ENERGY AUDIT REPORT

JAN-2024

B.S. Abdur Rahman Crescent Institute of Science & Technology
Deemed to be University u/s 3 of the UGC Act, 1956
GST Road, Vandalur, Chennai 600 048

Crescent Institute of Science & Technology,

GST Road, Vandalur, Chennai,

Tamil Nādu – 600 048.

CONDUCTED BY

SLR INDUSTRIAL SOLUTIONS	**SLR INDUSTRIAL SOLUTIONS** **(BEE Approved Energy Audit Firm)** **No.15, 4th Street, VIP Nagar,** **Thirukachur Post, Singaperumal Koil,** **Chengalpattu District, Tamil Nadu – 603 204** **(Mob: 9600500542, Email: slrischennai@gmail.com)** **CRESCENT Vendor Code-13271399**

ACKNOWLEDGEMENT

SLR Industrial Solutions (SLRIS) conveys their gratitude and thanks to the management of **M/s Crescent Institute of Science & Technology – Chennai,** for giving us an opportunity to study their College & equipment's for the Energy Audit, which was conducted in **Jan - 2024**

We render our sincere thanks to **Mr.V.N.A. JALAL, Director (Planning & Development) and Dr. Kaliluthin, Asso Professor/Civil & Deputy Director (Campus Development & Maintenance)** for their keen interest, proactive support for providing whole hearted support, helps and guidance during the course of study of the campus.

We are indeed touched by the helpful attitude and co-operation **Mr. Ramkumar, AP/EEE & Executive Engineer (Electrical) and Mr. E. Manivannan, Junior Engineer** & all technical staff, who rendered their valuable assistance and co-operation during the course of study.

The Audit and report making team constituted of the following Auditors from SLRIS.

Name of SLRIS Team Members

1. Mr. M. Srinivasan, Accredited Energy Auditor, BEE
2. Mrs. S. Hemavathi, Energy Analyst

M. Srinivasan
BEE Accredited Energy Auditor,
AEA 0324

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Singaperumal Koil - 603 204.
Chenglapattu Dist, Tamil Nadu

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DETAILS OF CONSUMER

1. Name of the Consumer : Crescent Institute of Science & technology, Chennai
2. Name of the Contact Person : Mr. Ramkumar, AP/EEE & Executive Engineer

   GST Road, Vandalur,

   Chennai, Tamilnadu – 600 048.
3. Website : www. Crescent.education.com
4. Nature of Business : Education
5. No of Shifts : General Shifts

https://www.google.com/maps/place/B.+S.+Abdur+Rahman+Crescent+Institute+Of+Science+And+Technology/@12.8753317,80.0847235,353m/data=!3m1!1e3!4m6!3m5!1s0x3a52f60e8ef70dad:0x1b7886934a452db8!8m2!3d12.8753945!4d80.0837794!16zL20vMDRicjc2?entry=ttu&g_ep=EgoyMDI0MTEwNi4wIKXMDSoASAFQAw%3D%3D

Location Map

EXECUTIVE SUMMARY -Crescent					
ECM. No	Energy Conservation Measures	Annual Savings		Investment	Payback
		kWh	Rs.	Rs.	Months
Short-Term Payback					
1	Replace FTL Lamps with LED and reduce power consumption	19,200	180,480	120,000	8
2	Rectify solar water heater in ladies hostel and reduce power consumption	20,930	196,744	180,000	11
3	Replace existing STP blower with new energy efficient blower	25,810	242,615	250,000	12
Medium-Term Payback					
4	Rectify Solar roof top panel problem and increase power generation	8,040	61,506	100,000	20
5	Install Demand Controller to avoid demand penalty charges		21,120	40,000	23
Long-Term Payback					
6	Replace conventional ceiling fans with BLDC fans	37,800	355,320	1,050,000	35
7	Replace old AC with Energy Efficient 5 star rated split AC	45,000	423,000	1,500,000	43
8	Replace main block water pump with new one and reduce power consumption	1,320	12,408	50,000	48
9	Replace street light with solar power light and reduce power consumption	1,314	12,352	60,000	58
10	Explore roof top solar PV possibility to generate electrical energy	327,600	2,506,140	12,600,000	60

Summary of Savings					
Annual	*Total Savings & Investment and Average Payback*	*487,014*	*4,011,685*	*15,950,000*	*48*
	Total kWh Savings in Percentage	*10*			
	Total Cost Savings in Percentage	*9*			
	Total CO_2 reduction in Tons	*385*			

CAMPUS ENERGY SAVINGS IDENTIFIED

1. Annual Energy Savings

Annual Energy Savings : 4, 87,014 kWh.

2. Annual Cost Savings

Annual Cost Savings : Rs. 40, 11,685.

3. Proposed Investment : Rs. 1, 59, 50, 000

4. Overall Payback period : 38 Months.

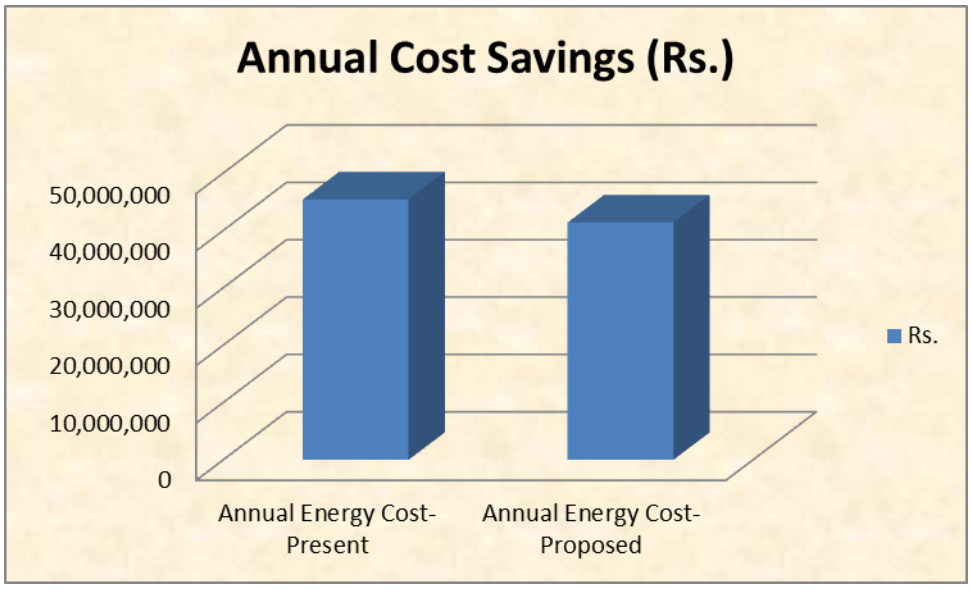

Figure 1 : Annual Cost Savings

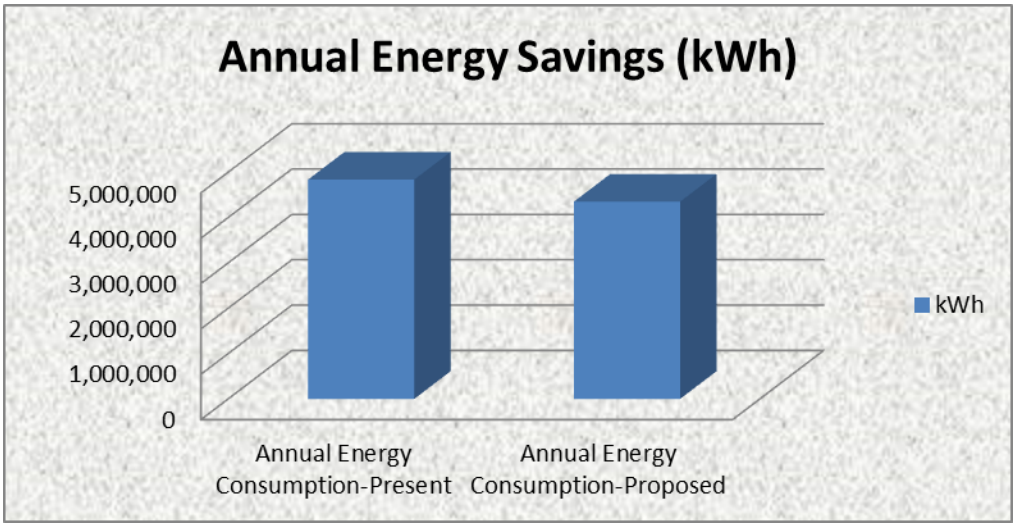

Figure 2 : Annual Energy Savings (%)

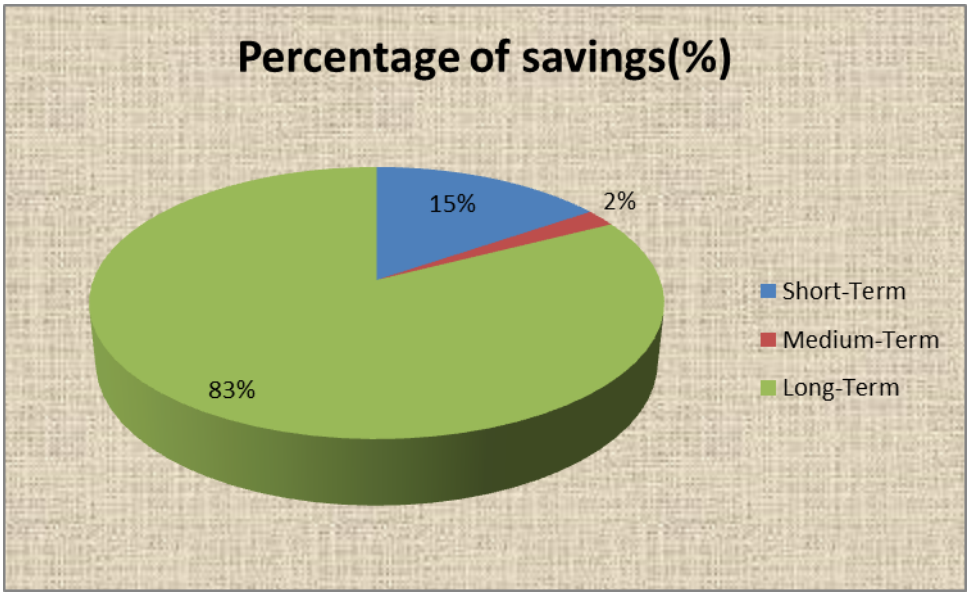

Figure 3: Savings (%)

1. INTRODUCTION

1.1 Preamble

B.S. Abdur Rahman Crescent Institute of Science and Technology is a renowned Quality Leadership Institution located at the greenest spot of Chennai near Tambaram since 1984. Through our long history of 38 years of excellence, the Institution has offered access to a wide range of academic opportunities. With 54 programmes, grouped under 12 different Schools, 31 Undergraduate programmes, 23 Postgraduate programmes, and Ph.D. (in all the departments), this institution is a rising stalwart in higher education with promising Quality, Security and Placement. We welcome students from all countries and our educational programmes are designed to equip the learners with virtual knowledge that helps them to achieve what they want to be and go where they want to go in the ladder of success.

This institution is an intellectual destination that challenges conventional thinking and stimulates passion to redefine learning. The distinctive teaching at this institution makes the students and scholars to compete with themselves and each other. Apart from providing top-notch education, our green campus and well-planned student life are solely dedicated to making students utilize the ambiance to the fullest. Through our wide array of educational programmes and unique clubs to foster student development activities, we provide opportunities and experiences that build community, help you grow personally and professionally, and create a place that you can call home now and throughout your life.

1.2 Objective

The energy audit is being conducted to identify areas of energy saving, both without and with investment.

This energy audit will also identify priorities for energy saving depending on saving potentials skills and time frame for execution, investment cost and payback etc.

1.3 Scope of Work

1 **Review of Electricity Bills, Contract Demand and Power Factor:** For the last one year, in which possibility will be explored for further reduction of contract demand and improvement of P.F.

2 **Electrical System Network:** Detailed study of all the Transformer operations of various Ratings / Capacities, their Operational Pattern, Loading, Power Factor Measurement on the Main Power Distribution Boards and scope for improvement if any. The study would also cover possible improvements in energy metering systems for better control and monitoring.

3 **Electrical Motors,** study of above 5 HP motors in terms of measurement of Voltage (V), Current (I), Power (kW) and P.F. in a complete cycle, and thereby suggesting measures for energy saving.

4 **Air Conditioning System:** The audit would involve analysis of various types of AC and usage. Further, various measures would be suggested to improve its performance.

5 **Illumination System:** Study of the illumination system, LUX level in various areas etc. and suggest measures for improvements and energy conservation opportunity wherever feasible.

6 **DG Sets:** Study the operations of DG Sets to evaluate their average cost of Power Generation, Specific Energy Generation and subsequently identify areas wherein energy savings could be achieved after analyzing the operational practices of the DG Sets.

7 **Pumping System:** Detailed Study of Pumps Measurement Analysis involves Pump Performance Study, the following parameters like Hydraulic Power, Pump Shaft Power, and Pump Efficiency are determined.

1.4 Methodology

SLRIS deputed senior Auditor for conducting the study and he worked in close association with the staff and officers of Crescent – Chennai.

SLRIS submitted an execution plan for assignment which was mutually agreed and relevant data support was provided by Crescent – Chennai.

The audit was started with an orientation meeting with Management / Operations / Maintenance personals.

SLRIS team conducted all necessary field trials and collected various data for analysis.

All the instruments support was provided by SLRIS for conducting the field study where in following instruments were used

1.5 List of Instruments Used

S. No	Instrument name	Specification
1	Power Analyser	
	a. ACV (True RMS)	Up to 830V
	b. ACA (True RMS)	Up to 6500 A
	c. Frequency	40 to 70 Hz
	d. Accuracy	+/- 0.5%
2	Clamp on Meter	
	a. ACV (True RMS)	10 to 600V
	b. ACA (True RMS)	10 to 1500 A
	c. Frequency	50 or 60 Hz
	d. Accuracy	+/- 0.5%
3	Lux Meter	
	a. Range	0 to 9999 lux
	b. Accuracy	+/- 4% of reading
4	Anemo Meter	
	a. Range	1 to 25 m/s
	b. Accuracy	+/- 3% of reading
5	Thermo Meter	
	a. Range	-50°C to 750°C
	b. Accuracy	+/- 1% of reading

Bouquets to CRESCENT-Chennai:

The following energy savings are already implemented in CRESCENT-Chennai:

1. LED lightings
2. Occupancy Sensor
3. 5 star rated and VRF AC's
4. BLDC Fans
5. Solar Water Heater
6. Solar Roof Top Power
7. Solar Street Light
8. Bio-gas Plant

2. BASELINE DATA FOR ENERGY AUDIT

2.1 Energy and Production

Energy (1 year data) details of CRESCENT – Chennai is given below:

1. Name of Electricity office : TANGEDCO
2. Tariff : HT IIB
3. Annual Energy Consumption

   Total EB Consumption : 40, 83,312 kWh/ Annum

   Total Solar Generation : 6, 63,189 kWh/ Annum

   Total DG Generation : 87, 994 kWh/Annum

4. Annual Energy bill

   Total Electricity bill paid to EB : Rs. 4, 26, 70,284 /Annum

   Total DG cost : Rs. 27, 23,650/ Annum

5. Unit Rate (EB+DG) : 9.4 Rs/kWh

% Source of Electricity

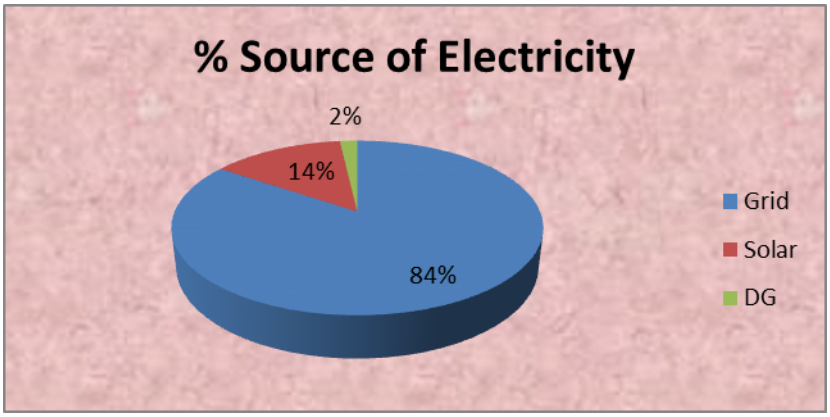

Figure 4: % Source of Electricity

% Load share of Utilities:

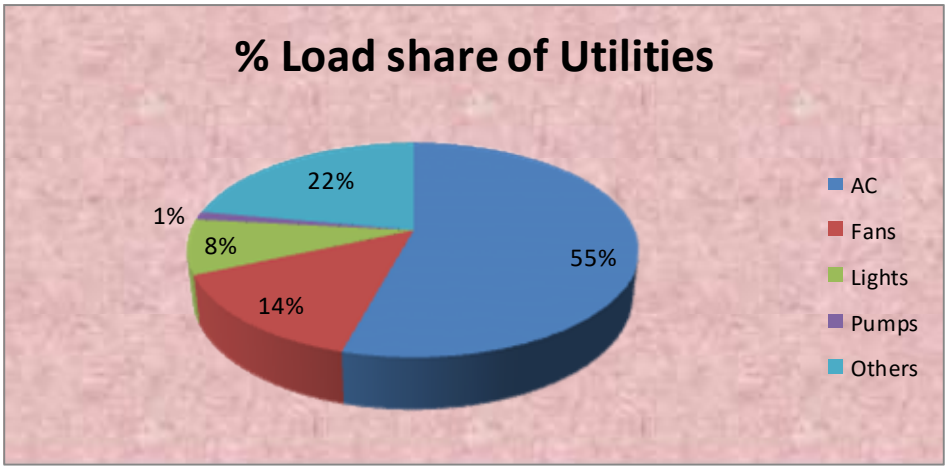

Figure 5: % Load of Utilities

Air Conditioners are the major power consumption followed by Fans.

% Load share of Utilities			
SL.No	**Particular**	**kWh/day**	**Consumption(%)**
1	AC	8748	54
2	Fans	2279	14
3	Lights	1334	8
4	Pumps	200	1
5	Others	3554	22
	Total	**16115**	**100**

% Load share-Feeder wise:

Sl.No.	Description	Actual Details				% share
		Voltage	Current	Active Power	Apparent Power	
		V	I	kW	kVA	
1	Chiller	400	130	81	90	11
2	MBA	400	70	44	48	6
3	Life science block	400	70	44	48	6
4	Men's Hostel	400	240	150	166	20
5	Ladies Hostel	400	60	37	42	5
6	Staff Quarters	400	70	44	48	6
7	Architecture	400	40	25	28	3
8	Science building	400	210	131	145	18
9	CIC	400	240	150	166	20
10	Arabic	400	60	37	42	5
Total			**1190**	**742**	**824**	**100**

It is recommended to provide energy meter for the all feeders

3. TRANSFORMER AND ELECTRICAL DISTRIBUTION SYSTEM

3.1 Transformer

At Presently CRESCENT- Chennai Receives Power from TANGEDCO at 11 kV and steps it down to 433 Volt using Distribution Transformer.

The Following Table showing the Design Details of the Transformer:

Distribution Transformer				
Description	**Unit**	**Transformer-1**	**Transformer-2**	**Transformer-3**
Make		Kirloskar	Universal	Universal
Type		Outdoor	Outdoor	Outdoor
Capacity	kVA	500	800	800
Voltage	HV	11000	11000	11000
	LV	433	433	433
Current	HV		42	42
	LV	666.7	1066.66	1066.66
Phases	HV	3	3	3
	LV	3	3	3
Frequency	Hz	50	50	50
Type of Cooling		ONAN	ONAN	ONAN
Year		1999	2006	2006
Status		Not in service	Working	Working

3.1.1 Voltage Analysis (800 kVA Transformer-2)

The Voltage (V) analysis for 800 kVA Transformer is given in following table

Parameter	Maximum	Minimum	Average
Line12 Voltage (Vrms)	402	396	399
Line 23 Voltage (Vrms)	405	400	403
Line 31 Voltage (Vrms)	401	399	400

3.1.2 Voltage Analysis (800 kVA Transformer-3)

The Voltage (V) analysis for 800 kVA Transformer is given in following table

Parameter	Maximum	Minimum	Average
Line12 Voltage (Vrms)	405	395	400
Line 23 Voltage (Vrms)	406	398	402
Line 31 Voltage (Vrms)	404	394	399

3.1.3 Current Analysis (800 kVA Transformer-2)

The Current (A) analysis for 800 kVA Transformer is given in following table.

Parameter	Maximum	Minimum	Average
Line1 Current (A)	625	575	600
Line 2 Current (A)	600	580	590
Line 3 Current (A)	610	590	600

3.1.4 Current Analysis (800 kVA Transformer-3)

The Current (A) analysis for 800 kVA Transformer is given in following table.

Parameter	Maximum	Minimum	Average
Line1 Current (A)	550	500	525
Line 2 Current (A)	600	500	550
Line 3 Current (A)	620	540	590

3.1.5 Apparent Power (kVA) Analysis (800 kVA Transformer-2)

The Apparent Power (kVA) analysis for 800 kVA Transformer is given in following table.

Parameter	Maximum	Minimum	Average
Line1 Power (kVA)	144	133	139
Line 2 Power (kVA)	139	134	136
Line 3 Power (kVA)	141	137	139

3.1.6 Apparent Power (kVA) Analysis (800 kVA Transformer-3)

The Apparent Power (kVA) analysis for 800 kVA Transformer is given in following table.

Parameter	Maximum	Minimum	Average
Line1 Power (kVA)	127	116	121
Line 2 Power (kVA)	139	116	127
Line 3 Power (kVA)	143	125	134

3.2 Transformer Loading

Transformer is a static device. Hence the losses of transformer are very low thus giving very high efficiency.

CRESCENT – Chennai has 2 Transformer (2*800 KVA) for energizing the Campus and one 500 kVA which is not in use.

For backup power supply, like emergency and critical loads, 2 DG sets of 750 KVA and 500 KVA capacities are put into operation during grid power failure.

The following table will give the Loading percentage of Transformer during audit.

Description	Rated Capacity(kVA)	Loading kVA			Loading %		
		Minimum	Maximum	Average	Minimum	Maximum	Average
Transformer-2	800	404	619	511	51	77	64
Transformer-3	800	357	600	479	45	75	60

Note:

Transformer is loading around 50 to 75%.

3.3 Motor Loading

Sl.No.	Description	Rated Power (kW)	Rated Efficiency	Voltage	Current	Power Factor	Active Power	Motor Loading
				V	I	COS Φ	kW	%
1	Chiller-1	75	93.2	405	102.0	0.85	61.0	75.8
2	Chilled water pump	7.5	89.0	405	13.6	0.92	8.8	104.4
3	AHU-1	3.7	89.0	407	7.6	0.73	3.9	93.8
4	AHU-2	4	89.0	407	6.6	0.75	3.5	84.2
5	AHU-3	4	89.0	407	7.0	0.80	4.0	96.2
6	AHU-4	3.7	89.0	407	6.7	0.80	4.0	96.2
7	AHU-5	2.2	89.0	407	2.7	0.60	1.1	44.5
8	AHU-6	2.2	89.0	407	3.7	0.70	1.7	68.8

Majority of Motor are loading above 50% which is OK

4. REVIEW OF ELECTRICITY BILL

4.1 Analysis of Electricity Bill

Following data has been taken from electricity bill:

Contract Demand	:	1200 kVA
Maximum Demand recorded	:	1219 kVA (May 2023)
Demand Charges	:	Rs. 562/ kVA
Power Factor	:	0.97
Total Units Consumed	:	40, 83,312 kWh
Total Electricity Bill	:	Rs. 4, 26, 70,284
Unit Rate	:	Rs. 9.0/kWh

4.2 Energy Consumption Month wise

Average Unit cost is around Rs 9.0 for EB and Rs 9.4 for EB and DG. For savings calculation, unit cost is taken as Rs 9.4.

No	Months	Contract Demand (kVA)	Actual Recorded Demand (kVA)	Demand Cost (Rs.)	EB units	Solar units	DG Units	Total Energy Consumption, kWh	Power Factor	Diesel ltrs	Demand Penalty	EB Amount (Rs)	DG Cost (Rs)	Total Amount-EB+DG (Rs)	Unit Cost-EB (Rs)	Unit Cost-EB+DG (Rs)
1	Jan-23	1200	744	594,000	245,496	58,407	2,952	306,855	0.98	780		2,699,431	73,320	2,772,751	8.9	9.0
2	Feb-23	1200	816	594,000	269,466	62,748	2,142	334,356	0.98	850		2,899,939	79,900	2,979,839	8.7	8.9
3	Mar-23	1200	1070	594,000	371,754	58,141	1,322	431,217	0.97	600		3,758,154	56,400	3,814,554	8.7	8.8
4	Apr-23	1200	1107	609,180	325,014	69,058	6,008	400,080	0.98	2,050		3,380,131	192,700	3,572,831	8.6	8.9
5	May-23	1200	1219	670,560	431,052	59,994	16,699	507,745	0.97	5,990	21,120	4,357,011	563,060	4,920,071	8.9	9.7
6	Jun-23	1200	1134	623,700	339,420	58,915	8,587	406,922	0.97	3,040		3,516,185	285,760	3,801,945	8.8	9.3
7	Jul-23	1200	1026	606,960	283,956	51,732	4,275	339,963	0.97	1,745		3,076,449	164,030	3,240,479	9.2	9.5
8	Aug-23	1200	1161	652,819	405,990	57,044	16,075	479,109	0.97	5,520		4,176,032	518,880	4,694,912	9.0	9.8
9	Sep-23	1200	1196	672,376	388,764	56,507	8,217	453,488	0.96	1,890		4,050,470	177,660	4,228,130	9.1	9.3
10	Oct-23	1200	1134	637,308	382,566	42,397	5,853	430,816	0.97	1,950		3,963,549	183,300	4,146,849	9.3	9.6
11	Nov-23	1200	1095	615,727	365,388	45,151	4,046	414,585	0.97	1,190		3,792,730	111,860	3,904,590	9.2	9.4
12	Dec-23	1200	828	606,960	274,446	43,095	11,768	329,309	0.99	3,370		3,000,203	316,780	3,316,983	9.4	10.1
	Total	**1,200**	**1,044**	**7,477,590**	**4,083,312**	**663,189**	**87,944**	**4,834,445**	**0.97**	**28,975**	**21,120**	**42,670,284**	**2,723,650**	**45,393,934**	**9.0**	**9.4**

4.3 Month Vs. Energy Consumption Analysis

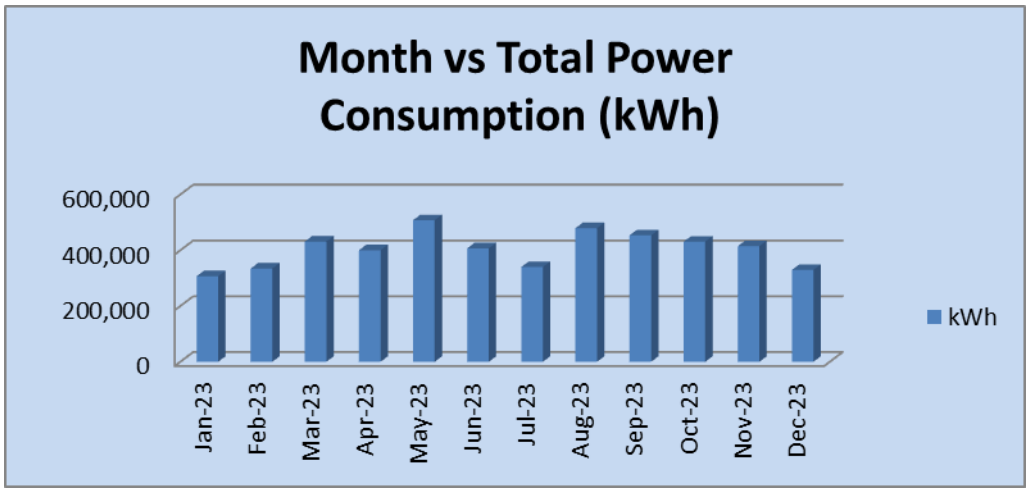

Figure 3: Month Vs. Energy Consumption Analysis

Power consumption is varied in months due to season variation.

4.4 Month vs. Total Cost Analysis

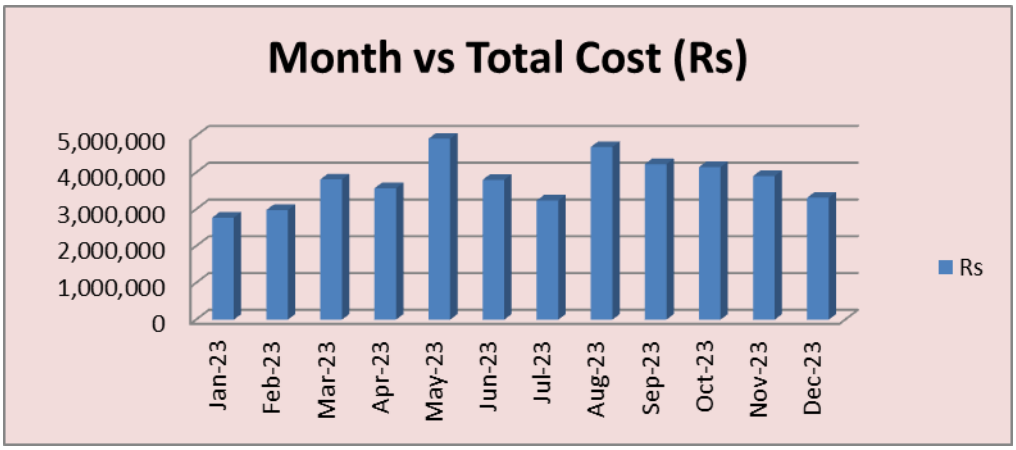

Figure 4: Month Vs. Total Cost Analysis

May Month EB cost is more due to more consumption.

4.5 Month vs. Demand Analysis

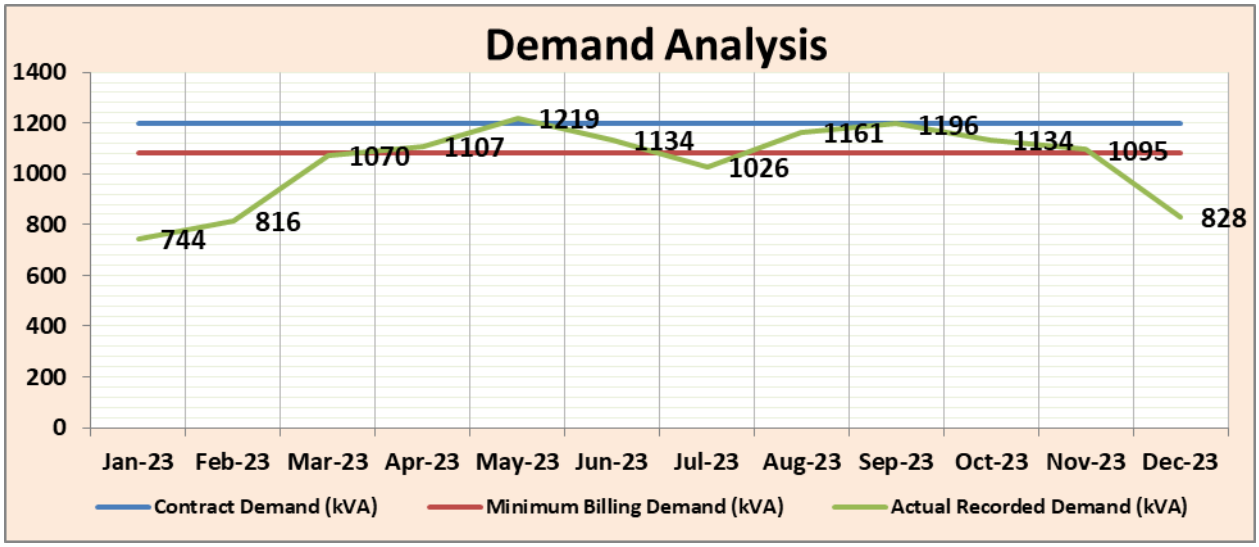

Figure 5: Month Vs. Demand Analysis

Max demand reached is 1219 kVA and contract demand is 1200 kVA. Suggested to provide Demand Controller to avoid demand penalty cost-Refer ECM 5.

4.6 Month vs. Power Factor Analysis

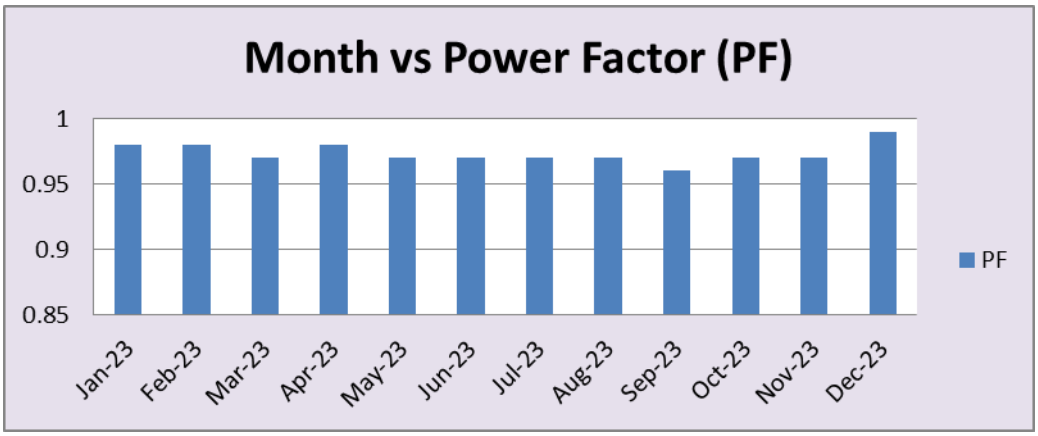

Figure 6: Month Vs. PF Analysis

Power Factor is maintained at 0.97 on average which is OK

5. LIGHTING SYSTEM

Lighting is a very significant aspect of utility. The efficiency, comfort factors and the quality of lighting should not be compromised.

70% lamps are replaced with LED lamps to reduce energy consumption.

SL NO	BUILDING	QTY	TOTAL WATTS	Operating Hours/day	kWh/day
1	AUDITORIUM	206	4487	8	36
2	SCIENCE BLOCK	435	5684	12	68
3	AERO BLOCK	573	6964	12	84
4	MAIN BLOCK	382	6252	12	75
5	MBA BLOCK	123	2597	12	31
6	FIRST YEAR BLOCK	217	4305	12	52
7	LIFE SCIENCE BLOCK	108	2828	12	34
8	NEW STAFF QUARTERS	383	5135	12	62
9	LADIES HOSTEL	664	8359	12	100
10	CAMPUS STREET LIGHT	286	8570	12	103
11	MEDICAL	35	589	12	7
12	PHARMACY	143	2575	12	31
13	GM OFFICE	47	910	8	7
14	MAIN CANTEEN	45	1042	12	13
15	VC OFFICE	100	620	8	5
16	VC VILLA	51	571	12	7
17	GUEST HOUSE	37	680	12	8
18	DRIVERS CABIN	8	120	12	1
19	OLD STAFF QUARTERS	53	1005	12	12
20	SPORTS LIGHTING	64	12800	8	102
21	HR OFFICE	27	500	8	4
22	PARANTS WAITING HALL	12	166	8	1
24	NEW ARCHITECTURE BLOCK	614	10808	12	130
25	CIVIL YARD CLASS ROOMS	40	650	12	8

SL NO	BUILDING	QTY	TOTAL WATTS	Operating Hours/day	kWh/day
26	CSB ROOM MENS HOSTEL	47	780	12	9
27	ROBOTICS LAB	22	280	12	3
28	RESEARCH SCHOLAR ROOM CHEMISTRY	4	144	12	2
29	FOOD WASTE MANAGEMENT PLANT	26	640	12	8
30	SOLAR STREET LIGHT	10	250	12	3
31	MENS HOSTEL	1007	13219	12	159
32	MBA PHASE 1	49	595	12	7
33	MBA PHASE 2	170	3108	12	37
34	COMPUTER SCIENCE LAB	51	690	12	8
35	PURCHASE OFFICE (EO)	2	30	8	0
36	CIIC BLOCK	328	5479	12	66
37	CIIC 2ND FLOOR STUDIO	13	225	12	3
38	DRAWING HALLS & LABS(MECH)	60	709	12	9
39	CANTEENS	119	1984	12	24
40	OUTDOOR LIGHTING	63	1306	12	16
TOTAL		**6624**	**117,656**		**1,334**

It is suggested to replace FTL with LED at Men's hostel, Canteen and Drivers cabin to reduce power consumption. (Refer ECM- 1)

It is recommended to install additional Solar street lights in road to reduce power consumption (Refer ECM-9)

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6. AIR CONDTIONERS

6.1 Introduction

In CRESCENT – Chennai using Split and Cassette type AC for comfort cooling. AC load is major one and around 1400 TR load is connected.

6.2 Study of AC

Set temperature of AC's are checked at various location. It is suggested to maintain AC temperature above 24°C. Old window AC's are available in campus. It is suggested to replace the AC with 5 star AC to reduce power consumption. (Refer ECM-7). Refer Annexure at the end of report for AC details.

7. Chiller

7.1 Introduction

In CRESCENT – Chennai using Chiller for Auditorium cooling. The following table gives the rated parameters of Chiller.

Description	Unit	Chiller-1	Chiller-2
Make		Blue Star	Blue Star
Type		Air Cooled	Air Cooled
Model		LCA1-090x54	LCA1-090x54
Cooling Capacity	TR	92	92
Chiller input power	kW	107	107
SEC	kW/TR	1.16	1.16
Refrigerant		R134a	R134a
Year		2012	2012

Chiller Pumps

S.No	Description	Rated Parameters					
		Pump Make	Design flow	Rated Head	Rated Power	Motor Make	Rated Motor Efficiency
			m3/h	m	kW		%
1	CH water pump-1	Kirloskar	50.4	30	7.5	Kirloskar	89.0
2	CH water pump-2	Kirloskar	50.4	30	7.5	Kirloskar	89.0
3	CH water pump-3	Kirloskar	50.4	30	7.5	Kirloskar	89.0

7.2 Study of Chiller and Pumps

Old Air cooled Chillers have been replaced with new Chillers based on previous audit report. Normally 1 chiller with 1 chilled water circulation pump is in operation. 2nd Chiller and pump will ON based on occupancy in auditorium. 3rd pump is kept as standby.

During audit, 1 chiller and pumps parameters are measured. The measured parameters are as follows:

Description			Units	Chiller-1
Evaporator	Chilled water temperature	Inlet	^{0}C	14.5
		Outlet	^{0}C	13.0
	Chilled water pressure	Inlet	bar	2.2
		Outlet	bar	2.1
	Refrigerant Suction pressure		psi	44
	Refrigerant Saturated suction temperature		^{0}C	9.3
	Evaporator Approach		^{0}C	3.7
	Measured pressure drop across evaporator		Meter	1.0
	Chiller evaporator designed water flow		m^3/h	55
	Chiller designed pressure drop at evaporator		Meter	0.4
	Estimated chilled water flow through the chiller based on pressure drop		m^3/h	87
	Calculated chiller load		**TR**	43
	Measured compressor input power-R phase		kW	61
	Measured compressor input power-Y phase		kW	62
	Measured compressor input power-B phase		kW	62
	Average Compressor input power		kW	62
	Chiller Specific Energy Consumption		**ikW/TR**	**1.43**

*Chiller design SEC is 1.16 and actual is 1.43 kW/TR which is high due to part load running

Chilled Water Pumps:

*Water is pumped to circulate chilled water through AHU for cooling. The measured parameters are as follows:

S.No	Description	Measured Parameters			Calculated Parameters		
		Flow	Head	Power Measured	Hydraulic Power	Motor Input Power	Pump Efficiency
		m3/h	m	kW	kW	kW	%
1	CH water pump-1	87	18	8.8	3.16	7.83	40

8. FANS

8.1 Introduction

In CRESCENT – Chennai using Ceiling fans at office and hostel room. Some fans are replaced with BLDC type and suggested to replace other fans with BLDC-Refer ECM 6.

9. RENEWABLE ENERGY

*6 no's Solar Water heater available in ladies hostel is not working and suggested to rectify to reduce heater power consumption-Refer ECM 2

*650 kWp Solar roof top panels were installed in the campus. Solar energy generation is low as compared with previous year. Also found that some panels are removed due to problem. It suggested to rectify the problem-Refer ECM 4

*Solar street lights are available in campus and suggested to provide additional lights–Refer ECM 9.

*Explore the possibility of installing solar panels in other locations-Refer ECM-10

10 DIESEL GENERATORS

At CRESCENT – Chennai, 2 Diesel Generator sets of 750 kVA and 500 kVA capacities are used for power back-up during power failure. The specification of the DG's are listed in the below table.

Month wise power generation and Diesel consumption were recorded in log book by Campus. and the details are as follows:

No	Months	DG		
		Power generation (kW)	Diesel Consumption (Litres)	SEC
1	Jan-23	2,952	780	3.8
2	Feb-23	2,142	850	2.5
3	Mar-23	1,322	600	2.2
4	Apr-23	6,008	2,050	2.9
5	May-23	16,699	5,990	2.8
6	Jun-23	8,587	3,040	2.8
7	Jul-23	4,275	1,745	2.4
8	Aug-23	16,075	5,520	2.9
9	Sep-23	8,217	1,890	4.3
10	Oct-23	5,853	1,950	3.0
11	Nov-23	4,046	1,190	3.4
12	Dec-23	11,768	3,370	3.5
	Total	**87,944**	**28,975**	**3.0**

SEC has to be maintained above 3 kWh/Liter.

11. Pumps and Blower

11.1 Introduction

CRESCENT Chennai using pumps for domestic water pumping and Blowers for aeration. The following table gives the rated parameters of Pumps.

Description	Main block Pump room			Science Block
	Pump: 1	Pump: 2	Pump: 3	Pump: 2
Pump Make	Beacon	Kirloskar	Crompton	Kirloskar
Total Head	35 m		36 m	
Rate of Flow			12 LPS	
Motor Make	Beacon	Kirloskar	Crompton	Kirloskar
Rated Power	5.5 kW	5.5 kW	5.5 kW	5.5 kW

11.2 Study of Pumps and blower

Pumps are old one and efficiency was low. Suggested to replace with new one -Refer ECM 8.

STP Blowers are running 24 hours for aeration purpose. Twin lobe blowers are used and suggested to replace with Tri-lobe blowers to reduce power consumption-Refer ECM 3

12. ENERGY CONSERVATION MEASURES

ECM1: Replace FTL Lamps with Energy Efficient LED Lamps

PRESENT SYSTEM

- Fluorescent tube lamps (FTL) are used at different locations in Campus
- Lamp efficacy is about 60-80 lumens/Watt
- FTLs have lamp life of < 8000 burning hours only
- Lumen depreciation Will be > 30% till end of life, leading to frequent maintenance & replacements
- Minimum voltage required is 180 V to ignite lamp

1x40 W FLUORESCENT TUBE LAMP

PROPOSAL

- Replace all remaining FTL lamps with Energy Efficient LED lamps-Men's hostel, Canteen and Drivers cabin
- Longer lamp life than conventional lamps
- 50% reduction in energy consumption with constant luminous flux compared with conventional lamps

ESTIMATED BENEFITS

Recurring annual cost savings : Rs 1, 80,480
Investment Cost : Rs 1, 20,000
Payback period : 8 Months

BACK-UP CALCULATION

Description	Units	Value
Power Consumption of FTL lamps	W	40
Power consumption of LED	W	20
Total no of Lamps	No	400
Lamps Glowing Hours	Hours/day	8
Operating Days(Approx.)	Days/ Annum	300
Expected Energy Savings	kWh/Annum	19,200
Energy Cost	Rs/kWh	9.4
Monetary Savings	Rs./ Annum	180,480
Investment Cost	Rs	120,000
Payback period	Months	8

ECM 2 Rectify Solar water heater at ladies hostel and reduce power consumption

PRESENT SYSTEM

- Solar water heaters (500 LPH) are available for ladies hostel hot water requirement
- 6 no's of Heater are not working and electric heater is used for bathing
- High power consumption

SOLAR WATER HEATER NOT IN SERVICE

PROPOSAL

- Rectify Solar water heaters or replace new one
- Heat the water from ambient temperature to 50^{o}C
- This will save heater power consumption

ESTIMATED BENEFITS

Recurring annual cost savings : Rs 1, 96,744
Investment Cost : Rs 1, 80,000
Payback period : 11 Months

BACK-UP CALCULATION

Description	Units	Value
Solar Water Capacity	Litre	500
No of heaters not working	No	6
Ambient temp	^{o}C	30
Hot water temperature from Solar heater	^{o}C	50
Equivalent Heat	kcal/day	60,000
Electricity saved	kWh/day	69.8
No. of days considered	Days	300
Annual electricity saving	kWh	20,930
Present Electricity cost	Rs./kWh	9
Recurring annual cost savings	Rs	196,744
Implementation cost	Rs	180,000
Payback period	months	11

ECM 3 Replace STP blower with new energy efficient blower & save power consumption

PRESENT SYSTEM

- 7.5 kW Twin lobe Blowers 2 no's are available for aeration air supply
- Blower efficiency is low
- It leads to high power consumption

Blower Twin lobe

PROPOSAL

- Replace existing Twin lobe blowers with Tri-lobe blowers
- Blower efficiency is high
- This will reduce power consumption.

ESTIMATED BENEFITS

Recurring annual cost savings : Rs 2, 42,615
Investment Cost : Rs 2, 50,000
Payback period : 12 months

BACK-UP CALCULATION

Description	Units	Value
Measured air flow	m^3/s	0.06
Measured static pressure	mmWc	4000
Measured input power	kW	6.6
Expected new Blower efficiency	%	70
Expected new Blower power consumption	kW	3.7
Power savings	kW	2.9
Annual operating hours	h	8760
Annual energy savings	kWh	25,810
Electricity cost	Rs/kWh	9.40
Recurring annual savings	Rs.	242,615
One time cost of implementation	Rs.	250,000
Payback period	Months	12

ECM 4 Rectify solar roof top panel and reduce EB power consumption

PRESENT SYSTEM

- Solar roof top panel of 650 kWp was installed in Campus.
- Presently 30 kWp is not working and power was not generated
- Power generation was low as compared to previous year
- EB power consumption is more.

SOLAR PANEL NOT AVAILABLE

PROPOSAL

- Rectify the panel problem by replacing new panel
- Solar additional power can be generated daily.
- This will save EB energy cost.

ESTIMATED BENEFITS

Recurring annual cost savings : Rs 61,506
Investment Cost : Rs 1, 00,000
Payback period : 20 Months

BACK-UP CALCULATION

Description	Units	Value
Solar plant capacity	kW	650
Actual power generation by the Campus year 2023	kwh/Annum	663,189
Power generation by the Campus year 2021	kwh/Annum	671,229
Additional power to be generated	kwh/Annum	8,040
Unit Cost saving	Rs./kWh	7.65
Annual Cost Savings	Rs	61,506
Investment cost	Rs	100,000
Payback Period	Months	20

ECM 5: Provide Demand Controller and avoid Penalty

PRESENT SYSTEM

- Present contract demand with TNEB is 1200 kVA. Demand charges are Rs.562/kVA
- Demand charges are billed for actual demand reached or 90% of contract demand (1080 kVA), whichever is higher
- During May 2023, the demand was exceeded and reached to 1219 kVA

PROPOSAL

- Provide Demand Controller in Incomer panel
- This will give alarm when demand reached to set limit.
- Non-essential load can be switched OFF during excess time
- Or Enhance the contract demand by taking up with TNEB

ESTIMATED BENEFITS

Recurring annual cost savings : Rs 21,120
Investment Cost : Rs 40,000
Payback period : 23 months

BACK-UP CALCULATION

Description	Units	Value
Present contract demand	kVA	1200
Maximum recorded demand (May 2023)	kVA	1219
Present penalty paid	Rs.	21,120
Recurring annual cost savings	Rs.	21,120
One time cost of implementation	Rs.	40,000
Payback period	months	23

ECM 6 Replace conventional fans with EE BLDC fans

PRESENT SYSTEM

- Ceiling fans are used at Campus and hostel areas.
- Conventional types are available.
- This leads to high power consumption

Ceiling Fan-Conventional

PROPOSAL

- Replace conventional fans into energy efficient BLDC fans-Men's hostel, Staff Quarters, Ladies hostel and Aero block
- BLDC fans consumes less energy
- This will reduce power consumption.

ESTIMATED BENEFITS

Recurring annual cost savings : Rs 3, 55,320
Investment Cost : Rs 10, 50,000
Payback period : 35 Months

BACK-UP CALCULATION

Description	Units	Value
Total No of Fans identified for replacement	No	300
Present Power consumption of fan	W	70
Proposed EE fan power consumption	W	35
Savings	W	35
Annual Operating Hours	h	3,600
Annual Energy Savings	kWh	37,800
Electricity cost	Rs./kWh	9.4
Annual cost Savings	Rs	355,320
One time cost of implementation	Rs	1,050,000
Payback	Months	35

ECM -7: Replace old AC's with Energy efficient 5 star rated split AC and reduce power consumption

PRESENT SYSTEM

- Windows AC of 2 TR capacities are running at Library, Conference, LAB and seminar hall.
- Old AC SEC is high
- It leads to more power consumption.

PROPOSAL

- Replace existing window AC with 5 star rated split AC
- 5 Star rated ACs SEC is low
- This will reduce power consumption.

ESTIMATED BENEFITS

Recurring annual cost savings : Rs 4, 23,000
Investment Cost : Rs. 15, 00,000
Payback period : 43 Months

BACK-UP CALCULATION

Description	Units	Value
Number of air conditioners	No	25
Installed cooling capacity	TR	2
Specific power consumption of present AC	kW/TR	1.3
Power consumption of present AC	kW	2.6
Specific power consumption of proposed AC	kW/TR	1
Expected power consumption with new AC	kW	2
Power savings	kW	0.6
Annual operating hours	h	3,000
Annual energy savings	kWh	45,000
Unit power cost	Rs./kWh	9.4
Annual cost savings	Rs.	423,000
One time cost of Implementation	Rs.	1,500,000
Payback period	Months	43

ECM 8 Replace domestic Water pumps with new pumps and reduce power consumption

PRESENT SYSTEM

- 5.5 kW rated capacity Water pumps are available in main block and science block for pumping water from sump to OH tank
- Pumps are old one and efficiency is low
- This leads to more power consumption.

OLD WATER PUMPS

PROPOSAL

- Replace main block and science block pumps with energy efficient pump.
- Provide water level controller
- This will reduce power consumption.

ESTIMATED BENEFITS

Recurring annual cost savings : Rs 12,408
Investment Cost : Rs 50,000
Payback period : 48 Months

BACK-UP CALCULATION

Description	Units	Main block	Science	Total
Power consumption of existing pump	kWh	3.4	3.5	6.9
Power consumption of new pump	kWh	2.9	2.9	5.8
Expected Energy Savings	kWh	0.5	0.6	1.1
Run hours	Hours	4	4	
Working Days	Days	300	300	
Annual Energy Savings	kWh	600	720	1,320
Energy Cost	Rs/kWh	9.4	9.4	
Annual Cost Savings	Rs	5,640	6,768	12,408
Investment Cost	Rs	25,000	25,000	50,000
Payback Period	Months	53	44	48

ECM -09: Replace Street light with Solar powered light and reduce power consumption

PRESENT SYSTEM

- Presently Street lights are available in Campus for lighting purpose
- 30W LED lamps are used
- It leads to electricity power consumption.

PROPOSAL

- Provide additional Solar Street light in front of the roads.
- Install 10 no's of lights.
- This will reduce power consumption.

ESTIMATED BENEFITS

Recurring annual cost savings : Rs 12,352
Investment Cost : Rs 60,000
Payback period : 58 Months

BACK-UP CALCULATION

Description	Units	Value
Power Consumption of Street lamps	W	30
No of lamps for replacement	No	10
Usage Hours	Hours/day	12
Present Power Consumption	kW/day	3.6
Proposed Power Consumption	kW/day	0
Savings	kWh/day	3.6
Operating Days(Approx.)	Days/ Annum	365
Expected Energy Savings	kWh/Annum	1,314
Energy Cost	Rs/kWh	9.4
Monetary Savings	Rs./ Annum	12,352
Investment Cost	Rs	60,000
Payback period	Months	58

ECM 10 Explore the possibility of Roof Top Solar PV to generate electrical energy

PRESENT SYSTEM

- 650 kWp Solar roof top panel was installed in Campus
- Presently Architecture block, Science block, Main block, Aerodynamic block, MBA block, Auditorium & CIIC area. Are having solar panels

PROPOSAL

- Explore the possibility to Install Solar Roof Top panel in identified areas- Substation, FM Lab etc.
- Possibility of generation of 300 kW power
- This will save EB cost.

ESTIMATED BENEFITS

Recurring annual cost savings : Rs 25, 06, 140
Investment Cost : Rs 1, 26, 00,000
Payback period : 60 Months

BACK-UP CALCULATION

Description	Units	Value
Available roof-top area	m^2	3,000
Installable capacity of SPV generation	kWp	300
Proposed average power generation	kW/day	1260
No. of days considered	Days	260
Annual Electricity generation from solar PV	kWh	327,600
Present electricity unit cost	Rs./kWh	7.65
Recurring annual cost savings	Rs	2,506,140
One-time cost of implementation	Rs	12,600,000
Payback period	months	60

13. Recommendation and Conclusions

- On an energy bill of Rs 4, 53, 93, 934, around 9% of savings can be achieved by implementing all schemes.
- The annual savings potential is Rs 40, 11,685 which can be gained by investing Rs 1, 59, 50, 500 with an average payback period of 48 months.
- It is recommended to install dedicated energy meters and energy monitoring system before implementing the schemes. This is required for establishing the baseline as well as for measurement and verification of savings upon implementation of each scheme.
- CRESCENT CHENNAI to reconfirm the investments by obtaining site-specific offers covering performance guarantee for savings.
- The implementation of the evaluated schemes needs to be taken up for implementation in a time bound manner with in a period of two years.

14. ANNEXURE

14.1 AC Data

No.	Location	Make/Type	Star rating	TR Capacity	Quantity	Total TR	kWh/ day
1.	GROUND FLOOR	OG/VRF		14	1	14	56
2.	GROUND FLOOR	OG/SPLIT		1	2	2	16
3.	GROUND FLOOR	OG/SPLIT		2	2	4	32
4.	GROUND FLOOR	SANYO/SPLIT		2	1	2	16
5.	GROUND FLOOR	OG/CASSETTE		3	1	3	24
6.	GROUND FLOOR	OG/WINDOW		2	2	4	32
7.	GROUND FLOOR	DAIKIN/SPLIT	2	2	1	2	16
8.	GREEN ROOM	DAIKIN/CASSETTE	2	2	2	4	32
9.	1 ST FLOOR	OG/SPLIT AC	2	2	1	2	16
10.	1 ST FLOOR	DAIKIN SPLIT	5	1	1	1	8
11.	1 ST FLOOR	SANYO SPLIT		1	1	1	8
12.	1 ST FLOOR	OG CASSETTE		2	1	2	16
13.	1 ST FLOOR	SANYO SPLIT		2	5	10	80
14.	1 ST FLOOR	VESTAR SPLIT	3	2	1	2	16
15.	1 ST FLOOR	OG WINDOW		2	2	4	32
16.	2 ND FLOOR	BLUE STARCHILLER		100	2	200	800
17.	APPLE LAB	SPLIT AC		1.5	4	6	48
18.	SEMINAR HALL 1	OG VRF		10	2	20	80
19.	SEMINAR HALL 2	OGVRF		14	1	14	56
20.	SEMINAR HALL3	OG CASSETTE		3	6	18	72
21.	PLACEMENT OFF	OG SPLIT		1	6	6	48
22.	PLACEMENT OFF	OG CASSETTE		1	1	1	8
23.	PLACEMENT OFF	OG SPLIT		2	1	2	16
24.	MAIN BLOCK GF	DAIKIN SPLIT	3	1.5	4	6	48
25.	ACCOUNTS OFFICE	OG SPLIT		1	2	2	16
26.	DEAN OFFICE	OG SPLIT		2	1	2	16
27.	DEAN OFFICE	DAIKIN SPLIT	3	1.5	1	1.5	12
28.	CDOE	OG SPLIT		2	1	2	16

No.	Location	Make/Type	Star rating	TR Capacity	Quantity	Total TR	kWh/ day
29.	DEAN OFFICE	VESTAR SPLIT	3	2	1	2	16
30.	DEAN OFFICE	OG SPLIT		2	1	2	16
31.	OFFICE OF DEAN	OG WINDOW		2	1	2	16
32.	PG& RESE LAB	OG SPLIT		2	1	2	16
33.	DEEN OFFICE	OG SPLIT		2	1	2	16
34.	DR KAJA OFFICE	OG SPLIT		2	1	2	16
35.	KUTTI RANI	ONIDA SPLIT		1.5	1	1.5	12
36.		OG SPLIT		2	1	2	16
37.	1F/COM/LAB	OG/SPLIT		2	2	4	32
38.	CONFERENEE	OG/WINDOW		1.5	3	4.5	36
39.	SEMINER HALL	OG/SPLIT		2	2	4	32
40.	EEE HOD CABIN	DAIKIN/SPLIT	3	2	1	2	16
41.	Departm,library	OG/WINDOW		1.5	1	1.5	12
42.		OG/WINDOW		1.5	1	1.5	12
43.	2F,Process,comt,lab	OG/WINDOW		2	4	8	64
44.		OG/WINDOW		1.5	1	1.5	12
45.		Daikan/split		2	1	2	16
46.	EIE HOD	OG/SPLIT		2	1	2	16
47.	DEAN	OG/SPLIT		2	1	2	16
48.	SEMINER HALL	OG/SPLIT		2	2	4	32
49.	Computer,LAB	OG/WINDOW		2	2	4	32
50.	Computer,Hall	OG/WINDOW		2	2	4	32
51.	MIS	Vestar/split	3	2	3	6	48
52.	COE	OG/SPLIT		2	1	2	16
53.	COE/STRONG	OG/SPLIT		2	1	2	16
54.	ACOE	OG/Slit	3	2	1	2	16
55.	DCOE	OG/SPLIT		2	1	2	16
56.	3,F,Dept of civil eng	SANYO/SPLIT		2	2	4	32
57.	Power electr lab	OG/SPLIT	5	2	2	4	32
58.	Power electr lab	SANYO/SPLIT		2	1	2	16
59.	Automation lab	OG/SPLIT		2	2	4	32
60.	PG civil lab	SANYO/SPLIT		2	2	4	32

No.	Location	Make/Type	Star rating	TR Capacity	Quantity	Total TR	kWh/ day
61.	LSG cili lab	SANYO/SPLIT		2	3	6	48
62.	G,floor,ATM	Voltas/split		1.5	2	3	72
63.	BOOK STOR	DAIKAN/Split		1.5	2	3	24
64.	Telephon exch	OG/Split		2	1	2	48
65.	VC/OFFICS	DAIKAN/Split		2	1	2	16
66.	VC/OFFICS	OG/Casset		3	2	6	48
67.	VC/OFFICS	OG/Casset		2	2	4	32
68.	VC/OFFICS	OG/Casset	3	3	1	3	24
69.	VC/OFFICS	OG/Casset		1.5	2	3	24
70.	VC/OFFICS	Daikan/split	3	1.5	1	1.5	12
71.	VC/OFFICS	OG/split	3	1.5	1	1.5	12
72.	VC/OFFICS	OG/Split		1	1	1	8
73.	Mba/G/F metal, lab	OG/window		2	2	4	32
74.	Mechatronics,lab	OG/window		2	2	4	32
75.	Metrology lab	OG/window		2	2	4	32
76.	CIM LAB	OG/window		2	3	6	48
77.	Cad LAB	Onida/window		2	2	4	32
78.	Room122	Votes/window		2	1	2	16
79.	Polmer/lab	Votes/window		2	2	4	32
80.	Rescapch lab	OG/Split		1	1	1	4
81.	Sescapch lab	OG/Split		1	1	1	4
82.	Seminar hall	OG/window		2	2	4	16
83.	1,F,Class room101	OG/Split	3	2	5	10	80
84.	Libray	Daikan/split		2	2	4	32
85.	Seminar hall,offic	Og/vrv 1outdoor		10	1	10	80
86.	Computer lab	Og/vrv 1outdoor		10	1	10	80
87.	Lectur lab	Og/vrv 1outdoor		9	1	9	36
88.	Calss room 102	Daikin /split	5	2	5	10	80
89.	Sm104	OG/split	3	2	1	2	16
90.	Wideanglexpey	Sanyo /split		1.5	2	3	24
91.	Maths /Hot	Vestar/split	3	2	1	2	16
92.	Dean	Lancer/window		1.5	1	1.5	12
93.	Computer lab	OG/window		2	2	4	32

No.	Location	Make/Type	Star rating	TR Capacity	Quantity	Total TR	kWh/ day
94.	Calss room	Sanyo /split		1.5	2	3	24
95.	Calss room	OG/window		2	2	4	32
96.	Seminar hall	OG/vrv/1outdoor		14	1	14	112
97.	Seminar hall	Daikin/split/ductable		5	1	5	40
98.	Depart of com	Daikin/split	4	1.5	1	1.5	12
99.	Life sci 5fl ass pro	OG/Split		2	2	4	32
100.	6f amimal lab2	OG/Split	3	1.5	2	3	24
101.	6f amimal lab1	Vrv/Daikin		1.5	2	3	24
102.	7Floor/Dean	OG/split		2	1	2	16
103.	LAB	Vrv/Daikin		16	1	16	128
104.	1year/G/F/HOD	Onida/split	3	1.5	1	1.5	12
105.	paysics	OG/Split		1.5	3	4.5	36
106.	Chemist HOD	OG/Split	3	2	1	2	16
107.	1Floor eng HOD	Sanyo/split		1.5	1	1.5	12
108.	2Floor/com/lab	OG/window		1.5	1	1.5	12
109.	Aero/G/Foor	OG/Split		2	1	2	16
110.	1floor	Daikin vrv		9	1	9	72
111.	Robo lab	Bluestar/ductabl		8.5	1	8.5	68
112.	2floor/cfd lab	Daikin/casset		3	2	6	48
113.	Conferen hall	Daikin/split	5	1.5	1	1.5	6
114.	Hod	Daikin/split	5	1.5	1	1.5	12
115.	3floor conferen hall	OG/split		2	1	2	16
116.	Hod	Daikin/split	5	1.5		0	0
117.	5floor	Vrv /daikin		12	1	12	96
118.	Comput/sc/G/F,it lab	OG/WINDOW		2	9	18	144
119.	IT HOD	OG/split		2	1	2	16
120.	SPPC LAB	OG/WINDOW		2	2	4	32
121.	Confenren hall	OG/split	5	2	2	4	32
122.	ICC	OG/split		1.5	1	1.5	12
123.	library	Sanyo /split		1.5	1	1.5	12
124.	1floor library	OG/split		2	4	8	64
125.	library	OG/split	3	1.5	1	1.5	12
126.	Lab 2	OG/WINDOW		2	5	10	80

No.	Location	Make/Type	Star rating	TR Capacity	Quantity	Total TR	kWh/ day
127.	Lab &ups	OG/WINDOW		2	2	4	32
128.	Boart room	Sanyo /split		1.5	1	1.5	6
129.	Dean room	Sanyo /split		1.5	1	1.5	12
130.	Scimc office dean	OG/WINDOW		2	3	6	48
131.	Cse semina hall	OG/split		2	2	4	32
132.	Csc Hod hall	OG/split		2	2	4	32
133.	Al&ml lab	OG/split	5	2	4	8	64
134.	Programming lab	OG/split	5	1.5	2	3	24
135.	Cybersecubity lab	OG/split	5	1.5	3	4.5	36
136.	Notworicng lab	OG/split	5	1.5	2	3	24
137.	Staff room	OG/window		1.5	1	1.5	12
138.	Ece hod	OG/window		2	1	2	16
139.	Seminar hall	OG/window		2	3	6	24
140.	Seminar hall	OG/window		1.5	2	3	12
141.	Seminar hall	Votes /window		1.5	1	1.5	6
142.	Computer cente	OG/window		2	2	4	32
143.	Computer cente	Vrf/vester		12	1	12	96
144.	Web lab	OG/casset		2	2	4	16
145.	Staff room	OG/split		2	1	2	16
146.	Lab	OG/casset		2	4	8	64
147.	Ca /nod	OG/Split	3	1	1	1	8
148.	Ca/ HOD	OG/window		2	1	2	16
149.	Seminar hall	Panasonic/casset		3	1	3	12
150.	Ca /lab-3	OG/window		2	2	4	32
151.	Ca /lab-2	OG/window		2	2	4	32
152.	CA/4	OG/window		2	4	8	64
153.	3floor computer lab	OG/vrv		10	1	10	80
154.	Embedded lab	OG/Split	3	2	3	6	48
155.	Embedded lab	Daikin/ductble		8.5	2	17	136
156.	Embedded lab	OG/casset		3	2	6	48
157.	Embedded lab	OG/Split		2	2	4	32
158.	Aivalok lab	OG/Split	5	2	1	2	16
159.	Vlsi lab	OG/Split	5	2	2	4	32

No.	Location	Make/Type	Star rating	TR Capacity	Quantity	Total TR	kWh/ day
160.	Lab view	OG/Split		2	4	8	64
161.	Hod	Sansua/window		1.5	1	1.5	12
162.	1,floor,Data center	OG/split		2	2	4	96
163.	Ground Data center	OG/split	3	2	1	2	48
164.	Data center	Emerson		6	2	12	288
165.	Main canteen D hall	NON-INVER		2	2	4	16
166.	Dining hall	OG/split		1.5	1	1.5	6
167.	Offices	OG/window		2	1	2	16
168.	Archist 2f st room	OG/split		2	1	2	16
169.	Dean office	Daikin /casset		3	1	3	24
170.	2floor,Cadlab	Bluestar /casset		8.5	1	8.5	68
171.	Csb block 4floor	Daikin/split	3	2	2	4	32
172.	Csb block 4floor	Daikin/split	3	2	1	2	16
173.	Csb block 4floor	Daikin /casset		8.5	5	42.5	340
174.	VC Villa	OG/split		1	4	4	16
175.	VC Villa	OG/split		2	7	14	56
176.	Con/materks&lab	OG/split		2	1	2	8
177.	Materil stor room	Sanyo/split		2	1	2	16
178.	Structures lab	Vestar/split	3	1.5	1	1.5	12
179.	Mens hostel A,block	Vrv /Daikin		14	2	28	112
180.	Mens hostel A,block	Vrv /Daikin		10	2	20	80
181.	B,block Gro floor	Sanyo/split		2	2	4	16
182.	B,block Gro floor	OG/split		1.5	2	3	12
183.	1,floor	Daikin/split	3	2	8	16	64
184.	2,floor	Daikin/split	3	2	5	10	40
185.	2,floor	Daikin/split	3	2	2	4	16
186.	2,floor	OG/split		2	6	12	48
187.	2,floor	OG/split		2	1	2	8
188.	PG block,3floor	OG/split		2	12	24	96
189.	Offices room	Daikin/split	3	1.5	1	1.5	6
190.	Offices room	OG/split	3	1.5	1	1.5	6
191.	3,floorT1&T2	OG/split	3	1.5	24	36	144
192.	PG,block CIIC,G,f	Vester/split		1.5	13	19.5	78

No.	Location	Make/Type	Star rating	TR Capacity	Quantity	Total TR	kWh/ day
193.	PG,block CIIC,G,f	LG/split	3	1.5	1	1.5	6
194.	PG,block CIIC,G,f	Daikin/split	3	1.5	2	3	12
195.	1 floor	Vester/split		1.5	14	21	168
196.	Est,off,res lab	Daikin/split	3	2	2	4	32
197.	PED	OG/split		1	1	1	8
198.	Ground floor	Daikin/split	2	1.5	1	1.5	12
199.	Ground floor	OG/split		2	1	2	16
200.	Ground floor	OG/split		1.5	3	4.5	36
201.	Ground floor	OG/split		2	2	4	32
202.	Ground floor	OG/split		1	1	1	4
203.	1,Floor	OG/split		2	5	10	40
204.	2,Floor	OG/split		2	1	2	8
205.	2,Floor	OG/window		1.5	2	3	24
206.	Pharmacy 1floo hod	Samsung/window		1.5	1	1.5	12
207.	2floor	OG/split		1.5	1	1.5	12
208.	men hos cold room	RE-techcold room		1.5	1	1.5	6
209.	Ladies host mi gr	Daikin/split		1.5	2	3	12
210.	Ground floor	OG/split		2	1	2	8
211.	Ground floor	Daikin/split,4star	4	1.5	1	1.5	6
212.	Ground floor	Daikin/split,2star	4	1.5	1	1.5	6
213.	2floor competr	OG/window		2	2	4	16
214.	3 floor	OG/split,3star	3	1.5	8	12	48
215.	Annex block G floor	Sanyo/split		2	3	6	24
216.	1 floor	OG/window		2	2	4	16
217.	2 floor	OG/split	3	1.5	13	19.5	78
218.	3 floor	OG/split	3	1.5	9	13.5	54
219.	3 floor	OG/split		2	4	8	32
220.	New block Gro floor	OG/split	3	1.5	1	1.5	6
221.	1floor	Daikin/split	3	1.5	1	1.5	6
222.	4 TO 8,Floor	Daikin/vrv		12	2	24	96
223.	3 Floor	OG/split	3	1.5	3	4.5	18
224.	4 ,Floor	OG/split	3	1.5	4	6	24
225.	5,Floor	OG/split	3	1.5	3	4.5	18

No.	Location	Make/Type	Star rating	TR Capacity	Quantity	Total TR	kWh/ day
226.	6,Floor	OG/split	3	1.5	4	6	24
227.	7,Floor	OG/split	3	1.5	3	4.5	18
228.	8,Floor	OG/split	3	1.5	4	6	24
Total					**514**	**1378**	**8748**

Measurement at Panels

End of the Report