ENERGY AUDIT REPORT

A.B.M.S PARISHAD'S

ANANTRAO PAWAR COLLEGE OF ENGINEERING AND RESEARACH, PUNE

S. NO. 103, SHAHU COLLEGE ROAD,
PARVATI, PUNE - 411009.
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Conducted and Submitted by

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ENERFUTURE

CERTIFICATE

ENERFUTURE TECHNOLOGY PRIVATE LIMITED

Verified and Certified that

ABMSP'S

ANANTRAO PAWAR COLLEGE OF ENGINEERING AND RESEARACH, PUNE

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HAS CARRIED OUT

ENERGY AUDIT

AS PER GUIDANCE LAID DOWN IN THE ENERGY CONSERVATION ACT-2001, MINISTRY OF POWER, GOVERNMENT OF INDIA IN 2020-21

This certificate is valid for 3 years from 2020-21 to 2022-23

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ENERFUTURE TECHNOLOGY PRIVATE LIMITED ★ PUNE ★

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ACKNOWLEDGEMENT

Enerfuture Technology Private Limited thanks the management of Anantrao Pawar College of Engineering and Research, Pune for assigning this important work of Energy Audit Anantrao Pawar College of Engineering and Research, Pune

Energy Audit study is a joint venture exercise of consultant and college account and contain energy usage without sacrificing the purpose of energy use.

Contribution of college's team is equally important in this venture. Team of technical experts from Enrfuture Technology Private Limited is grateful to all the following personnel of Anantrao Pawar College of Engineering and Research, Pune for their kind cooperation, furnishing required data, analysis report and support offered during our visit.

Name	Designation
Prof. Dr. Sunil Thakare	Principal
Prof. Ganesh Kindhalkar	IQAC Coordinator
Prof Dr Soojey Deshpande	NAAC Coordinator

We are also thankful to the other staff members who were actively involved while taking measurements and conducting field study.

STUDY TEAM

Sr No	Name	Qualification
1	Mr. Chetan Nemade	M.Tech (Energy Studies), Advance Diploma in Industrial Safety (ADIS), LLB, BEE Certified Energy Manager
2	Mr Vinay Mulay	M.Tech (Energy Studies), ISO 50001 Lead Auditor, BEE Accredited Energy Auditor
3	Mr Swapnil Gaikwad	M.Tech (Energy Studies), ISO 50001 Lead Auditor , BEE Certified Energy Auditor
4	Mr YogeshKuwar	M.Tech (Energy Studies), IGBC, Post Graduate Diploma in Environmental law and Policy (PGDELP), BEE Certified Energy Manager
5	Mr Swapnil bedre	BE Mechanical

LIST OF INSTRUMENTS USED

1. Single Phase Power Analyzer
2. Ultrasonic Water Flow meter
3. Distance Meter (Bosch)
4. Lux meter (Meco)
5. TD meter
6. CO2 meter
7. Air quality measure meter
8. Sound meter

CONTENTS

EXCECUTIVE SUMMARY

Sr no	Location	Area	Proposed Action	Expected Result	Saving Potential	Monetary Saving	Investment	Simple Payback Period
				monthly	kWh	INR	INR	months
1	College building	Lightning recommendations	Replace existing old conventional 1x36W with new energy efficient 1x18W LED tube light battens	Existing lighting consumption=13249.22kWh Expected energy consumption= 8809.31kWh Total energy saved per month=4439.91kWh	4439.91	58,162.82	2,57,690	4.43
	College building	Fan recommendations	Replace existing old conventional fans which consumes 65W with new energy efficient fans which consumes 28W(18W & 8W for exhaust fan)	Existing fan consumption= 3434.2kWh Expected energy consumption= 1373.68kWh Total energy saved per month=2060.52kWh	2060.52	26,992.81	5,09,400	18.87
2	College building	Water pumping system	Replace all old less energy efficient (46.5%) pumps with new energy efficient pumps. Optimise the existing water pumping distribution system.	Existing fan consumption= 7505kWh Expected energy consumption= 5253.50kWh Total energy saved per month=2251.50kWh	2251.50	29,494.65	10,00,000	34

3	Available rooftop on various buildings	Solar PV system	Can be installed 74kWp system		8280	1,16,251.2	33,12,000	28.49
4	College building	Bio-gas plant	Installed the 50 kg of bio-gas plant at canteen to save LPG cylinders	-	217 LPG cylinder	2,16,710	-	-

COLLEGE INTRODUCTION

INTRODUCTION

Akhil Bharatiya Maratha Shikshan Parishad is an offshoot of the reformist thoughts initiated and spread by great revolutionaries like Mahatma Jyotiba Phule who established the 'Satyashodhak Samaj' and created awareness about the significance of education. Shrimant Sayajirao Gaikwad of Baroda too contributed greatly to the educational upliftment of the ordinary masses. A well-known advocate from Pune Mr. Gangaram Bhau Mhaske duly felt the need for the spread of English education amongst people. However at the same time he felt the economic backwardness of people and the expensive nature of English education and in order to resolve this impasse, in 1885 he founded 'Deccan Association' and raised funds for mass education. Shrimant Sayajirao Gaikwad started an annual grant for the Association and supported it greatly. Great King of Kolhapur, Rajarshi Shahu Maharaj too sanctioned grants to the institute.

Rajarshi Shahu had undertaken the task of the upliftment of the socially and economically backword sections of society. In 1901 he set up a Students' Hostel where children from all walks of life and all castes were admitted. It was indeed a great revolutionary step ahead in the path of social progress. And such revolutionary acts gave way to a public discussion in the newspapers on the need for an Association/Federation of the backward classes. Shri Narayan Lokhande in his paper 'Deenbandhu' initiated such discussion which was positively responded to by Shrimant Sayajirao Gaikwad with an assurance of financial support. In one of his editorials in 1906 Shri Lokhande mentioned that there was a need for a social and educational institute which would not delimit its efforts to just one or the other community but would adopt an all inclusive, comprehensive approach which would

understand and incorporate all the backward sections of the nation equally. This revolutionary thought led to the organisation of the very first educational conference in 1907 at Dharvad.

Thus the A.B.M.S. Parishad is the oldest educational institute founded in the first decade of the 20th Century. It is undoubtedly the “mother institute” of many other educational institutes in Maharashtra. The Parishad with the able efforts by various social reformists, revolutionaries and intellectuals including journalists like Mr. Lokhande and Mr. Bhagvanrao Patekar of ‘Jagriti’ initiated a great social, educational movement in the 20th century. Remarkably enough it was a joint venture which included the ordinary, common masses as well as the rulers. Accordingly on account of such joint and honest efforts academic programmes began all over; boardings, schools and colleges were established and obviously society started adopting a progressive look.

Today all over Maharashtra there is a great network of educational institutions viz. Shri Shivaji Maratha Society, Pune; Maratha Shikshan Prasarak Mandali, Solapur; Maratha Vidya Prasarak Samaj, Jalgaon; Maratha Unnati Samaj, Nagpur; Shri Shivaji Maratha Society, Amaravati; Shri Shahu Maratha Boarding, Baramati; Many more institutes have been functional at Mumbai, Nashik, Dhule, Dharvad, Jabalpur, Zat, Akkalkot, Ichalkaranji, Bhusawal etc. All these institutions have their roots in the A.B.M.S. Parishad, Pune.

It was indeed remarkable that this mass movement of education and social progress was promoted and encouraged by the rulers who did not want their subject to remain ignorant and blind. Contrary to ordinary rulers who sought their own well-being at the cost of their people these rulers like Rajarshi Shahu Maharaj of Kolhapur, Shrimant Sayajirao Maharaj Gaikwad of Baroda and Shrimant Alijabahadur Madhavrao Maharaj Shinde of Gwalior, themselves had a great desire for social welfare and change. Besides their attitude towards education was devoid any vested political or commercial interests. This pure concern on the part of the kings along with the mass inclination towards betterment brought about a great social change and helped the Parishad attain its goals.

There was, however, a phase when the Parishad fell short of financial support which is the backbone of any social institution. It is then that Karmaveer Bhausaheb Hirey came forward and in 1948, in the capacity of the General Secretary of the Paishad he rejuvenated the slack spirit of work and once again the Parishad was on its glorious path. It is Karmaveer Hirey’s efforts which won 67 acres of land from the Government of Maharashtra for an educational complex in Pune – the city known for its education and culture. During the 7 years from 1960 to 1967 Shri Shahu Mandir Mahavidyalaya, Karmaveer Bhausaheb Hirey High-school and Jedhe-More Boys’ Hostel were established in Pune. Since then the Parishad has never ceased to progress.

The once dry and desert-like area of 67 acres at the foot of the Parvati hill has been meticulously developed and preserved over a period of a hundred years. More than 2 lakh trees have been planted. Strenuous efforts have been made to retain the natural beauty of this area and to beautify it even more. As a result of this great contribution to environment the Govt. of Maharashtra awarded the Parishad with the ‘Vanashree Puraskar’ in 1996 and the Pune Municipal Corporation honoured it with the ‘Harit Pune Puraskar’ in the year 2000.

ABOUT APCOER

Anantrao Pawar College of Engineering and Research is situated in nation's education hub, Pune and recognized for its quality education and research. It is the institute of Akhil Bhartiya Maratha Shikshan Parishad, Parvati Pune 09, an educational trust was founded by a team of renowned educationists and social reformers. The institute is situated in the area of 10 acres of land surrounded by beautiful landscape of Sahyadri Hills of Western Ghat nearing to famous Parvati Hills. The institute is established in 2012 having 5 UG and 2 PG courses affiliated to SPPU, Pune. Institute is on creating versatile engineers who can apply their knowledge and skills in any field across the globe. Highly qualified faculty members, well equipped laboratories, extensive industry - academia interactions all serve to make engineering education at APCOER campus a unique and enriching experience.

OUR VISION

Committed to comprehensive development of students through quality technical education

OUR MISSION

1. To provide state of art infrastructure that shall create ambience to encourage novel ideas, research activities and consultancy services.
2. To inspire students in creation & entrepreneurship.
3. To create future technocrats with intelligence, technical skills & good ethical moral values so as to serve needs of society & industries.
4. To provide healthy Teaching-Learning environment that will cultivate contemporary research activities, innovations & inventions.
5. To develop centre of excellence in technical education.

GOAL OF INSTITUTE

- Imparting quality engineering education.
- Provide healthy environment for physical, intellectual, emotional and spiritual growth of students and staff.
- Create aesthetically sensitive, socially committed and technologically competent engineers.

EDUCATE ENABLE ENGAGE EMPOWER

-

LOCATION

ELECTRICITY BILL SUMMARY

Indira College of Pharmacy, Pune has one MSEDCL three phase HT electricity connections in the main college building.

The major electricity consumption in college building is lighting, fans, AC as well as water pumping during college hours.

ELECTRICITY BILL SUMMARY

1. MAIN COLLEGE ELECTRICITY BILL SUMMARY

Meter No	170011873980			
BU	4605			
Tariff	HT-VIII-B Public Services-Others			
Connected load	89.98			kW
Contract demand	121			KVA
	Bill demand	Total units	Total bill	Average unit rate
	KVA	kWh	INR/month	INR/kWh
Oct-22	48	2839	57778	20.35
Sep-22	45	4292	75187	17.52
Aug-22	45	5396	89152	16.52
Jul-22	45	4812	81805	17.00
Jun-22	45	6097	98072	16.09
May-22	45	**5886**	85804	14.58
Apr-22	45	4964	75748	15.26
Mar-22	45	4177	66247	15.86
Feb-22	45	1738	38870	22.36
Jan-22	45	2168	43594	20.11
Dec-21	45	3277	56078	17.11
Nov-21	45	2403	46251	19.25

OBSERVATION

1. Total monthly energy consumption of the college is approximate 4004 units.
2. Total monthly billing is INR 67,882/-
3. Solar water heating system is installed in hostel for hot water generation as renewable energy source.

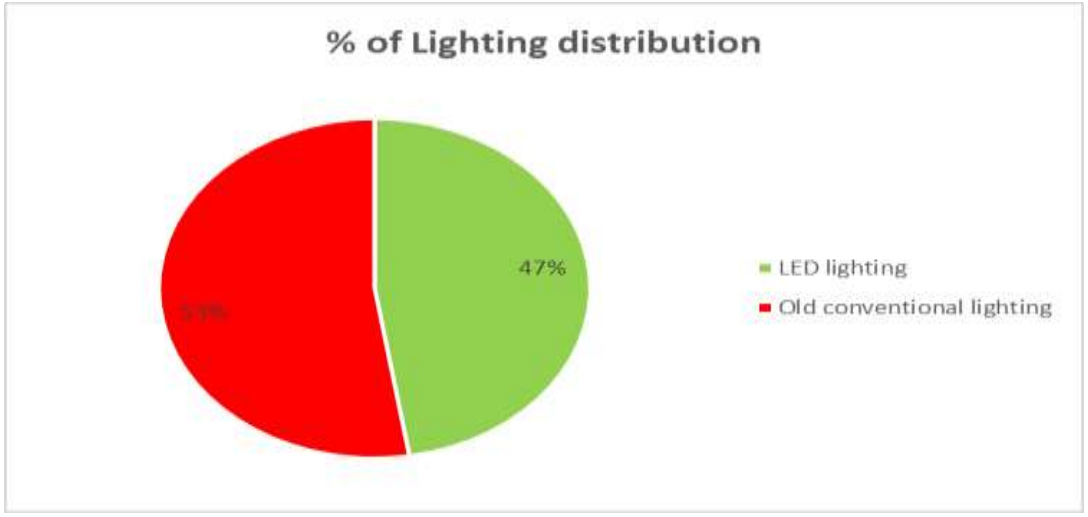
ENERGY PERFORMANCE ASSESSMENT OF LIGHTING

COLLEGE BUILDING AND OTHERS

OBSERVATION

College has installed new energy efficient LED lighting in the college building. There are old conventional lightings are also in the college in use.

Type	Quantity	kW load	% of load
LED lighting	1372	24.70	47.42
Old conventional lighting	1521	54.76	52.58
Total	2893	79.45	100



PERFORMANCE ASSESSMENT OF LIGHTING SYSTEM

Building	Floor	Light Type	Type	Qty	Wattage	Hours of usage	No of Days in a month	Monthly consumption
				Nos	watt	hrs	days	kWh/day
Main building	Ground floor	LED	1x18W	12	18	5	25	27.00
		FTL	1x36W	40	36	5	25	180.00
		LED	1x18W	28	18	5	25	63.00
		FTL	1x36W	3	36	5	25	13.50
		LED	1x18W	15	18	5	25	33.75
		LED	1x18W	1	18	5	25	2.25
		LED	1x18W	8	18	5	25	18.00
		LED	1x18W	38	18	5	25	85.50
		LED	1x18W	3	18	5	25	6.75
		FTL	1x36W	61	36	5	25	274.50
		LED	1x18W	22	18	5	25	49.50
		FTL	1x36W	16	36	5	25	72.00
		LED	1x18W	38	18	5	25	85.50
		FTL	1x36W	4	36	5	25	18.00
		LED	1x9W	25	9	5	25	28.13
		LED	1x18W	13	18	5	25	29.25
		FTL	1x36W	20	36	5	25	90.00
		FTL	1x18W	44	18	5	25	99.00
		FTL	1x36W	36	36	5	25	162.00
		LED	1x50W	24	18	5	25	54.00
		FTL	1x36W	50	36	5	25	225.00
	First floor	FTL	1x36W	40	36	5	25	180.00

		FTL	1x36W	34	36	5	25	153.00
		FTL	1x36W	7	36	5	25	31.50
		FTL	1x36W	31	36	5	25	139.50
		FTL	1x36W	84	36	5	25	378.00
		FTL	1x36W	51	36	5	25	229.50
		LED	1x18W	2	18	5	25	4.50
		FTL	1x36W	32	36	5	25	144.00
		LED	1x18W	50	18	5	25	112.50
		FTL	1x36W	99	36	5	25	445.50
		LED	1x18W	32	18	5	25	72.00
		LED	1x18W	48	18	5	25	108.00
	Second floor	LED	1x18W	5	18	5	5	2.25
		FTL	1x36W	18	36	5	25	81.00
		FTL	1x36W	43	36	5	25	193.50
		FTL	1x36W	19	36	5	25	85.50
		FTL	1x36W	25	36	5	25	112.50
		LED	1x18W	45	18	5	25	101.25
		LED	1x18W	86	18	5	25	193.50
		FTL	1x36W	9	36	5	25	40.50
		FTL	1x36W	20	36	5	25	90.00
	Third floor	LED	1x18W	9	18	5	25	20.25
		FTL	1x36W	82	36	5	25	369.00
		LED	1x18W	88	18	5	25	198.00
Premises		LED	1x18W	15	18	5	25	33.75
		FTL	1x36W	7	36	5	25	31.50
		LED	1x18W	47	18	5	25	105.75
Hostels		LED	1x18W	150	18	5	25	337.50

		FTL	1x36W	72	36	5	25	324.00
		LED	1x18W	114	18	5	25	256.50
		FTL	1x36W	114	36	5	25	513.00
		LED	1x18W	95	18	5	25	213.75
		FTL	1x36W	95	36	5	25	427.50
		LED	1x18W	11	18	5	25	24.75
		FTL	1x36W	4	36	5	25	18.00
		FTL	1x36W	2	36	5	25	9.00
		LED	1x18W	3	18	10	30.5	16.47
		FTL	1x36W	2	36	10	30.5	21.96
		LED	1x18W	20	18	10	30.5	109.80
		FTL	1x36W	20	36	10	30.5	219.60
		LED	1x18W	4	18	10	30.5	21.96
		FTL	1x36W	3	36	10	30.5	32.94
		LED	1x18W	15	18	10	30.5	82.35
		FTL	1x36W	18	36	10	30.5	197.64
		LED	1x18W	6	18	10	30.5	32.94
		FTL	1x36W	6	36	10	30.5	65.88
		LED	1x18W	2	18	10	30.5	10.98
		FTL	1x36W	2	36	10	30.5	21.96
		LED	1x18W	8	18	10	30.5	43.92
		FTL	1x36W	9	36	10	30.5	98.82
		LED	1x18W	2	18	10	30.5	10.98
		FTL	1x36W	2	36	10	30.5	21.96
		LED	1x18W	1	18	10	30.5	5.49
		LED	1x18W	22	18	10	30.5	120.78
		FTL	1x36W	22	36	10	30.5	241.56

		LED	1x18W	6	18	10	30.5	32.94
		FTL	1x36W	7	36	10	30.5	76.86
		FTL	1x36W	2	36	10	30.5	21.96
		LED	1x18W	3	18	10	30.5	16.47
		FTL	1x36W	3	36	10	30.5	32.94
		LED	1x18W	5	18	10	30.5	27.45
		FTL	1x36W	4	36	10	30.5	43.92
		LED	1x18W	4	18	10	30.5	21.96
		FTL	1x36W	4	36	10	30.5	43.92
		LED	1x18W	19	18	10	30.5	104.31
		FTL	1x36W	20	36	10	30.5	219.60
		LED	1x18W	4	18	10	30.5	21.96
		FTL	1x36W	4	36	10	30.5	43.92
		LED	1x18W	8	18	10	30.5	43.92
		FTL	1x36W	9	36	10	30.5	98.82
		LED	1x18W	2	18	10	30.5	10.98
		FTL	1x36W	2	36	10	30.5	21.96
		LED	1x18W	3	18	10	30.5	16.47
		FTL	1x36W	4	36	10	30.5	43.92
		LED	1x18W	3	18	10	30.5	16.47
		FTL	1x36W	3	36	10	30.5	32.94
		LED	1x18W	12	18	10	30.5	65.88
		FTL	1x36W	13	36	10	30.5	142.74
		LED	1x18W	29	18	10	30.5	159.21
		FTL	1x36W	29	36	10	30.5	318.42
		LED	1x18W	23	18	10	30.5	126.27
		FTL	1x36W	24	36	10	30.5	263.52

		LED	1x18W	4	18	10	30.5	21.96
		FTL	1x36W	5	36	10	30.5	54.90
		LED	1x18W	27	18	10	30.5	148.23
		FTL	1x36W	28	36	10	30.5	307.44
		LED	1x18W	24	18	10	30.5	131.76
		FTL	1x36W	24	36	10	30.5	263.52
		LED	1x18W	26	18	10	30.5	142.74
		FTL	1x36W	26	36	10	30.5	285.48
		LED	1x18W	15	18	10	30.5	82.35
		FTL	1x36W	15	36	10	30.5	164.70
		LED	1x18W	6	18	10	30.5	32.94
		FTL	1x36W	6	36	10	30.5	65.88
		LED	1x18W	4	18	10	30.5	21.96
		FTL	1x36W	4	36	10	30.5	43.92
		LED	1x18W	21	18	10	30.5	115.29
		FTL	1x36W	21	36	10	30.5	230.58
		LED	1x18W	7	18	10	30.5	38.43
		FTL	1x36W	7	36	10	30.5	76.86
		LED	1x18W	2	18	10	30.5	10.98
		FTL	1x36W	3	36	10	30.5	32.94
		LED	1x18W	3	18	10	30.5	16.47
		FTL	1x36W	3	36	10	30.5	32.94
		LED	1x18W	5	18	10	30.5	27.45
		FTL	1x36W	5	36	10	30.5	54.90

ENERGY SAVING MEASURES

Building	Floor	Change	New wattage	New used Qty	New monthly consumption	Monthly saving	Total investment	Payback period
			watt	nos	kWh/month	kWh/month	INR	months
Main building	Ground floor	No change	18	12	27.00	0.00	0	#DIV/0!
		LED-1x18W	18	40	90.00	90.00	6800	5.77
		No change	18	28	63.00	0.00	0	#DIV/0!
		LED-1x18W	18	3	6.75	6.75	510	5.77
		No change	18	15	33.75	0.00	0	#DIV/0!
		No change	18	1	2.25	0.00	0	#DIV/0!
		No change	18	8	18.00	0.00	0	#DIV/0!
		No change	18	38	85.50	0.00	0	#DIV/0!
		No change	18	3	6.75	0.00	0	#DIV/0!
		LED-1x18W	18	61	137.25	137.25	10370	5.77
		No change	18	22	49.50	0.00	0	#DIV/0!
		LED-1x18W	18	16	36.00	36.00	2720	5.77
		No change	18	38	85.50	0.00	0	#DIV/0!
		LED-1x18W	18	4	9.00	9.00	680	5.77
		No change	9	25	28.13	0.00	0	#DIV/0!
		No change	18	13	29.25	0.00	0	#DIV/0!
		LED-1x18W	18	20	45.00	45.00	3400	5.77
		LED-1x18W	9	44	49.50	49.50	6600	10.18
		LED-1x18W	18	36	81.00	81.00	6120	5.77

		No change	50	24	150.00	-96.00	0	0.00
		LED-1x18W	18	50	112.50	112.50	8500	5.77
	First floor	LED-1x18W	18	40	90.00	90.00	6800	5.77
		LED-1x18W	18	34	76.50	76.50	5780	5.77
		LED-1x18W	18	7	15.75	15.75	1190	5.77
		LED-1x18W	18	31	69.75	69.75	5270	5.77
		LED-1x18W	18	84	189.00	189.00	14280	5.77
		LED-1x18W	18	51	114.75	114.75	8670	5.77
		No change	18	2	4.50	0.00	0	#DIV/0!
		LED-1x18W	18	32	72.00	72.00	5440	5.77
		No change	18	50	112.50	0.00	0	#DIV/0!
		LED-1x18W	18	99	222.75	222.75	16830	5.77
		No change	18	32	72.00	0.00	0	#DIV/0!
		No change	18	48	108.00	0.00	0	#DIV/0!
	Second floor	No change	18	5	2.25	0.00	0	#DIV/0!
		LED-1x18W	18	18	40.50	40.50	3060	5.77
		LED-1x18W	18	43	96.75	96.75	7310	5.77
		LED-1x18W	18	19	42.75	42.75	3230	5.77
		LED-1x18W	18	25	56.25	56.25	4250	5.77
		No change	18	45	101.25	0.00	0	#DIV/0!
		No change	18	86	193.50	0.00	0	#DIV/0!
		LED-1x18W	18	9	20.25	20.25	1530	5.77
		LED-1x18W	18	20	45.00	45.00	3400	5.77
	Third floor	No change	18	9	20.25	0.00	0	#DIV/0!
		LED-1x18W	18	82	184.50	184.50	13940	5.77
		No change	18	88	198.00	0.00	0	#DIV/0!
Premises		No change	18	15	33.75	0.00	0	#DIV/0!

		LED-1x18W	18	7	15.75	15.75	1190	5.77
		No change	18	47	105.75	0.00	0	#DIV/0!
Hostels		No change	18	150	337.50	0.00	0	#DIV/0!
		LED-1x18W	18	72	162.00	162.00	12240	5.77
		No change	18	114	256.50	0.00	0	#DIV/0!
		LED-1x18W	18	114	256.50	256.50	19380	5.77
		No change	18	95	213.75	0.00	0	#DIV/0!
		LED-1x18W	18	95	213.75	213.75	16150	5.77
		No change	18	11	24.75	0.00	0	#DIV/0!
		LED-1x18W	18	4	9.00	9.00	680	5.77
		LED-1x18W	18	2	4.50	4.50	340	5.77
		No change	18	3	16.47	0.00	0	#DIV/0!
		LED-1x18W	18	2	10.98	10.98	340	2.36
		No change	18	20	109.80	0.00	0	#DIV/0!
		LED-1x18W	18	20	109.80	109.80	3400	2.36
		No change	18	4	21.96	0.00	0	#DIV/0!
		LED-1x18W	18	3	16.47	16.47	510	2.36
		No change	18	15	82.35	0.00	0	#DIV/0!
		LED-1x18W	18	18	98.82	98.82	3060	2.36
		No change	18	6	32.94	0.00	0	#DIV/0!
		LED-1x18W	18	6	32.94	32.94	1020	2.36
		No change	18	2	10.98	0.00	0	#DIV/0!
		LED-1x18W	18	2	10.98	10.98	340	2.36
		No change	18	8	43.92	0.00	0	#DIV/0!
		LED-1x18W	18	9	49.41	49.41	1530	2.36
		No change	18	2	10.98	0.00	0	#DIV/0!
		LED-1x18W	18	2	10.98	10.98	340	2.36

		No change	18	1	5.49	0.00	0	#DIV/0!
		No change	18	22	120.78	0.00	0	#DIV/0!
		LED-1x18W	18	22	120.78	120.78	3740	2.36
		No change	18	6	32.94	0.00	0	#DIV/0!
		LED-1x18W	18	7	38.43	38.43	1190	2.36
		LED-1x18W	18	2	10.98	10.98	340	2.36
		No change	18	3	16.47	0.00	0	#DIV/0!
		LED-1x18W	18	3	16.47	16.47	510	2.36
		No change	18	5	27.45	0.00	0	#DIV/0!
		LED-1x18W	18	4	21.96	21.96	680	2.36
		No change	18	4	21.96	0.00	0	#DIV/0!
		LED-1x18W	18	4	21.96	21.96	680	2.36
		No change	18	19	104.31	0.00	0	#DIV/0!
		LED-1x18W	18	20	109.80	109.80	3400	2.36
		No change	18	4	21.96	0.00	0	#DIV/0!
		LED-1x18W	18	4	21.96	21.96	680	2.36
		No change	18	8	43.92	0.00	0	#DIV/0!
		LED-1x18W	18	9	49.41	49.41	1530	2.36
		No change	18	2	10.98	0.00	0	#DIV/0!
		LED-1x18W	18	2	10.98	10.98	340	2.36
		No change	18	3	16.47	0.00	0	#DIV/0!
		LED-1x18W	18	4	21.96	21.96	680	2.36
		No change	18	3	16.47	0.00	0	#DIV/0!
		LED-1x18W	18	3	16.47	16.47	510	2.36
		No change	18	12	65.88	0.00	0	#DIV/0!
		LED-1x18W	18	13	71.37	71.37	2210	2.36
		No change	18	29	159.21	0.00	0	#DIV/0!

		LED-1x18W	18	29	159.21	159.21	4930	2.36
		No change	18	23	126.27	0.00	0	#DIV/0!
		LED-1x18W	18	24	131.76	131.76	4080	2.36
		No change	18	4	21.96	0.00	0	#DIV/0!
		LED-1x18W	18	5	27.45	27.45	850	2.36
		No change	18	27	148.23	0.00	0	#DIV/0!
		LED-1x18W	18	28	153.72	153.72	4760	2.36
		No change	18	24	131.76	0.00	0	#DIV/0!
		LED-1x18W	18	24	131.76	131.76	4080	2.36
		No change	18	26	142.74	0.00	0	#DIV/0!
		LED-1x18W	18	26	142.74	142.74	4420	2.36
		No change	18	15	82.35	0.00	0	#DIV/0!
		LED-1x18W	18	15	82.35	82.35	2550	2.36
		No change	18	6	32.94	0.00	0	#DIV/0!
		LED-1x18W	18	6	32.94	32.94	1020	2.36
		No change	18	4	21.96	0.00	0	#DIV/0!
		LED-1x18W	18	4	21.96	21.96	680	2.36
		No change	18	21	115.29	0.00	0	#DIV/0!
		LED-1x18W	18	21	115.29	115.29	3570	2.36
		No change	18	7	38.43	0.00	0	#DIV/0!
		LED-1x18W	18	7	38.43	38.43	1190	2.36
		No change	18	2	10.98	0.00	0	#DIV/0!
		LED-1x18W	18	3	16.47	16.47	510	2.36
		No change	18	3	16.47	0.00	0	#DIV/0!
		LED-1x18W	18	3	16.47	16.47	510	2.36
		No change	18	5	27.45	0.00	0	#DIV/0!
		LED-1x18W	18	5	27.45	27.45	850	2.36

Total lighting savings- College building and Other		
Monthly consumption	13249.22	kWh/month
New monthly consumption	8809.31	kWh/month
New monthly saving	4439.91	kWh/month
New monthly saving	**58162.82**	**INR/month**
Total Investment	257690	INR
Payback period	**4.43**	**months**

ENERGY SAVING MEASURES- OTHER RECOMMENDATIONS

College can installed motions sensor LED tube lights or bulbs where lighting is on for maximum period and occupancy or motion is less. This save additional energy by automatic switching of lighting.

ENERGY PERFORMANCE ASSESSMENT OF FAN

COLLEGE BUILDING AND OTHERS

OBSERVATION

College has installed old conventional induction motor fan which consumes 65W at full speed. It is recommended that replace old fan which are operated maximum usage per day with new energy efficient fan which consumes 28W at full speed. Also exhaust fan of 50W with 18W energy efficient fans.

ENERGY SAVING MEASURES

Building	Floor	Qty	Wattage	Hours of usage	No of Days in a month	Monthly consumption	New wattage	New monthly consumption	Monthly saving	Total investment	Payback period
		Nos	watt	hrs	days	kWh/day	watt	kWh/month	kWh/month	INR	months
Main building	Ground floor	3	70	5	25	26.25	28	10.50	15.75	5400	26.17
		1	70	5	25	8.75	28	3.50	5.25	1800	26.17
		4	70	5	25	35.00	28	14.00	21.00	7200	26.17
		4	70	5	25	35.00	28	14.00	21.00	7200	26.17
		1	70	5	25	8.75	28	3.50	5.25	1800	26.17
		12	70	5	25	105.00	28	42.00	63.00	21600	26.17
		2	70	5	25	17.50	28	7.00	10.50	3600	26.17
		2	70	5	25	17.50	28	7.00	10.50	3600	26.17
		6	70	5	25	52.50	28	21.00	31.50	10800	26.17

		3	70	5	25	26.25	28	10.50	15.75	5400	26.17
		10	70	5	25	87.50	28	35.00	52.50	18000	26.17
		2	70	5	25	17.50	28	7.00	10.50	3600	26.17
		4	70	5	25	35.00	28	14.00	21.00	7200	26.17
	First floor	1	70	5	25	8.75	28	3.50	5.25	1800	26.17
		3	70	5	25	26.25	28	10.50	15.75	5400	26.17
		1	70	5	25	8.75	28	3.50	5.25	1800	26.17
		7	70	5	25	61.25	28	24.50	36.75	12600	26.17
		14	70	5	25	122.50	28	49.00	73.50	25200	26.17
		5	70	5	25	43.75	28	17.50	26.25	9000	26.17
		5	70	5	25	43.75	28	17.50	26.25	9000	26.17
		9	70	5	25	78.75	28	31.50	47.25	16200	26.17
		1	70	5	25	8.75	28	3.50	5.25	1800	26.17
		3	70	5	25	26.25	28	10.50	15.75	5400	26.17
		2	70	5	25	17.50	28	7.00	10.50	3600	26.17
	Second floor	2	70	5	25	17.50	28	7.00	10.50	3600	26.17
		2	70	5	25	17.50	28	7.00	10.50	3600	26.17
		4	70	5	25	35.00	28	14.00	21.00	7200	26.17
		4	70	5	25	35.00	28	14.00	21.00	7200	26.17
		3	70	5	25	26.25	28	10.50	15.75	5400	26.17
		3	70	5	25	26.25	28	10.50	15.75	5400	26.17
		3	70	5	25	26.25	28	10.50	15.75	5400	26.17
	Third floor	20	70	5	25	175.00	28	70.00	105.00	36000	26.17
		2	70	5	25	17.50	28	7.00	10.50	3600	26.17
Premises		5	70	5	25	43.75	28	17.50	26.25	9000	26.17
		1	70	5	25	8.75	28	3.50	5.25	1800	26.17
Hostels		10	70	5	25	87.50	28	35.00	52.50	18000	26.17

		1	70	5	25	8.75	28	3.50	5.25	1800	26.17
		1	70	5	25	8.75	28	3.50	5.25	1800	26.17
		2	70	5	25	17.50	28	7.00	10.50	3600	26.17
		3	70	8	30.5	51.24	28	20.50	30.74	5400	13.41
		2	70	8	30.5	34.16	28	13.66	20.50	3600	13.41
		2	70	8	30.5	34.16	28	13.66	20.50	3600	13.41
		4	70	8	30.5	68.32	28	27.33	40.99	7200	13.41
		5	70	8	30.5	85.40	28	34.16	51.24	9000	13.41
		3	70	8	30.5	51.24	28	20.50	30.74	5400	13.41
		9	70	8	30.5	153.72	28	61.49	92.23	16200	13.41
		3	70	8	30.5	51.24	28	20.50	30.74	5400	13.41
		6	70	8	30.5	102.48	28	40.99	61.49	10800	13.41
		13	70	8	30.5	222.04	28	88.82	133.22	23400	13.41
		10	70	8	30.5	170.80	28	68.32	102.48	18000	13.41
		3	70	8	30.5	51.24	28	20.50	30.74	5400	13.41
		4	70	8	30.5	68.32	28	27.33	40.99	7200	13.41
		1	70	8	30.5	17.08	28	6.83	10.25	1800	13.41
		1	70	8	30.5	17.08	28	6.83	10.25	1800	13.41
		3	70	8	30.5	51.24	28	20.50	30.74	5400	13.41
		3	70	8	30.5	51.24	28	20.50	30.74	5400	13.41
		3	70	8	30.5	51.24	28	20.50	30.74	5400	13.41
		1	70	8	30.5	17.08	28	6.83	10.25	1800	13.41
		2	70	8	30.5	34.16	28	13.66	20.50	3600	13.41
		5	70	8	30.5	85.40	28	34.16	51.24	9000	13.41
		2	70	8	30.5	34.16	28	13.66	20.50	3600	13.41
		1	70	8	30.5	17.08	28	6.83	10.25	1800	13.41
		1	70	8	30.5	17.08	28	6.83	10.25	1800	13.41
		1	70	8	30.5	17.08	28	6.83	10.25	1800	13.41
		1	70	8	30.5	17.08	28	6.83	10.25	1800	13.41
		2	70	8	30.5	34.16	28	13.66	20.50	3600	13.41

		2	70	8	30.5	34.16	28	13.66	20.50	3600	13.41
		2	70	8	30.5	34.16	28	13.66	20.50	3600	13.41
		1	70	8	30.5	17.08	28	6.83	10.25	1800	13.41
		1	70	8	30.5	17.08	28	6.83	10.25	1800	13.41
		3	70	8	30.5	51.24	28	20.50	30.74	5400	13.41
		3	70	8	30.5	51.24	28	20.50	30.74	5400	13.41
		3	70	8	30.5	51.24	28	20.50	30.74	5400	13.41
		3	70	8	30.5	51.24	28	20.50	30.74	5400	13.41
		3	70	8	30.5	51.24	28	20.50	30.74	5400	13.41

Total fan savings- College building and other		
Monthly consumption	3434.2	kWh/month
New monthly consumption	1373.68	kWh/month
New monthly saving	2060.52	kWh/month
New monthly saving	**26992.81**	**INR/month**
Total Investment	509400	INR
Payback period	**18.87**	**months**

ENERGY PERFORMANCE ASSESSMENT OF WATER PUMPING

OBSERVATION

1. There are more than eight pumps operated in the premises for gardening, drinking water and domestic purposes at college, girl's and boy's hostel etc
2. One centralized water sump tank is in the premises where water comes from bore well in the college and one pump outside the premises at water body.
3. There are two main water lines goes from water sump to college and hospital. After that again water distributed to various buildings like hostels, college building, etc.
4. Main two water line is always pressurized at 4 kg.
5. Various pumps at different buildings are operated automatically with sensors.

Particulars	Rated			Actual			
	Power	Flow	Head	Voltage	Current	Power	PF
	kW	lps	m	V	A	kW	
Pump 1	2.238	7	18	410	3.6	2.04	0.85
Pump 2	2.238	7	18	413	3.9	2.04	0.85
C-type pump	2.238	7	18	409	3.7	2.04	0.85
Boy's hostel	2.238	7	18	405	3.8	2.04	0.85
	2.238	7	18	413	3.6	2.04	0.85
Girl's hostel	2.238	7	18	410	3.9	2.04	0.85
Bore well	NA	NA	NA	414	17.95	8.8655	0.788
Old bore well	NA	NA	NA	400	9.8	6.32	0.995
Sump pump no-2	NA	NA	NA	393	24	14.88	0.88
Total Power						**42.31**	

RECOMMENDATION

1. It is recommended that to replace the old less energy efficient (46.5%) with new energy efficient water pumps.
2. Optimises the existing water pumping system with new water pump system in which discard the various pumps at building locations. Fitted the ball valve at overhead tank inlets. Install only two pumps at centralised water sump in which one is stand by pump. Installed the pressurized water tank system to the new pump to regulate the water line pressure.
3. It is recommended that bore well pump should be run by automatic control panel with cyclic timer based to optimise the pump efficiency and to help the ground water recharge.
4. Also sensors or automatic pressure tank can be used for water pumping with precaution of there is no leakage in water line to avoid water as well as energy loss.
5. This will save 20 to 30 % of energy in water pumping.

SAVINGS MEASURES

SAVINGS DUE TO WATER PUMPING SYSTEM OPTIMISATION

Total water pump savings		
Total monthly consumption	300.2	kWh/day
Total monthly consumption	7505	kWh/month
New monthly consumption	5253.50	kWh/month
Total saving kWh	2251.50	kWh/month
Total saving INR	**29494.65**	**INR/month**
Total Investment	1000000	INR/month
Payback period	34	months
Payback period	**2.83**	**year**

RENEWABLE ENERGY SYSTEMS

1. SOLAR PHOTOVOLTAIC SYSTEM- ELECTRICAL ENERGY GENERATION

INTRODUCATION

Solar photovoltaic system- with Net meter

Maharashtra Government has new solar energy policy name as “Rooftop Solar with Net Meter system”. Maharashtra government encourages to install rooftop solar PV system with net meters at available roof top of consumers. This helps to reduce the burden on existing conventional fuel fired power plants in the country.

Solar Rooftop Net meter system helps consumers to reduce the electricity consumption in the electricity bill due to net meter.

OBSERVATION

1. It is observed that in the college Solar PV system is not installed for solar energy generation.
2. College has large rooftop space available for Solar PV system installation.

RECOMMENDATION

1. It is recommended that college can installed Solar Photovoltaic (PV) system on available rooftop for solar energy generation.

SAVINGS MEASURES

SAVINGS DUE TO SOLAR PV SYSTEM INSTALLATION- MAIN COLLEGE BUILDING

Savings due to Solar PV system installation		
Total Rooftop space available- approximate	8096	sqfoot
Total capacity of Solar PV system can be installed	74	kWp
Total solar unit generation	8280	kWh/month
Average electricity unit rate	14.04	INR/kWh
Total cost of Solar PV system	3312000	INR
Total saving	116251.2	INR/month
Payback period	28.49	months
Payback period	2.37	year

2. BIO-GAS PLANT

INTRODUCTION

Bio-Gas Generation Plant - 10g/day- At canteen

Biogas is a mixture of gases, primarily consisting of methane and carbon dioxide, produced from raw materials such as agricultural waste, manure, municipal waste, plant material, sewage, green waste or food waste. It is a renewable energy source.

Biogas is produced by anaerobic digestion with anaerobic organisms or methanogen inside an anaerobic digester, bio digester or a bioreactor.

Biogas is primarily methane (CH_4) and carbon dioxide (CO_2) and may have small amounts of hydrogen sulphide (H_2S), moisture and siloxanes. The gases methane, hydrogen, and carbon monoxide (CO) can be combusted or oxidized with oxygen. This energy release allows biogas to be used as a fuel; it can be used in fuel cells and for any heating purpose, such as cooking. It can also be used in a gas engine to convert the energy in the gas into electricity and heat.

Biogas can be compressed after removal of Carbon dioxide, the same way as natural gas is compressed to CNG, and used to power motor vehicles. In the United Kingdom, for example, biogas is estimated to have the potential to replace around 17% of vehicle fuel. It qualifies for renewable energy subsidies in some parts of the world. Biogas can be cleaned and upgraded to

natural gas standards, when it becomes bio-methane. Biogas is considered to be a renewable resource because its production-and-use cycle is continuous, and it generates no net carbon dioxide. As the organic material grows, it is converted and used. It then regrows in a continually repeating cycle. From a carbon perspective, as much carbon dioxide is absorbed from the atmosphere in the growth of the primary bio-resource as is released, when the material is ultimately converted to energy

Biogas in India has been traditionally based on dairy manure as feed stock and these "gobar" gas plants have been in operation for a long period of time, especially in rural India. In the last 2–3 decades, research organisations with a focus on rural energy security have enhanced the design of the systems resulting in newer efficient low cost designs such as the Deenabandhu model.

The Deenabandhu Model is a new biogas-production model popular in India. (Deenabandhu means "friend of the helpless.") The unit usually has a capacity of 2 to 3 cubic metres. It is constructed using bricks or by a ferrocement mixture. In India, the brick model costs slightly more than the ferrocement model; however, India's Ministry of New and Renewable Energy offers some subsidy per model constructed.

Biogas which is mainly methane/natural gas can also be used for generating protein rich cattle, poultry and fish feed in villages economically by cultivating Methylococcus capsulatus bacteria culture with tiny land and water foot print. The carbon dioxide gas produced as by product from these plants can be put to use in cheaper production of algae
oil or spirulina from algaculture particularly in tropical countries like India which can displace the prime position of crude oil in near future. Union government of India is implementing many schemes to utilise productively the agro waste or biomass in rural areas to uplift rural economy and job potential. With these plants, the non-edible biomass or waste of edible biomass is converted in to high value products without any water pollution or greenhouse gas (GHG) emissions.

LPG (Liquefied Petroleum Gas) is a key source of cooking fuel in urban India and its prices have been increasing along with the global fuel prices. Also the heavy subsidies provided by the successive governments in promoting LPG as a domestic cooking fuel has become a financial burden renewing the focus on biogas as a cooking fuel alternative in urban establishments. This has led to the development of prefabricated digester for modular deployments as compared to RCC and cement structures which take a longer duration to construct. Renewed focus on process technology like the Biourja process model has enhanced the stature of medium and large scale anaerobic digester in India as a potential alternative to LPG as primary cooking fuel

OBSERVATION

1. In the college canteen approximately 45kg kitchen waste is generated daily.
2. Currently there is no any bio gas plant for generation of bio gas in the college.

RECOMMENDATION

1. It is recommended that installed the small capacity of bio gas plant at college canteen for production of bio gas from kitchen waste generated daily.
2. Produced bio gas can be used for small purposes in the canteen instead of LPG which saves monthly approximate 217 cylinders of INR 2,16,710/-
3. Or College can also produce electricity from bio gas by installing gas generator to reduced energy consumption.

SAVINGS

Saving due to Bio gas plant		
Capacity of bio gas plant can be installed	50	kg/day
Waste generated	45	kg/day
Approximate bio gas generation	2	m3/day
Approximate bio gas generation	2745	m3/month
Equivalent LPG gas saved	4117.5	kg/month
Approximate LPG cylinder saved	217	nos
Cost saved	**2,16,710**	**INR/month**

ENERGY CONSERVATION BY SAVING OF WATER

TAP WATER REDUCER

Conventional Tap water system	Tap water system with Reducer
	
Existing tap water system uses more water while during purpose of washing of utensils, hands etc in college.	**Used reducer to tap water for purpose of washing of utensils, hands etc which reduces flow of water and ultimately saves the water.**
⃠	√

RECOMMENDATION

It is recommended that to use water reducer for water taping for save the water.

ANNEXTURE

ENERGY EFFICIENT FANS

ATOMBERG TECHNOLOGIES	
	**28 watts**
	**18watts or 8 watts as per size and load**

ENERGY EFFICIENT LIGHTING

LED Lightings	
	**18 watts, 9 watts, 5 watts** **Companies:** **1. Wipro** **2. Osram** **3. Syska** **4. Philips** **etc**
	
	**Motion/Heat sensor bulbs** **Companies:** **1. Orient electric** **2. Halonix** **etc**

ENERGY EFFICIENT INVERTER AC

ENERGY EFFICIENT INVERTER AC	
	**Companies:** **1. Daikin** **2. Mitsubishi Electric** **3. LG** **etc**