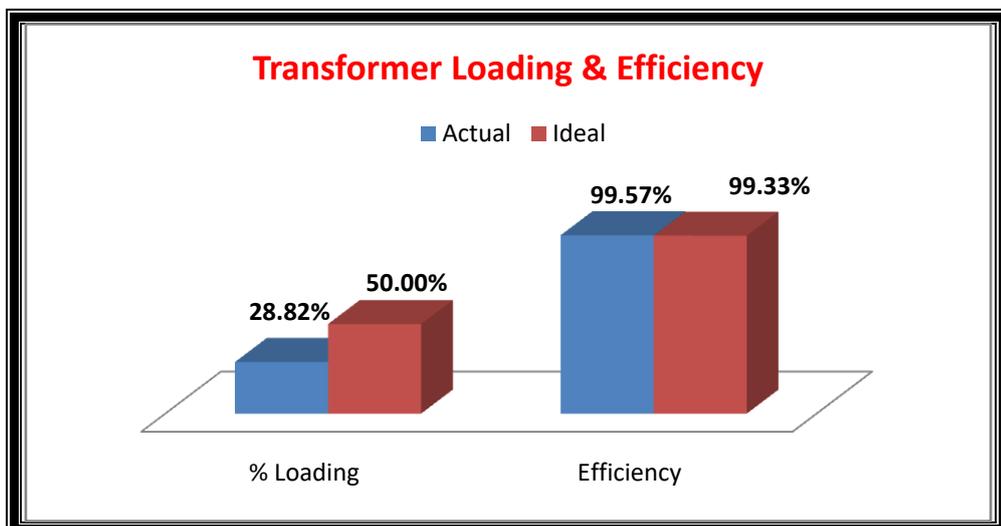
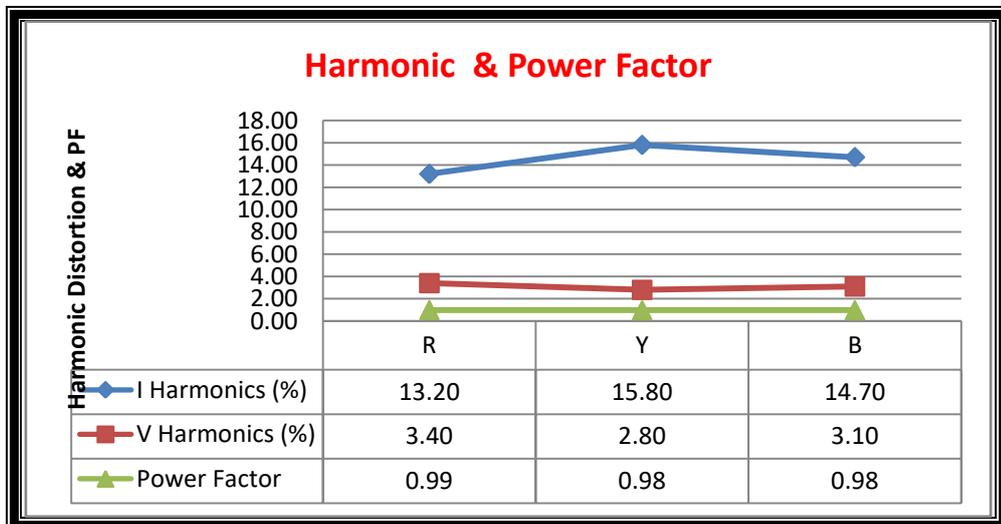
Sources of Energy and Consumptions and Unit Cost Calculation

Parameters	Description
Annual Energy Consumption (TPCODL) (kWh)	864804
Annual Energy Consumed through DG Sets (kWh)	31488
Total Annual Energy Consumption (kWh)	896292
Annual Electricity Cost (Rs)	6251371
Annual Diesel Cost (Rs)	1375000
Total Energy Cost (Rs.)	7626371
Unit Cost (Rs./kWh)	8.51



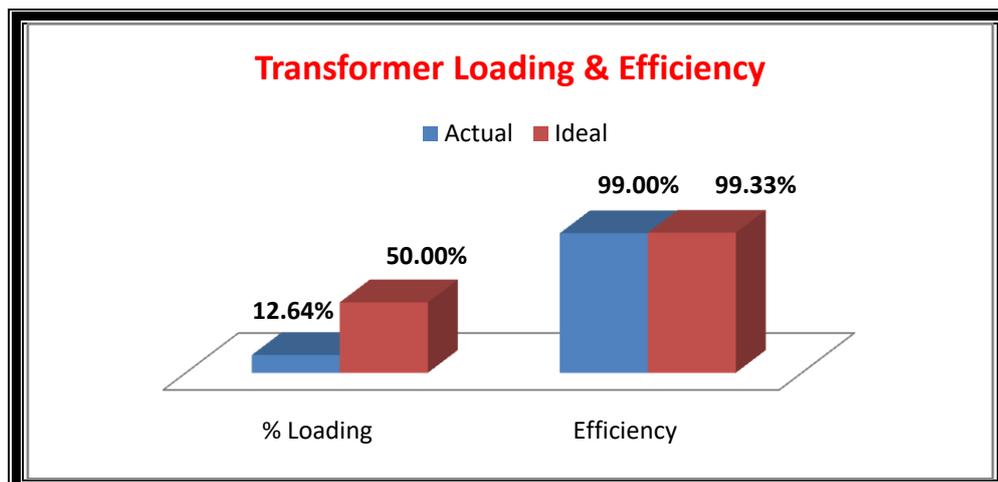
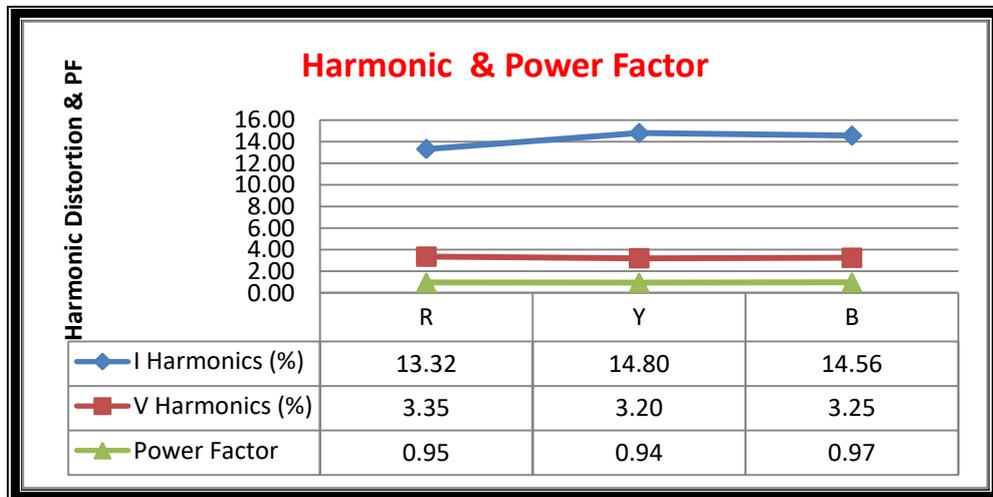
MEASUREMENTS AND PERFORMANCE CALCULATION

Transformer kVA	500		
	R	Y	B
I Harmonics (%)	13.20	15.80	14.70
V Harmonics (%)	3.40	2.80	3.10
Power Factor	0.99	0.98	0.98
Voltage	240	239	238
Current	182	220	201
kW	43.24	51.53	46.88
kVA	43.68	52.58	47.84
Total Load (kVA)	144.10		
% Loading on transformer	28.82%		
No Load Losses kW	1.4		
Load Losses kW	8.65		
Total Energy Loss kW	2.12		
Efficiency %	99.57%		
Ideal Efficiency (500kVA TR with 50% loading)	99.33%		





Measurement of Transformer - II			
Transformer kVA	500		
	R	Y	B
I Harmonics (%)	13.32	14.80	14.56
V Harmonics (%)	3.35	3.20	3.25
Power Factor	0.95	0.94	0.97
Voltage	227	230	230
Current	96	92	88
kW	20.70	19.89	19.63
kVA	21.79	21.16	20.24
Total Load (kVA)	63.19		
% Loading on the transformer	12.64%		
No Load Losses kW	1.4		
Load Losses kW	10.25		
Total Energy Loss kW	1.56		
Efficiency %	99.00%		
Ideal Efficiency (500kVA TR with 50% loading)	99.33%		





Measurement in Different Control Panels

Location / Machines: In front of Post office Feeder-I								
Phase	V	I	kVA	KVAR	kW	PF	Total kW	Hz
RY	361.3	61.68	22.98	19.3	12.41	0.531	62.75	50
YB	362.2	57.8	20.83	18.3	9.9	0.466		49.9
BR	357.3	57.66	20.54	18.41	9.54	0.436		50
R	211.8	61.46	12.81	6.72	11.04	0.86		50
Y	209.2	58.1	11.58	7.07	10.17	0.833		50
B	205.5	57.63	11.82	6.13	9.69	0.822		50
N								

Location / Machines: In front of Post office Feeder-II								
Phase	V	I	kVA	KVAR	kW	PF	Total kW	Hz
RY	396.9	25.81	10.55	3.37	9.81	0.974	36.23	50
YB	394.1	25.72	10.2	4.03	9.35	0.936		50
BR	399.5	16.67	6.55	2.23	6.79	0.936		50
R	225.4	26.25	5.82	4.28	3.78	0.692		50
Y	225.8	25.25	5.69	4.64	3.59	0.587		49.9
B	227.1	17.11	3.86	4.41	2.91	0.697		49.9

Location / Machines: Library								
Phase	V	I	KVA	KVAR	kW	PF	Total kW	Hz
RY	409.7	15.01	6.09	2.26	6.04	0.979	27.01	49.9
YB	405.7	14.7	5.92	3.82	5.86	0.924		50
BR	409.2	14.36	5.81	1.43	5.74	0.879		50
R	237.8	14.62	3.35	3.01	3.44	0.858		49.8
Y	236.9	14.26	3.37	1.05	3.22	0.941		49.8
B	231.2	13.05	3.05	0.92	2.71	0.845		49.8
N								

Location / Machines: Laboratory								
Phase	V	I	kVA	KVAR	kW	PF	Total kW	Hz
RY	400	12.5	6.19	0.46	4.71	0.998	19.03	50
YB	391.1	13.07	4.13	0.29	4.65	0.998		50
BR	392.9	12.36	2.95	0.51	4.66	0.86		50
R	227.2	12.55	2.63	1.51	1.74	0.823		50
Y	228.7	13.07	1.78	1.345	2.18	0.845		50
B	222.7	12.36	1.59	1.01	1.09	0.858		50
N								



Location / Machines: Near Principal Chamber								
Phase	V	I	kVA	KVAR	kW	PF	Total kW	Hz
RY	400	12.5	6.19	0.46	4.71	0.998	19.03	50
YB	391.1	13.07	4.13	0.29	4.65	0.998		50
BR	392.9	12.36	2.95	0.51	4.66	0.86		50
R	227.2	12.55	2.63	1.51	1.74	0.823		50
Y	228.7	13.07	1.78	1.345	2.18	0.845		50
B	222.7	12.36	1.59	1.01	1.09	0.858		50
N								

Location / Machines: Science Block								
Phase	V	I	kVA	KVAR	kW	PF	Total kW	Hz
RY	402.1	4.4	1.74	1.35	1.15	0.66	5.17	50
YB	392.7	3.67	1.54	1.04	1.2	0.741		50
BR	395.3	3.67	1.5	0.98	1.43	0.719		50
R	235.3	4.27	1	0.95	0.21	0.226		50
Y	231.8	3.86	0.93	0.85	0.35	0.384		50
B	223.9	3.56	0.79	0.13	0.83	0.999		50
N								

Location / Machines: Near Principal Residence								
Phase	V	I	kVA	KVAR	kW	PF	Total kW	Hz
RY	415.5	5.87	2.47	0.38	2.48	0.980	10.72	49.9
YB	415.2	5.37	2.20	0.59	2.18	0.909		49.9
BR	419.2	5.87	2.47	0.66	2.30	0.975		49.9
R	245.3	5.54	1.37	0.82	1.11	0.828		49.9
Y	239.9	5.48	1.21	0.82	0.89	0.736		49.9
B	244.0	5.22	1.44	1.03	1.76	0.716		49.9
N								

Location / Machines: DM School								
Phase	V	I	kVA	KVAR	kW	PF	Total kW	Hz
RY	389.7	12.85	4.83	1.05	4.32	0.986	10.38	50
YB	386.7	2.22	0.85	0.13	0.83	0.999		50
BR	385.1	3.33	1.31	0.27	1.25	0.978		50
R	222.7	11.25	2.77	0.82	2.99	0.953		50
Y	224.3	2.11	0.47	0.09	0.46	0.999		49.9
B	223.2	3.25	0.73	0.47	0.53	0.739		50



**Detailed Energy Audit Report of Regional Institution of Education,
Bhubaneswar**

Location / Machines: Ashutosh Hostel								
Phase	V	I	kVA	KVAR	kW	PF	Total kW	Hz
RY	402.6	18.76	6.09	5.85	4.6	0.683	16.49	50
YB	401.4	23.9	9.48	7.7	5.23	0.549		50
BR	399.4	21.12	7.83	6.74	4.89	0.579		50
R	233.3	19.1	4.31	4.22	0.73	0.151		50
Y	231.7	22.9	5.24	5.27	0.42	0.097		50
B	236.2	21.12	4.96	4.98	0.62	0.095		50
N								

Location / Machines: Pump House								
Phase	V	I	kVA	KVAR	kW	PF	Total kW	Hz
RY	393.4	7.98	3.13	1.27	2.84	0.909	12.14	50
YB	391.1	8.2	3.23	1.64	2.79	0.86		50
BR	391.3	5.01	1.97	0.84	1.77	0.905		50
R	227.5	7.91	1.79	0.26	1.78	0.994		50.1
Y	226.6	8.23	1.83	0.19	1.86	0.999		50
B	225.2	4.95	1.11	0.14	1.1	0.993		50
N	4.1	5.5						



Measurement of Harmonics

Location / Machine: (Infront of Post office) Feeder-I			
Current Harmonics	R	Y	B
I	9	9.5	9.1
Harmonic Current	9.3	9.2	8.9
THDI (%)	16	20.2	9.9
CF	1.54	1.43	1.45
Hz	55	51.2	50.1
Voltage Harmonics	R	Y	B
V	387.9	382.9	388.8
Harmonic Voltage	388	383.1	387.6
THDV (%)	1.9%	2.10%	2.20%
CF	1.43	1.45	1.43
Hz	49.9	49.9	49.9

Measurement of Harmonics			
Location / Machine: (Infront of Post office) Feeder-II			
Current Harmonics	R	Y	B
I	3.2	3.15	3.6
Harmonic Current	3.5	3.41	3.9
THDI (%)	8.2	5.9	6.4
CF	1.48	1.48	1.46
Hz	50.6	51.1	49.9
Voltage Harmonics	R	Y	B
V	387.8	389.7	389.9
Harmonic Voltage	387.9	389.5	391.2
THDV (%)	2.5%	2.30%	2.00%
CF	1.46	1.44	1.43
Hz	50	50	50



Measurement of Harmonics			
Location / Machine: Library			
Current Harmonics	R	Y	B
I	63.8	57.8	59.18
Harmonic Current	63	57.17	59.2
THDI (%)	2.4	2.55	2.4
CF	1.45	1.46	1.46
Hz	50.1	50.1	50.1
Voltage Harmonics	R	Y	B
V	361.6	361.6	357.3
Harmonic Voltage	360.6	361	356.3
THDV (%)	1.6%	1.70%	1.70%
CF	1.42	1.42	1.43
Hz	50	50	50

Measurement of Harmonics			
Location / Machine: DM School			
Current Harmonics	R	Y	B
I	10.18	10.24	10.36
Harmonic Current	10.01	10.02	10.36
THDI (%)	2.70%	3.70%	4.70%
CF	1.4	1.4	1.41
Hz	50.1	49.9	50
Voltage Harmonics	R	Y	B
V	411.8	409.8	409.6
Harmonic Voltage	411.5	409.6	409.8
THDV (%)	0.4%	0.50%	0.40%
CF	1.41	1.41	1.42
Hz	49.9	49.9	49.9



Measurement of DG Sets

DG Set kVA	180		
	R	Y	B
Hz	49.3	49.3	49.3
V	228.54	232	231.43
I	165	145	167
KW	35.41	32.73	33.20
PF	0.939	0.973	0.859
KVAR	41.12	42.45	45.98
kVA	37.71	33.64	38.65
V Harmonic	23.40%	22.20%	23.30%
I Harmonic	10.45%	12.43%	18.92%
Percentage of DG Loading			61.11%
Actual Fuel Consumption (Ltr/Hr)			55.00
Electricity Generation (KWh/Hr)			126
Annual Average Running (Hour)			235
Annual Fuel Consumption (Ltrs)			12988
Annual Electricity Generation (KWh)			29775
Specific Power Generation (kWh/Ltr)			2.29



Measurement of DG Sets			
DG Set kVA	100		
	R	Y	B
Hz	50	49.8	49.5
V	229.3	231	232.5
I	81	72	75
KW	17.09	15.14	15.00
PF	0.92	0.91	0.86
KVAR	8.5	8.7	8.9
kVA	18.57	16.63	17.44
V Harmonic	23.40%	22.20%	23.30%
I Harmonic	10.45%	12.43%	18.92%
Percentage of DG Loading			52.64%
Actual Fuel Consumption (Ltr/Hr)			15.23
Electricity Generation (kWh/Hr)			34
Annual Average Running (Hour)			50
Annual Fuel Consumption (Ltrs)			762
Annual Electricity Generation (kWh)			1713
Specific Power Generation (kWh/Ltr)			2.25



Performance Measurement of Fans

Sl. No.		Ceiling Fan	Wall Fan	Pedestal Fan	Exhaust Fan
1	Voltage (V)	240	242		243
2	Current (I)	0.36	0.48		0.47
3	PF (%)	0.95	0.95		0.96
4	THDI (%)	15.2	13.6		12.4
5	THDV (%)	2.3	2.2		2.4
6	Power (Watt)	90	122		120

Performance Measurement of 1 Ton AC

Capacity of AC		1 Ton	Ideal
Cooling Capacity	Btu	12000	12000
Cooling Air Delivery	CFM	270	280
Dry Bulb Temperature	Deg C	36	36
Wet Bulb Temperature	Deg C	20	20
Relative Humidity	%	56	56
Cooling Output	Btu	11491	11917
Measured Tonnage	TR	0.96	0.99
Voltage	V	232	228
Current	I	6.2	4.2
Power Factor	pf	0.94	0.94
Power Consumed	kW	1.35	0.90
Specific Power Consumption	kW/TR	1.41	0.91
Energy Efficiency Ration (EER)	%	2.49	3.88
Note:			
Btu = 4.5 X CFM X (Change in Enthalpy/2.326)			
1 Btu = 2.326 KJ/Kg, 1 Ton = 12000 Btu, 1 kW = 3412 Btu			
Energy Efficiency Ration (EER) = Btu / (kW X 3412)			



Performance Measurement of 1.5 Ton AC

Measurement of AC			
Capacity of AC		1.5	Ideal
Cooling Capacity	Btu	18000	18000
Cooling Air Delivery	CFM	470	490
Dry Bulb Temperature	Deg C	36	36
Wet Bulb Temperature	Deg C	20	20
Relative Humidity	%	67	58
Cooling Output	Btu	17237	18089
Measured Tonnage	TR	1.44	1.51
Voltage	V	232	231
Current	I	8.3	6.5
Power Factor	pf	0.91	0.91
Power Consumed	kW	1.75	1.36
Specific Power Consumption	kW/TR	1.22	0.90
Energy Efficiency Ration (EER)	%	2.88	3.91
Note:			
Btu = 4.5 X CFM X (Change in Enthalpy/2.326)			
1 Btu = 2.326 KJ/Kg, 1 Ton = 12000 Btu, 1 kW = 3412 Btu			
Energy Efficiency Ration (EER) = Btu / (kW X 3412)			



ENERGY SAVING CALCULATION

Energy Conservation Measure: 1
Replacement of Old Ceiling Fans with BLDC Ceiling Fan

Replacement of Old Ceiling Fans with Energy Efficient BLDC fan				
SI No	Description	Unit	Present Status	Recommended Status
	Type of Fan		Traditional	BLDC
1	Installed Average Capacity	Watt	90	28
2	No. of Fans	No. s	700	700
3	Total Power	kW	63.00	19.60
4	Load Reduction	kW	43.40	
5	Working Hours/day	hrs	10	10
6	Working Days/Annum	days	200	200
7	Annual Consumption (kWh/yr)	kWh	126000	39200
8	Average Unit Cost (Rs/kWh)	Rs.	8.51	8.51
9	Annual Energy Cost (Rs.)	Rs.	10,72,110	3,33,545
10	Annual Savings (kWh/Annum)	kWh	86800	
11	Annual Savings (Rs/ Annum)	Rs.	738564	
12	Investment	Rs.	24,50,000	
13	Simple Payback Period	months	40	



Energy Conservation Measure: 2
Replacement of Old Wall Fans with BLDC Fan

Replacement of Old Wall Fans with Energy Efficient BLDC fan				
Sl. No	Description	Unit	Present Status	Recommended Status
	Type of Fan		Traditional	BLDC
1	Installed Average Capacity	Watt	120	30
2	No. of Fans	No. s	113	113
3	Total Power	kW	13.56	3.39
4	Load Reduction	kW	10.17	
5	Working Hours/day	hrs	8	8
6	Working Days/Annum	days	200	200
7	Annual Consumption (kWh/yr)	kWh	21696	5424
8	Average Unit Cost (Rs/kWh)	Rs.	8.51	8.51
9	Annual Energy Cost (Rs.)	Rs.	1,84,607	46,152
10	Annual Savings (kWh/Annum)	kWh	16272	
11	Annual Savings (Rs/ Annum)	Rs.	138455	
12	Investment	Rs.	4,52,000	
13	Simple Payback Period	months	39	



Energy Conservation Measure: 3
Replacement of Old Exhaust Fans with BLDC Fan

Replacement of Old Exhaust Fans with Energy Efficient BLDC fan				
Sl. No	Description	Unit	Present Status	Recommended Status
	Type of Fan		Traditional	BLDC
1	Installed Average Capacity	Watt	120	30
2	No. of Fans	No. s	104	104
3	Total Power	kW	12.48	3.12
4	Load Reduction	kW	9.36	
5	Working Hours/day	hrs	8	8
6	Working Days/Annum	days	200	200
7	Annual Consumption (kWh/yr)	kWh	19968	4992
8	Average Unit Cost (Rs/kWh)	Rs.	8.51	8.51
9	Annual Energy Cost (Rs.)	Rs.	1,69,904	42,476
10	Annual Savings (kWh/Annum)	kWh	14976	
11	Annual Savings (Rs/ Annum)	Rs.	127428	
12	Investment	Rs.	4,16,000	
13	Simple Payback Period	months	39	



Energy Conservation Measure: 4
Retrofitting Microcontroller 1 Ton AC Energy Saver

Retrofitting Microcontroller AC Energy Saver				
Sl. No	Description	Unit	Present Status	Recommended Status
			Without Micro Controller	With Micro Controller
1	No of Split AC	Nos.	129	129
2	Tonnage of AC's	TR	1	1
3	Average Cooling Air Delivery	CFM	270	280
4	Average Cooling Output	Btu	11491	11917
5	Average Measured Tonnage	TR	0.96	0.99
6	Average Power Consumed	kW	1.35	0.9
7	Specific Power Consumption (SPC)	kW/TR	1.41	0.91
8	Energy Efficiency Ration (EER)	%	2.49	3.88
9	AC Running hours/Yr	Hours/year	990	990
10	Annual consumption (kWh/yr)	kWh/year	172409	114939
11	Annual Energy Savings	kWh/year	57470	
12	Percentage of Energy Savings	%	33.33%	
13	Average Unit Cost (Rs/kWh)	Rs./kWh	8.51	
14	Annual Savings (Rs/ Annum)	Rs/ Annum	4,88,997	
15	Investment (Rs)	Rs.	14,19,000	
16	Simple Payback period (months)	Months	35	



Energy Conservation Measure: 5
Retrofitting Microcontroller 1.5 Ton AC Energy Saver

Retrofitting Microcontroller AC Energy Saver				
SI No	Description	Unit	Present Status	Recommended Status
			Without Micro Controller	With Micro Controller
1	No of Split AC	Nos.	129	129
2	Tonnage of AC's	TR	1.5	1.5
3	Average Cooling Air Delivery	CFM	405	425
4	Average Cooling Output	Btu	17237	18089
5	Average Measured Tonnage	TR	1.44	1.51
6	Average Power Consumed	kW	1.75	1.36
7	Specific Power Consumption (SPC)	kW/TR	1.22	0.90
8	Energy Efficiency Ration (EER)	%	2.89	3.90
9	AC Running hours/Yr	Hours/year	990	990
10	Annual consumption (kWh/yr)	kWh/year	223493	173686
11	Annual Energy Savings	kWh/year	49807	
12	Percentage of Energy Savings	%	22.29%	
13	Average Unit Cost (Rs/kWh)	Rs./kWh	8.51	
14	Annual Savings (Rs/ Annum)	Rs/ Annum	4,23,797	
15	Investment (Rs)	Rs.	14,19,000	
16	Simple Payback period (months)	Months	40	



Energy Conservation Measure: 6
Retrofitting Microcontroller 4 Ton AC Energy Saver

Retrofitting Microcontroller AC Energy Saver				
SI No	Description	Unit	Present Status	Recommended Status
			Without Micro Controller	With Micro Controller
1	No of Split AC	Nos.	9	9
2	Tonnage of AC's	TR	4	4
3	Average Cooling Air Delivery	CFM	1040	1200
4	Average Cooling Output	Btu	44262	51072
5	Average Measured Tonnage	TR	3.69	4.26
6	Average Power Consumed	kW	4.85	3.9
7	Specific Power Consumption (SPC)	kW/TR	1.31	0.92
8	Energy Efficiency Ration (EER)	%	2.67	3.84
9	AC Running hours/Yr	Hours/year	990	990
10	Annual consumption (kWh/yr)	kWh/year	43214	34749
11	Annual Energy Savings	kWh/year	8465	
12	Percentage of Energy Savings	%	19.59%	
13	Average Unit Cost (Rs/kWh)	Rs./kWh	8.51	
14	Annual Savings (Rs/ Annum)	Rs/ Annum	72,023	
15	Investment (Rs)	Rs.	2,25,000	
16	Simple Payback period (months)	Months	37	



Energy Conservation Measure: 7
Retrofitting PIR Sensor for Indoor Lights

Retrofitting PIR Sensor for Indoor Lights				
SI No	Description	Unit	Present Status	Recommended Status
	Type of Control		Traditional	PIR Sensor
1	Installed Capacity	kW	50	50
2	No. of Control	No. s	Multiple	100
3	Working Hours/day	Hrs	7	6
4	Working Days/Annum	Days	250	250
5	Annual Consumption (kWh/yr)	kWh	40993	35137
6	Annual Savings (kWh/ Annum)	kWh	5856	
7	Average Unit Cost (Rs/kWh)	Rs.	8.51	
8	Percentage of Energy Savings	%	14.29%	
9	Annual Savings (Rs/ Annum)	Rs.	49829	
10	Investment	Rs.	1,00,000	
11	Simple Payback Period	Months	24	



Energy Conservation Measure: 8
Retrofitting Automatic Control for Street Lights

Retrofitting Automatic Control System for Street Lights				
SI No	Description	Unit	Present Status	Recommended Status
	Type of Control		Traditional Switching	Automatic Control System
1	Installed Capacity	kW	25.68	25.68
2	No. of Control	Nos	25	25
3	Working Hours/day	Hrs	12	11
4	Working Days/Annum	Days	365	365
5	Annual Consumption (kWh/yr)	kWh	112478	103105
6	Annual Savings (kWh/ Annum)	kWh	9373	
7	Average Unit Cost (Rs/kWh)	Rs.	8.51	
8	Percentage of Energy Savings	%	8.33%	
9	Annual Savings (Rs/ Annum)	Rs.	79755	
10	Investment	Rs.	2,00,000	
11	Simple Payback Period	months	30	



Energy Conservation Measure: 9
Net Metering Solar Power System

Net Metering Solar Power System				
Sl. No.	Description	Unit	Present Status	Solar System
1	Contract Demand	kVA/ kW	260	200
2	Shadow free Rooftop Area Available	Sq.Ft	4500	
3	Annual operating days	days/year		350
4	Average Power Generation/kW Solar PV	kWh/day		4.4
5	Annual Power consumption	kWh/year	864804	
6	Daily power generation	kWh/day		880.00
7	Annual power generation	kWh/year		308000
8	Energy cost	Rs/kWh	8.51	
9	Annual Energy Bill paid	Rs/year	62,51,371	
10	Expected Energy Saving with Implementation of all ECM	(%)	20	
11	Annual Energy Bill Payable after Implementation of ECM	Rs./Annum	50,01,097	
12	Annual Energy Cost Generated by Solar	Rs/year		26,20,712
13	Annual Energy Bill Payable after Implementation of Solar System along with ECM	Rs/year	23,80,384	
14	Investment for solar PV	Rs	1,00,00,000	
15	Payback Period	Months	46	



Energy Conservation Measure: 10
Retrofitting of Fuel Saver in DG Set

Retrofitting of Fuel Saver in DG Set				
SI No	Description	Unit	Present Status	Recommended Status
1	No of DG Set	Nos.	1	1
2	Capacity of DG Set	kVA	180	180
3	Average Fuel Consumption/Hr	Ltr	55.00	40.00
4	Operational Running Hour/Yr	Hour/Yr	235	235
5	Annual Fuel consumption	Litres	12988	9400
6	Power Generation	kWh	29775	29775
7	Specific Power Generation	kWh/Ltr	2.29	3.17
8	Specific Fuel Consumption	Ltr/kWh	0.44	0.32
9	Average Fuel Cost	Rs./Ltr	100	100
10	Annual Fuel Cost	Rs./year	1298800	940000
11	Annual savings	Ltr/Annum	3588	
12	Percentage of Fuel Savings	%	27.63%	
13	Annual Savings	Rs./year	358800	
14	Investment for Fuel Saver & Overhauling	Rs.	150000	
15	Simple Payback period	Months	5	



Energy Conservation Measure: 11
Installation of Biogas Digester

Installation of Biogas Digester			
SI No	Description	Unit	Biogas Digester
1	No. of Persons per Hostel	No. s	100
2	No. of Hostel	No. s	4
3	Availability of Food & Vegetable Waste/Day	Kg	10
4	Availability of Human Excreta/Day	Kg	40
5	Water Requirement/Day	Ltr	20
6	Bio Gas Generation/Day	m ³	4
7	Bio Gas Generation/Month	m ³	120
8	Bio Gas Generation (equivalent LPG)/Day	kg	1.68
9	Bio Gas Generation (equivalent LPG)/Annum	kg	605
10	Slurry Generation/Day	Ltr	50
11	Bio Manure Production/Day	kg	5
12	Liquid Fertilizer Production/Day	Ltr	27
13	Cost of Bio Gas/kg	Rs.	70
14	Cost of Bio Manure/Kg	Rs.	10
15	Cost of Liquid Fertilizer/Kg	Rs.	1
16	Area Required	Sq.Ft	5Ft X 4Ft
17	Revenue Generated from Bio Gas/Month	Rs.	14112
18	Revenue Generated from Bio Manure/Month	Rs.	6000
19	Revenue Generated from Liquid Fertilizer/Month	Rs.	3240
20	Total Revenue Generated/Month	Rs.	23352
21	Total Annual Profit	Rs.	2,80,224
22	Investment for 4 Sets of Bio Gas Digester, Waste Shredder, Moisture Remover, H ₂ S Scrubber, Biogas Booster Pump, Biogas Canteen Burners and Electro-Mechanical Equipments	Rs.	8,00,000
23	Payback Period	Months	34



Energy Conservation Measure: 12
Installation of Steam Cooking with Solar Water Heater

Installation of Steam Cooking with Solar Water Heater				
SI No	Description	Unit	Present Status	Solar Application
1	Type of Cooking		Traditional	Steam Cooking
2	No of Meals preparation	No. s	100	100
3	Fuel Used		LPG	LPG+SOLAR
4	Calorific value of LPG	kcal/kg	10800	
5	Annual Equivalent LPG Consumption	Kg	1200	600
6	Annual Equivalent LPG Consumption in 4 Hostels	Kg	4800	2400
7	Fuel saving	%		50
8	Average Unit Cost of LPG	(Rs/Kg)	70.00	
9	Annual LPG Saving	Kg	2400	
10	Annual Fuel Cost	(Rs.)	336000	168000
11	Labour Cost Savings	(Rs.)	360000	
12	Total Annual Cost Savings	(Rs.)	528000	
13	Investment	(Rs)	1600000	
14	Simple Payback Period	(months)	36	



CONCLUSION

Energy Conservation has become significant now days in view of continuously depleting primary energy resources & is being strictly reviewed at National level. It is suggested to create energy conservation awareness among the employees for gainful utilization of energy at Institution& spreading further awareness.

Krishna Engineers & Consultants has complete energy audit for Regional Institution of Education as per the scope of work and mention some energy conservation option. The technology used in RIE, Bhubaneswar is old and traditional technologies with a compromise on the energy efficiency. Often the ideas for improvement of energy efficiency are generated by the management, needs technical assistance for design and capacity building of all stakeholders (vendors, Institute management and O&M persons).

There is a good opportunity for energy cost reduction in AC, Fans, Lights, & Fuel Saver in DG Sets. There is a scope of about above 62% energy reduction with 74% cost reduction. The investment required will be Rs.192 Lakhs with a Payback of 39 months. The RIE management will have to be considered for proposing energy management interventions. A core committee on Energy Conservation may also be formed to review the related activities.



ANNEXURE - I
Connected Load & Energy Consumption
DM SCHOOL

Items	Watt	Numbers	Total kW	Hours/day	Working days/ annum	Total kWh/ annum
LED Light	20	449	8.98	4	280	10058
Varanda Light	12	81	0.97	4	280	1089
LED Down Light	18	6	0.11	4	280	121
Campus Light	45	23	1.04	12	280	3478
Ceiling Fan	90	271	24.39	8	200	39024
Ceiling Fan	65	20	1.30	8	200	2080
Exhaust Fan	120	15	1.80	6	200	2160
Wall Fan	120	7	0.84	6	200	1008
AC 1.5 ton	1500	24	36.00	6	150	32400
AC 1 ton	1000	6	6.00	6	150	5400
Projector	200	2	0.40	1	100	40
LCD TV	75	29	2.18	2	100	435
Computer	70	75	5.25	6	280	8820
Printer	200	3	0.60	4	280	672
Xerox	400	1	0.40	1	280	113
Water Cooler Machine	300	5	1.50	1	280	420
Freeze	300	6	1.80	6	280	3024
Total			93.55			110341



ANNEXURE - I
Connected Load & Energy Consumption
COLLEGE BUILDING

Items	Watt	Numbers	Total KW	Hours/day	Working days/ annum	Total kWh/ annum
LED Tube Light	20	1450	29.00	4	280	32480
Light 100 Watt	100	50	5.00	4	280	5600
LED Bulb	12	48	0.58	4	280	645.12
LED Down Light	18	110	1.98	4	280	2217.6
Campus Light	45	45	2.03	12	280	6804
Play Ground Light	300	9	2.70	12	280	9072
Ceiling Fan	90	200	18.00	8	200	28800
Ceiling Fan	65	380	24.70	8	200	39520
Exhaust Fan	120	55	6.60	6	200	7920
Wall Fan	120	91	10.92	6	200	13104
AC 1.5 ton	1500	85	127.50	6	150	114750
AC 1 ton	1000	46	46.00	6	150	41400
AC 4 ton	4000	9	36.00	6	150	32400
Projector	200	26	5.20	2	100	1040
LCD TV	75	36	2.70	2	280	1512
Computer	70	207	14.49	6	280	24343
Printer	200	22	4.40	2	280	2464
xerox	400	14	5.60	2	280	3136
Freeze	300	9	2.70	6	280	4536
Oven	1000	8	8.00	1	280	2240
Motor	3000	1	3.00	1	280	840
Miscellaneous	3000	1	3.00	1	280	840
Total			360.09			375664



ANNEXURE - I
Connected Load & Energy Consumption
DISPENSARY

Items	Watt	Numbers	Total kW	Hours/day	Working days/ annum	Total kWh/ annum
Light	20	35	0.70	8	300	1680
Ceiling Fan	90	7	0.63	8	300	1512
Ceiling Fan	65	6	0.39	8	300	936
Wall Fan	120	3	0.36	8	300	864
AC 1.5 ton	1500	3	4.50	8	300	10800
Freeze	300	1	0.30	8	300	720
Misclanious	3000	1	3.00	8	300	7200
Total			9.88			23712

Connected Load & Energy Consumption
SAROJINI GUEST HOUSE

Items	Watt	Numbers	Total kW	Hours/day	Working days/ annum	Total kWh/ annum
LED Light	20	107	2.14	4	120	1027
Down Light	18	15	0.27	4	120	130
Campus Light	45	12	0.54	12	365	2365
Ceiling Fan	65	52	3.38	8	120	3245
Exhaust Fan	120	4	0.48	2	120	115
AC 1.5 ton	1500	4	6	8	120	5760
LCD TV	75	1	0.075	2	120	18
Water Cooler Machine	300	2	0.6	0.5	120	36
Freeze	300	1	0.3	6	120	216
Gyser	3000	4	12	0.5	120	720
Total			25.79			13632



ANNEXURE - I
Connected Load & Energy Consumption
NEW GUEST HOUSE

Items	Watt	Numbers	Total kW	Hours/day	Working days/ annum	Total kWh/ annum
Light	20	45	0.90	4	120	432
Varanda Light	12	32	0.38	12	120	553
Down Light	18	13	0.23	4	120	112
Ceiling Fan	65	24	1.56	8	120	1498
Exhaust Fan	120	13	1.56	2	120	374
Wall Fan	90	12	1.08	2	120	259
AC 1.5 ton	1500	13	19.50	8	120	18720
LCD TV	75	12	0.90	2	120	216
Water Cooler Machine	300	1	0.30	0.5	120	18
Freeze	300	1	0.30	6	120	216
Geyser	3000	13	39.00	0.5	120	2340
Total			65.72			24738

Connected Load & Energy Consumption
CANTEEN

Items	Watt	Numbers	Total kW	Hours/day	Working days/ annum	Total kWh/ annum
Down Light	18	23	0.41	8	300	993.6
Campus Light	45	23	1.04	12	300	3726
Ceiling Fan	90	16	1.44	12	300	5184
Exhaust Fan	300	6	1.80	12	300	6480
Water Cooler Machine	300	1	0.30	12	300	1080
Freeze	300	3	0.90	8	300	2160
Total			5.89			19624



ANNEXURE - I
Connected Load & Energy Consumption
STREET LIGHT

Items	Watt	Numbers	Total kW	Hours/day	Working days/ annum	Total kWh/ annum
LED Street Light	45	350	15.75	12	365	68985
LED Light	45	54	2.43	4	250	2430
LED Flood Light	300	25	7.5	4	250	7500
Total		429	25.68			78915

Connected Load & Energy Consumption
PUMP HOUSE

Items	Watt	Numbers	Total kW	Hours/day	Working days/ annum	Total kWh/ annum
Water Pump	15000	2	30.00	1	300	9000
Water Pump	11200	2	22.40	1	300	6720
Water Pump	2000	2	4.00	1.5	300	1800
Water Pump	3730	1	3.73	1.5	300	1679
Water Pump	5600	1	5.60	1	300	1680
Total			65.73			20879



ANNEXURE - I
Connected Load & Energy Consumption
GOPABANDHU HOSTEL

Items	Watt	Numbers	Total kW	Hours/day	Working days/ annum	Total kWh/ annum
LED Tube Light	20	310	6.20	8	300	14880
Varanda Light	12	72	0.86	12	300	3110
Campus Light	45	11	0.50	12	300	1782
Ceiling Fan	80	140	11.20	12	300	40320
Exhaust Fan	300	2	0.60	12	300	2160
LCD TV	75	1	0.08	4	300	90
Floor Mopping	1000	1	1.00	1	300	300
Water Cooler Machine	300	1	0.30	4	300	360
Aqua Guard	20	5	0.10	4	300	120
Geyser	3000	11	33.00	4	100	13200
Total			53.83			76322

Connected Load & Energy Consumption
ASUTHOSH HOSTEL

Items	Watt	Numbers	Total kW	Hours/day	Working days/ annum	Total kWh/ annum
LED Tube Light	20	163	3.26	8	300	7824
Varanda Light	12	30	0.36	12	300	1296
Campus Light	45	8	0.36	12	300	1296
Ceiling Fan	65	71	4.615	12	300	16614
Exhaust Fan	120	2	0.24	12	300	864
LCD TV	75	1	0.075	4	300	90
Water Cooler Machine	300	1	0.3	1	300	90
Aqua Guard	20	2	0.04	4	300	48
Fridge	300	1	0.3	4	300	360
Geyser	3000	8	24	4	100	9600
Total			33.55			38082



ANNEXURE - I
Connected Load & Energy Consumption
RAMANUJA HOSTEL

Items	Watt	Numbers	Total kW	Hours/day	Working days/ annum	Total kWh/ annum
Light	20	176	3.52	8	300	8448
Varanda Light	12	30	0.36	12	300	1296
Campus Light	45	13	0.59	12	300	2106
Ceiling Fan	80	66	5.28	12	300	19008
Exhaust Fan	300	3	0.90	12	300	3240
LCD TV	75	1	0.08	4	300	90
Grinder	1000	1	1.00	1	300	300
Water Cooler Machine	1000	2	2.00	4	300	2400
Fridge	1000	1	1.00	4	300	1200
Geyser	3000	8	24.00	4	100	9600
Total			38.72			47688

Connected Load & Energy Consumption
HOMI BHABA HOSTEL

Items	Watt	Numbers	Total kW	Hours/day	Working days/ annum	Total kWh/ annum
Light	20	270	5.40	8	300	12960
Varanda Light	12	70	0.84	12	300	3024
Down Light	18	10	0.18	12	300	648
Campus Light	45	2	0.09	12	300	324
Ceiling Fan	65	148	9.62	12	300	34632
Exhaust Fan	120	4	0.48	4	300	576
LCD TV	75	1	0.08	1	300	22.5
Grinder	1000	1	1.00	2	300	600
Flour Mopping	1000	1	1.00	2	300	600
Water Cooler Machine	300	1	0.30	2	300	180
Aqua Guard	20	2	0.04	4	300	48
Motor	3600	1	3.60	1	300	1080
Gyser	3000	10	30.00	4	100	12000
Total			52.625			66695

**ANNEXURE-II
PHOTOS DURING ENERGY AUDIT**





ANNEXURE-III Description on Energy Conservation Measures (ECM)

ELECTRONIC SMART BLDC FANS

These super energy efficient fans consume barely one-third the electricity needed for normal fans. This smart fan consumes only 28 watts while the same for normal fans from reputed companies is 75-80 watts. This fan comes with special features like noise-reduction, no heating and a smart remote with timer and sleep mode. The sleep mode as a feature is a huge value addition for cities where the temperature keeps on decreasing throughout the night.

The new technology implemented smart algorithms to precisely tune the motor in real time, thus minimizing losses. I can also reduce the power usages in Air Conditioners. Due to highest capacity of circulation of air and no heat generation, one can use AC at temperature 4 degree higher and still get same level of comfort.

Features:

- India's most energy efficient ceiling fan-consuming only 28W
- Highest Service Value in India (>7)
- No Humming Noise
- No Heat generation
- Runs 3 Times Longer on Inverter
- Excellent Performance even with low voltage and power fluctuation
- Smart Remote with Sleep Mode

FUEL SAVING DEVICE

The dynamics of combustion of hydrocarbon fuel has forever been a subject of intense research the world over; as also the problems associated with it such as decrease in equipment efficiency through incomplete combustion, consequent carbon deposits and high emission levels.

Flux Hi-Tech, Inc. has conducted exhaustive research into the utilization of permanent magnetic fields in alleviating these problems currently associated with hydrocarbon fuel combustion. These studies led to the invention of the FLUX maxiox™, with its rare earth metallurgy and the unique patented flux-collimator-pervader. The on-field success of this device and continuous research has now given way to the new FLUX maxiox™ (β-series) which, with its patented fusion technology and a better availability of magnetic field, promises to give rapid and effective results.

The FLUX Technology

The most important factors in the flux products are the magnetic field intensity and the collimation of the magnetic lines of flux. It is these two aspects that render the flux products different from any ordinary permanent magnets. The intensity of the magnetic field is far superior to that generated by regular permanent magnets and the collimation of the magnetic fields renders the magnetic lines of flux exactly parallel to each other at extremely high densities (to the order of millions of lines of flux per sq.cm.).

These devices are external online installations without cutting or modifying the fuel pipes and the magnetic energy generated through the FLUX maxiox™ (β-series) is rendered concentric and exactly perpendicular to the flow of the fuel.



Micro Controller Energy Saver for AC

Load Controller is a microcontroller, which determines the cooling demand and thermal characteristics of the entire Air Conditioning & Refrigeration system by analyzing the compressor's Cycle Pattern and dynamically modifies that Cycle Pattern to provide the required amount of cooling in the most efficient manner. This is accomplished in real-time by delaying the start of the next compressor on cycle, by an amount determined by the cooling demand analysis. These new patterns also result in less frequent and more efficient compressor cycles.

Microcontroller electrically augments the existing controls, and will not cause the compressor to run unless the existing thermostat is calling for it to do so. Just as computer control has increased the Gas mileage of Automobiles, the Load controller reduces electricity consumption in Air Conditioning & Refrigeration. It improves the electrical efficiency of Air Conditioning systems, by supplementing the antiquated ON/OFF action of the thermostat with the analysis and control capabilities of a computer. It works in conjunction with the existing thermostat and will not void the compressor manufacturer's warranty.