



पंडित रविशंकर शुक्ल विश्वविद्यालय, रायपुर छत्तीसगढ़ भारत
Pt. Ravishankar Shukla University, Raipur Chhattisgarh, India
Estd-1964 – recognized by UGC U/s 2(f) and 12 (B)
NAAC “A” Grade

CRITERION-VI

EVIDENCE(S), AS PER SOP

METRIC No. 7.1.6	<p>Quality audits on environment and energy are regularly undertaken by the Institution and any awards received for such green campus initiatives:</p> <ul style="list-style-type: none">• Green audit• Energy audit• Environment audit• Clean and green campus recognitions / awards• Beyond the campus environmental promotion activities
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Energy Audit Report of Pandit Ravi Shankar Shukla University (PRSU) Campus, Raipur, Chhattisgarh



Conducted by

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TQ SERVICES

Detailed Energy Audit Report of Pandit Ravi Shankar Shukla University (PRSU) Campus, Raipur, Chhattisgarh (FINAL)

Issue No. 1

Rev. No. 04

Date: 11.02.2016

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Pandit Ravi Shankar Shukla University (PRSU) Campus, Raipur, Chhattisgarh

SUBMITTED BY

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Hyderabad

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Abbreviations Used

AC	:	Alternating Current
AC Units	:	Air Conditioner Units
AMC	:	Annual Maintenance Contract
BEE	:	Bureau of energy efficiency
CSPDCL	:	Chhattisgarh State Power Distribution Company Limited
CTPT Unit	:	Current Transformer Potential Transformer Unit
DB	:	Distribution Board
DG Set	:	Diesel Generator Set
DVRF	:	Digital Variable Refrigeration Flow System
ECBC	:	Energy Conservation Building code
ELCB	:	Earth Leakage Circuit Breaker
EPM	:	Electrical Preventive Maintenance Program
GI Pipe	:	Galvanized Iron Pipe
HT	:	High Tension
IE	:	Indian Electricity
IS	:	Indian Standard
KVA	:	Kilo Volt Ampere
KW	:	Kilo Watt
KWH	:	Kilo Watt Hour/ units
LPD	:	Lighting Power density
MSB	:	Main switch board
MTC	:	Material Test Certificate
NOC	:	No Objection Certificate
PF	:	Power factor
PM	:	Preventive Maintenance
SFU	:	Switch Fuse Unit
SOP	:	Standard Operating Procedure
SLD	:	Single Line Diagram
T/F	:	Transformer
THD	:	Total harmonic distortion
UPS	:	Un-interrupted Power Supply
WI	:	Work Instruction

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No	Name	Designation
1	Mr Shiv Kumar Pandey	Vice chancellor- PRSU
2	Mr K K Chandraker	Registrar- PRSU
3	Dr. Sanjay Tiwari	HOD-Electronics & Photonics- PRSU
4	Mr Johan Thakur	Sub Engineer (Elect)- PRSU
5	Mr B C Biswas	Finance Controller- PRSU

No	Name	Designation
1	Mr Sanjeev Jain	CE - CREDA
2	Mr Rajiv Gyani	EE- CREDA
3	Mr Kamran Shaikh	AE- CREDA
4	Mr Dhir Singh	PC - CREDA

EXECUTIVE SUMMARY

Energy Audit options at a glance & recommendations to University

Annual energy savings	=	179100kWh
Annual financial savings	=	Rs. 22, 62,240
Total investment	=	Rs. 19, 72,500

ENERGY CONSERVATION OPTIONS AND RECOMMENDATION

Energy conservation options & recommendation (As per investment)

LOW INVESTMENT (< 1 LAKH):

Sl.No	PARTICULARS	ANNUAL ENERGY SAVINGS (kWh)	ANNUAL FINANCIAL SAVINGS (Rs)	INVESTMENT (Rs)	SIMPLE PAY BACK PERIOD(Months)
1	Replacing 400 Nos.T12(40 W) Fluorescent Lamps (fitted with Copper Chokes) with electronic choke and T-8 Tubes	14400	1,15,200	62500	07
2	Replacing 500 Nos.T12(40 W) Fluorescent Lamps (fitted with Electronic Chokes) with 28 W T-5 Fitting:	11520	92160	85000	13
3	Replacing 300 Nos. Of Ordinary resistance type regulators with electronic regulators	7200	57600	1,00,000	20

MEDIUM INVESTMENT: (1 lakhs > x < 10 lakhs):

4	Replacement of existing CRT computer screens with LCD screen	7500	60,000	2,50,000	50
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5	Replacing 250 Nos.T12(40 W) Fluorescent Lamps with LED Lights	24000	1,92,000	3,00,000	19
6	Replacement of300 existing ceiling fans with BLDC fans	54000	432000	9,00,000	25

HIGH INVESTMENT: (>10 LAKHS):

7	Replacement of old 1.5TR window a/c with 4 star Split A/c	60480	483840	12,60,000	32
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Distribution of power

	Potential area for energy savings and safety issues	Present system	Proposed Recommendations
8	No isolation switches for building or rooms	Prevention of Short circuit and energy saving by single isolation	MCB/ELCB or master switch for isolation of electricity supply.
9	Selection of cables	Due to harmonics and unbalance current neutral wire can burn	Avoid unbalance and provide 4 core wiring
10	Over voltage in transformers	Over voltage increase energy consumption, safety and maintenance issues for luminaries and equipment's	Take up issue with CSPDCL for lowering the tap setting in the corresponding transformer
11	Connected loads	Connected Load is more than sanctioned Load which will invite penalty from CDPDCL	Increase the connected load from CSPDCL and change it in the next bills
12	Low Power factor	Power factor found lower than 0.85 which invites penalty from CSPDCL	Increase the power factor by installing LV capacitors with loads.
13	Cable joint and termination burning	For safety cable termination and fuses found red hot	Proper crimping and terminal joints and use of proper fuses instead of wires as fuses.

Lighting

	Potential area for energy savings and safety issues	Present system	Proposed Recommendations
14	Street Light, garden lights	Operated by security persons	Provision for timers for operation
15	Common lights in toilets , corridor steps	Found burnt in normal time	Energy team to be formed among students and responsibility to be given, stickers and posters to be provided in the lighting switch boards, Lights to be changed in first phase of changing
16	For New buildings under construction	T-12 tubes are being used	Change into LED tubes and Luminaries. Order to be issued
17	Cleaning of luminaries	Most of the tubes and Luminaries are dusty	Energy team to be made among students in collaboration with NSS volunteers for scheduled cleaning.

	Potential area for energy savings and safety issues	Identified issue	Recommendations
20	Engineering practice	Lengthy copper tube from compressor to condenser, installation of air conditioner evaporator and condenser locations against its installation manual	Minimum gap between top ceiling and top of evaporator should be 1 feet, and for condenser side and back gaps are to be 1feet for proper circulation of air, avoid the blockage of air in front of condenser fan.
21	Cleaning	Condenser fins and evaporator suction filter not cleaned	Cleaning schedule to be incorporated, AMC for repairing and cleaning, along with checking of power consumption periodically and recording of the same.
22	Ingress of heat into the room	The windows are plain glass and gaps found in doors and old windows	The old metal frame of windows to be changed, proper sealing of doors and windows to be done, Cool film installation on windows

23	Set temperature	Set temperature in ACs found between 16 to 20 °C in many areas	Set temperature to be changed and kept between 23°C to 26°C as per ASHRAE standard for HVAC
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Ceiling Fans

	Potential area for energy savings and safety issues	Present system	Proposed Recommendations
18	Cleaning	Old fans not cleaned and corrosion in side of blades found. Improper lubrication of bearings increases power consumption	Change to BLDC fans which consumes 35 W Energy. Team to be made among students in collaboration with NSS volunteers for scheduled cleaning,
19	Cross ventilation	New buildings window positions	Design the new building as per ECBC norms. On cross ventilation.

Diesel generators:

SL No	Potential area for energy savings and safety issues	Identified issue	Recommendations
25	AMF installed in many DG sets	AMF is not working and CSPDCL supply restored DG working continuously without the knowledge of people.	AMF to be repaired with Supplier. Indication with lights and alarm for failure and restoration of CSPDCL supply to be incorporated
26	Log book	No log book maintained regarding type diesel consumption, running hours, energy generation and maintenance checkups and services.	Log book to be maintained (health card of the DG).

PUMPS

SL no	Potential area for energy savings and safety issues	Identified issue	Recommendations
27	No record of rewind motors and repaired pumps	Most of the pumps are bore well pumps, its motors are rewinded many times	Monitoring of repairing will be required for alternate pumping solutions, and reason for replacement to be recorded
28	Peak time running	Peak time charges are more and we observed pumps are running during peak hours,	Peak time pumping to be shifted and pumping should be at off peak time ,
29	Capacitors in pumping installations	LV Capacitors installed in pumps are not working	Change the LV capacitors for better operation and improving power factor.

GOOD OBSERVATIONS:

1. Renovation in all the major buildings has been done in the electrical side and also the building as a whole.
2. Good knowledge about the energy conservation and its purpose among the staffs and students that we interacted.
3. Waste management in the campus was found to be well organised.

Specific Electricity Consumption of University Building:-

SL No:	Particulars	Connecte d Load (kW)	Average Energy consumptio n (kWh)	Area (m ²)	Specific electricity consumptio n (Avg) (kWh/m ²)	Specific electricity consumption (Max) (kWh/m ²)	Specific electricity consumption (Min) (kWh/m ²)	Remarks
1	Guest house (page no-29)	51.86	2373.41	967.98	2.45	7.24(June)	1.14(Apr)	High SEC in June due to building renovatio n
2	Gandhi hostel (page no-34)	9.96	2293.33	1589.46	1.4425	5.78(Sep)	0.63(Aug)	High SEC in June due to building renovatio n
3	PG girls hostel (page no-38)	3.7	1378.41	1339.52	1.03	2.26(Apr)	0.47(Jul)	
4	Teachers hostel(page no-42)	3.7	5342.5	1163.4	0.45	1.04(Sep)	0.14(Jun)	
5	Azad hostel(page no-46)	2.1	1149	1484	1.33	1.54(Mar)	0.8(June)	Meter not working from June onwards
6	Research Hostel for Girls (page no-50)	2.25	2135.6	744	2.87	5.94(Apr)	2.1(Dec-14)	Variation in SEC due to the variation in accomm odation
7	Professional girls hostel (page no-54)	7.3	2483.66	1172.4	2.12	6.76 (Apr.)	1.19(Jan)	Variation in SEC due to the variation in accomm odation

SL No:	Particulars	Connecte d Load (kW)	Average Energy consumptio n (kWh)	Area (m ²)	Specific electricity consumptio n (Avg) (kWh/m ²)	Specific electricity consumption (Max) (kWh/m ²)	Specific electricity consumptio n (Min) (kWh/m ²)	Remarks
8	Research boys hostel (page no-58)	3.94	345.5	656	0.52	1.43(Sep.)	0.2(Mar)	
9	Girls hostel pump house (page no-62)	3.73	983.5	--	--			
10	Street light (page no-63)	23.76	4756	---	---			
11	SOS in electronics and photonics(page no-66)	34.3	1150.09	1409.44	0.9	2, 09(Jun)	0.285(Jan)	May and June no bill
12	SOS in computer science and IT(page no-71)	20	1335.5	3171.36	1.71	2.59(Mar)	1.25(Apr)	
13	Institute of Management (page no-82)	51.7	1833.33	2514.02	0.745	1.095(Mar)	0.87(May)	
14	National Centre for Natural Resources(p age no-87)	30.6	1351	3754.4	0.36	0.742(Sep)	0.134(Apr)	
15	Sos Physics and Chemistry(p age no-92)	69.8	6995.05	3616.04	1.52	2.3(Sep)	1.215(Jan)	
16	USIC(page no-100)	9	3504.54	308.83	1.183	2.73(Mar)	0.17(Apr)	
17	SOS geology and water resource management (page no-104)	22.5	2773.41	1294.34	2.14	3.25(Mar)	0.5(Oct)	
18	SOS in life Science-1(page no-109)	10.444	2651.25	2441.28	1.02	3.25(Jun)	0.16(Jan)	Separate area for each

19	SOS in life Science-2	9.04	2061					section is not available in the University.
20	Bio science Lab	4	1749.75					
21	Tissue culture	9	660					
22	SOS in Pharmacy(page no-119)	74.99	2940.33	6558.98	0.446	0.695(Sep)	0.075(Dec. 14)	
23	SOS in statistics &mathematic (page no-124)	12	1721	1223.24	1.40	1.84(May)	1.09 (Oct)	
24	University press(page no-129)	0.9	517.16	----	----			
25	SOS in regional study and research:	2.25	710	560.54	1.27	2.11(May)	0.41(Jan)	
26	SOS in Physical education(page no-135)	--	1459.4	2905.06		0.62(Sep)	0.4(Oct)	
27	SOS in Law(page no-140)	---	1209	1625.42		8.05(May)	09.24(Feb)	No meter reading from June onwards
28	Auditorium(page no-145):	13.965	927	1315.98	0.703	1.75(Mar)	0.3(Apr)	No bill on May
29	Community hall	8	183.33	744.18	0.244	1.38(Mar)	0.067(Oct)	No bills on May, Aug, Sep-15
30	Engineering department:(page no-152)	3.36	470.33	164.67	2.85	5.28(Apr)	1.5(Feb)	
31	SOS in Geography(page no-156)	33.08	1170	1751.3	6.48	10.82(May)	2.44(Apr)	
32	Library(page no-161)	65	4224.83	4950	0.85	2.17(May)	0.52(Nov-14)	
33	Animal house(page no-165)	3.36	373	17	21.94	26.71(Jun)	15.29(Nov)	No bills from July onwards
34	Pump and block(page	-	677.54	----	----			

	no-169)							
35	Botanical garden pump(page no-170)	3.75	510.25	----	----			
36	Pump near library(page no-171)	2.238	1041.6	----	----			
37	Arts bhavan ground floor(page no-172)	65	4141.83	2433.48	1.7	6.23(May)	0.47(Sep)	High SEC due to building renovation
38	Arts Dept In first Floor(page no-177)	32	576	2433.48	0.278	0.34(Aug)	0.05(Oct)	No bill for March, Apr, May
39	Arts bhavan second floor(page no-182)	32.14	672.5	2433.48	0.438	0.61(Sep)	0.19(Oct)	No bill first 6 months
40	Health centre(page no-186)	4.95	317.83	960	0.33	0.57(Jun)	0.2(Jan)	No bill on Jan and June
41	Administrative building(page no-196)	66.725	10868	3916.35	2.773	3.69 (May-15)	1.82 (Nov-14)	
42	VC bungalow(page no-200)	4.768	1031.6	470.13	5.124	9.66(Jul)	1.66(May)	No bill on power meter
43	VC Bungalow Street light(page no-205)	0.36	317.83					
44	Registrars bungalow(page no-209)	2.28	240.03	285.51	0.84	12.1(Jun)	0.3(Jan)	High SEC in June as accommodation provided for guests in university programs.

Lighting Loads of University

Particulars	T-12	T-8	Bulb	CFL-15W	CFL-36W	SVL
Guest house	50		02	36		
Gandhi hostel	79			05		
PG girls hostel	112					02
Teachers hostel	52	04				
Azad hostel	76					02
Research Hostel for Girls	45	09				02
Professional girls hostel	72		02	91		02
Research boys hostel	34		02	01		
Street light		30				60
SOS in electronics and photonics	35			93		
SOS in computer science and IT	125	05		02		
Human Resource centre	90	06				
Institute of Management	126			07	08	
National Centre for Natural Resources	12	15		08		
SOS Physics and Chemistry	235			48		
USIC	16	02		01		
SOS geology and water resource management	76			02	01	
SOS in life Science-1	320	44		88		
Particulars	T-12	T-8	Bulb	CFL-15W	CFL-36W	SVL
SOS in Pharmacy				32	26	
SOS in statistics & mathematics	32			30		01
University press	40					01

Auditorium:	25			15		01
Community hall	24					
Engineering department:	08					
SOS in Geography	125		01			
Library:	132		126			
Animal house	06			04		
Arts bhavan ground floor	143			07		
Arts Dept In first Floor	108			5		
Arts bhavan second floor	87			2		
Health centre	10		01	01		
Administrative building First Floor	157	26	110	28		
Administrative building second Floor	257	16	15	52		
VC bungalow	42					03
Registrars bungalow	08				02	01
Total Nos	2759	157	259	558	37	75

Fan loads of university:

Particulars	Ceiling fan (New)	Ceiling fan (Old)	Exhaust fans
Guest house		36	02
Gandhi hostel		56	04
Pg girls hostel		66	01
Teachers hostel		25	02
Azad hostel		48	02
Research Hostel for Girls		26	02
Professional girls hostel		39	03
Research boys hostel		25	02
SOS in electronics and photonics	05	13	01
SOS in computer science and IT	33	50	3
Human Resource centre	57		03
Institute of Management		81	01
National Centre for Natural Resources	08		
SOS Physics and Chemistry	18	99	21
Music		07	
SOS geology and water resource management		42	02
SOS in life Science-1		138	04
SOS in Pharmacy		106	06
SOS in statistics & mathematics		38	
Auditorium:		26	
SOS in Geography		92	02
Library:	60	16	
Arts bhavan ground floor		78	
Particulars	Ceiling fan (New)	Ceiling fan (Old)	Exhaust fans
Arts Dept In first Floor		58	02

Arts bhavan second floor		48	02
Health centre	05	02	
Administrative building First Floor	38	59	10
Administrative building second Floor	107	56	28
VC bungalow	04	10	03
Registrars bungalow	08		01
Total nos	343	1340	107

Air conditioners loads:

Particulars	Window	Split A/C-1TR	Split A/C-1.5 TR	Split A/C-2TR
Guest House	09		04	
SOS in electronics and photonics			09	04
SOS in computer science and IT			21	02, 12 TR not working
Human Resource centre			17	
Institute of Management			02	05 (Not Working)
National Centre for Natural Resources			08	04
SOS Physics and Chemistry	10		16	01
SOS geology and water resource management			03	
SOS in life Science-1	07 and 01 1TR		17	05
SOS in Pharmacy	04		12	02
SOS in statistics & mathematics	02 and 1No: 1TR		01	02
Particulars	Window	Split A/C-1TR	Split A/C-1.5 TR	Split A/C-2TR
SOS in Geography			05	01
Library:			01	05
Animal House			06	01
Health center	02	01		

Administrative building	02		22	03
Total Nos	36	1	144	35

COMPUTERS AND OTHER EQUIPMENTS

Particulars	Computer LCD	Computer CRT	Lap top	Laser Printer	3 Phase Printer	Scanner	Xerox M/c
Guest House	02						
Gandhi Hostel			05				
PG Girls Hostel	06		05				
Teachers Hostel			05				
Azad Hostel		06	05				
Research Hostel for Girls		05	10				
Professional Girls Hostel			5				
Research Boys Hostel			05				
SOS in electronics and photonics	13	16			02	01	01
SOS in computer science and IT	67		02	03		01	01
Particulars	Computer LCD	Computer CRT	Lap top	Laser Printer	3 Phase Printer	Scanner	Xerox M/c
Human Resource centre	10			04	01	01	01
Institute of Management	09	20	04	02	01	01	01
National Centre for Natural Resources	05				01	01	02
SOS Physics and Chemistry	63	06	04	26	02	04	02
SOS geology and water resource management	15	01		02	01		



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SOS in life Science-1	28	05	04	11	03	02	01
SOS in Pharmacy	25		02	05	01		
SOS in statistics & mathematics	05	15	5	1	1		
SOS in Geography	38	04	01	09	01	01	
Library:	12				01	03	01
Animal House							
Arts Bhavan Ground Floor		25		07	01	01	
Arts Dept In first Floor		28	03	04	02	01	
Arts Bhavan Second Floor		08		06		02	
Health centre	02						
Administrative building	75	03		32	15	07	10
VC Bungalow	03				01		
Total	378	142	65	112	34	26	20

TOTAL CONNECTED LOAD IN EACH METER:

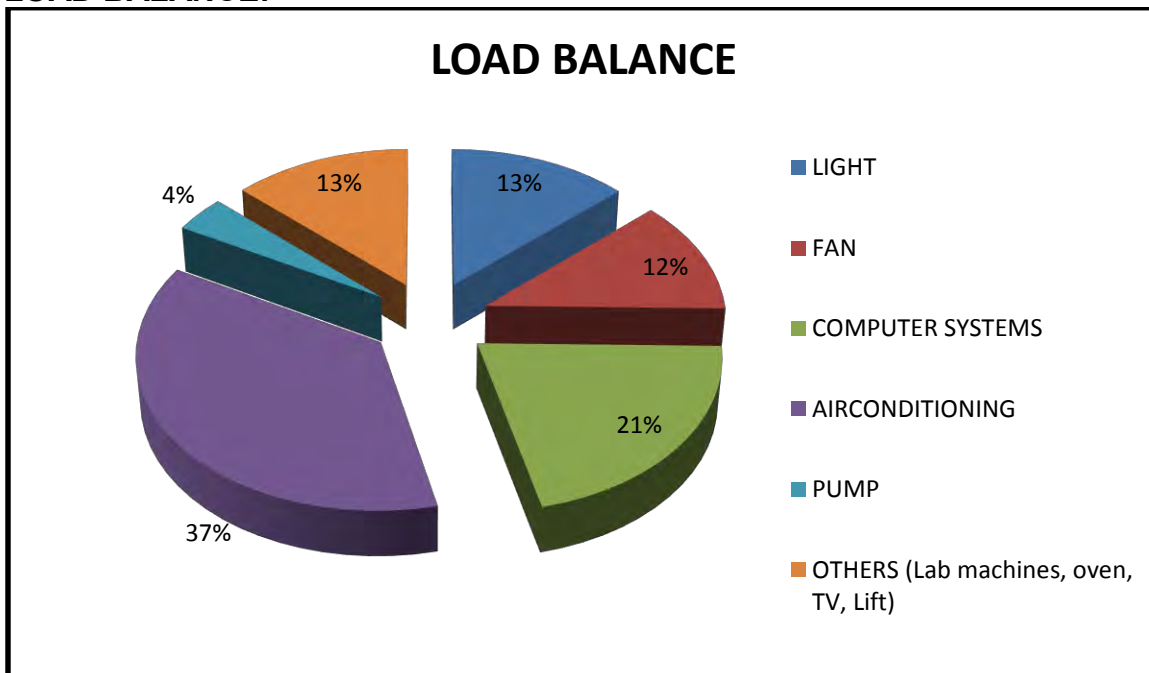
SL NO	PARTICULARS	Service No/Consumer no	SANCTIONED LOAD (kW)	CONNECTED LOAD (kW)	REMARKS
1	Guest house	405439	51.86	35.652	
2	Gandhi hostel	403267	9.96	9.015	
3	Pg girls hostel	403268	3.7	12.68	Greater than the Sanctioned load
4	Teachers hostel	403288	3.7	5.09	Greater than the Sanctioned load
5	Azad hostel	404408	2.1	9.52	Greater than the Sanctioned load
6	Research Hostel for Girls	771284	2.25	7.33	Greater than the Sanctioned load
7	Professional girls hostel	774229	7.3	7.65	Greater than the Sanctioned load
8	Research boys hostel	606167	3.94	4.34	Greater than the Sanctioned load
9	Girls hostel pump house	406131	3.73	3.5	
10	Street light	1000145454	23.76	19.08	

11	SOS in electronics and photonics	771282	34.3	38.52	Greater than the Sanctioned load
12	SOS in computer science and IT	773349	20	26.41	Greater than the Sanctioned load
13	New Computer building	406284	40	36.25	
14	Computer server room	406285	10	9	
15	HRDC	1005795195	40	41	Greater than the Sanctioned load
16	Institute of Management	773578	51.7	38.9	
17	National Centre for Natural Resources	1005248369	30.6	23.16	
18	SOS Physics and Chemistry	404300	69.8	62.52	
SL NO	PARTICULARS	Service No/Consumer no	SANCTIONED LOAD (kW)	CONNECTED LOAD (KW)	REMARKS
19	SOS Physics and Chemistry	406134	71.9	65.2	
20	USIC	406148	9	11.5	Greater than the Sanctioned load
21	SOS geology and water resource management	406195	22.5	23.12	Greater than the Sanctioned load
22	SOS in life Science-1	406147	10.444	21.2	Greater than the Sanctioned load
23	SOS in life Science-2	404446	9.04	18.5	Greater than the Sanctioned load
24	Bio science Lab	771215	4	8.5	Greater than the Sanctioned load
25	Tissue culture	406200	9	16.2	Greater than the Sanctioned load
26	SOS in Pharmacy	773533	74.99	72.5	
27	SOS in statistics &	774228	12	25.194	Greater than the Sanctioned load

	mathematics				
28	University press	403232	0.9	8.15	Greater than the Sanctioned load
29	SOS in regional study and research:	771283	2.25	8.765	Greater than the Sanctioned load
30	SOS in Physical education	606210		27.07	
31	SOS in Law	405438	8.72	17.2	Greater than the Sanctioned load
32	Auditorium:	405914	13.965	12.27	
33	Community hall	406296	8	5.75	
34	Engineering department:	405708	3.36	2.21	
35	SOS in Geography	606211	33.38	37.58	Greater than the Sanctioned load
36	Library	402164	65	28.5	
37	Animal house	405706	3.36	13.05	
38	Pump and block	406185	-	3.5	
SL NO	PARTICULARS	Service No/Consumer no	SANCTIONED LOAD (kW)	CONNECTED LOAD (KW)	REMARKS
39	Botanical garden pump	406203	3.75	3.65	
40	Pump near library	406126	2.238	3.62	Greater than the Sanctioned load
41	Arts bhavan ground floor	402163	65	29.435	Maintenance work was going on during the period of audit.
42	Arts Dept In first Floor	406354	32	19.3	Maintenance work was going on during the period of audit.
43	Arts bhavan second floor	406355	32.14	9.27	Maintenance work was going on during the period of audit.
44	Health centre	402158	4.95	8.25	
45	Administrative building	406135	63.35	67.25	Greater than the Sanctioned load
46	Administrative	404298	69.95	66.56	

	ve building				
47	Pareekshab havan	406267	----	13.55	
48	VC chamber	406184	3.375	3.35	
49	VC bungalow	403290	2.25	4.25	Greater than the Sanctioned load
50	VC Bungalow Street light	402168	0.36	0.4	
51	Registrars bungalow	775464	--	6.25	
52	Bio technology	1005623708	67	63.2	
	TOTAL KW		1116.87	1113.91	

LOAD BALANCE:



- As one can see, Max load has been taken by the Air conditioning units in the university.

1.0 INTRODUCTION

Pt. Ravishankar Shukla University is Chhattisgarh's largest and oldest institution of higher education, founded in 1964, and named after the first chief minister of erstwhile Madhya Pradesh. The University has a campus in the western part of the capital of Chhattisgarh, Raipur. Land. The University is about 5 km from the Raipur Railway Station and about 15 km from the Raipur airport. There are Twenty-Nine teaching departments in the University. Out of which six departments buildings have been constructed recently. The total number of employees is 700, who provide the administrative support at different levels.

There are 5000 students enrolled for variety of courses offered by the departments who are steered under the guidance of more than 100 faculty members. Jurisdiction of PRSU covers entire central and southern part of Chhattisgarh. There are 180 educational institutions affiliated to the University.

1.1 Scope of work:

- (A) Electricity Supply and Distribution Network
- (B) Lighting System
- (C) Diesel Generators (DG) Sets
- (D) Water Pumping System
- (E) Motor Load Survey
- (F) Energy Monitoring and Accounting System

2.0 Energy Audit Team

1. K V S N Rao, B-Tech Electrical

Registered Energy Auditor of Bureau of Energy Efficiency (BEE – Govt of India)
Energy Auditor No – EA 9064

2. Santhosh A, B-Tech, DEE, PGDENM.

Registered Energy Auditor of Bureau of Energy Efficiency (BEE – Govt of India)
Energy Auditor No – EA 7597

3. AZEEM K , M-TECH

Registered Energy Auditor of Bureau of Energy Efficiency (BEE – Govt of India)
Energy Auditor No – EA 3375

4. Ashok K M P, Sr project Engineer

5. Ranjith M- Project engineer

6. Maqbool M - Project engineer

3.0. ANALYSIS OF EACH DEPARTMENT:

In this section, auditors have analysed each department or building according to the metre number. This section contains base line data of each department electricity bill, Electrical load analysis using logged data by the power quality analyser, Light, Fan, Computer loads consumption pattern and its connected load, Light intensity (LUX) of each sections, Air conditioning loads and its efficiency and Specific electricity consumption of each building. The Auditors have tried to separate measurements by each loads vies departments and Electricity board metre, however there found difficulties in doing so in most of the buildings as the one department itself contains more than one metre.

Present system of Electricity supply

At present most of the buildings in the Raipur University have separate LT connection with an energy metre provided by the CSPDCL. Whenever any expansion occurs in the building, University applies for another connection in the same and the CSPDCL provided it. Thus in most of the departments or buildings more than one EB metre is common. Diesel generator is provided as back up supply for almost all the buildings individually.

4.0 TARIFF STRUCTURE OF CSPDCL FOR YEAR 2015-16:

1. LV1 DOMESTIC GENERAL:

The tariff for all consumption slabs of LV-1 category has been revised. In LV-1 domestic category, the Commission has split the consumption slab of 0-200 units by introducing two new consumption slabs, i.e., 0-40 units per month and 41-200 units per month, as under:

Slab 1: 0-40 units;

Slab 2: 41-200 units;

Slab 3: 201-600 units; and

Slab 4: more than 600 units.

A. APPLICABILITY:

This tariff is applicable to domestic light and fan and power used for all domestic appliances, student hostels; working women's hostels; schools

B. TARIFF:

Category of Consumers	Units Slab	Fixed Charge (Rupees per kWh)	Energy Charge (Rs. per kWh)	Minimum Fixed Charge
LV-1: Domestic				
Domestic including BPL Consumers	0 -40 units	2.00	1.00	Single Phase Rs. 40/- p.m.
	41-200 units	2.10	1.00	
	201 - 600 units	2.80	1.60	Three phase Rs. 120/- pm
	601 and above units	4.30	2.20	

2. LV2 NON DOMESTIC

A. APPLICABILITY:

This tariff is applicable to light and fan and power to shops, showrooms, business houses, offices, educational institutions (except those included in LV-1 and LV-5), public buildings, town halls, clubs, gymnasium and health clubs, meeting halls, places of public entertainment, circus, hotels, cinemas, public libraries and reading rooms.

B. Tariff:

Category of Consumers	Units Slab	Fixed Charge (Rs per kWh of Contracted load/Demand)	Energy Charge (Rs. per kWh)
LV-2.1: Non-Domestic (Normal Tariff)	0 – 100 units	Rs. 60 per kW per month up to 3 kW and	4.40
	101 - 500 units		4.90
	501 and above units	Rs. 120 per kW per month above 3 kW	6.20
LV-2.2: Non-Domestic Demand Based Tariff (for Contract demand of 15 to 75 kW)		Demand Charges- Rs 200/kW/month on billing demand	5.60

3. LV6 PUBLIC UTILITY

A. APPLICABILITY

This tariff is applicable to public utilities such as water supply schemes, sewage treatment plants, street lights, streets including public parks and archaeological and other monuments when requisition for supply is made by Public Health Engineering Department, local bodies, Gram Panchayats or any organization made responsible by the Government to maintain these services.

B. Tariff:

Category of Consumers	Fixed Charge	Energy Charge (Rs. per kWh)
LV-6: Public utilities Public street light and water works	Rs. 100/HP/month or Rs. 135/kW/month	4.00

4. Terms & conditions:

For the purpose of Demand Based Tariff (LV-2.2. LV-4.2 and LV-5.3)

- a. **Determination of Maximum Demand**- The maximum demand of the consumer in each month shall be twice the largest amount of kilo Watt hours delivered at the point of supply of the consumer, during any consecutive thirty minutes, in that month.
- b. **Billing Demand**– The billing demand for the month shall be the actual maximum kW demand of the consumer recorded during the month or 75% of the contract demand or 15 kW, whichever is higher. The billing demand shall be rounded off to the next whole number.
- c. **Minimum Charge** – The demand charge on contract demand (CD) is a monthly minimum charge whether any energy is consumed during the month or not.
- d. There shall be no restriction on connected load for applicability of demand based tariff.

Power Factor Incentive and Surcharge:

- a. All the agriculture **pump connections of above 3HP** shall provide with capacitor of specified rating and **maintain average monthly power factor of 0.85 or above** failing which they shall be required to pay power factor surcharge @ 35 paisa per kWh on the entire consumption of the month.
- b. All **LT non-domestic consumers** with contracted load/connected load of 15 kW or above shall arrange to install suitable low tension capacitors of appropriate capacity at their cost. The consumer shall ensure that the capacitors installed by him properly match with the actual requirement of the load so as **to ensure**

average monthly power factor of 0.85 or above. A consumer who fails to do so will be liable to pay power factor surcharge @ 35 paisa per kWh on the entire consumption of the month.

Provisions of billing in case of Excess Supply

I. For Normal Tariff consumers

- a) In case the **connected load of any LT consumer, except the domestic (LV-1) consumers, is found at any time in excess of contracted load**, the consumer shall have to pay charges at tariff (fixed and energy charge) corresponding to the excess load at the rate of one and half times the normal tariff for the excess load to the extent of 20% of contracted load and at the rate of two times of the normal tariff if the excess load is found beyond 20% of contracted load for actual period of enhancement of load or 6 months whichever is less, including the month in which the existence of excess load is detected and shall be continued to be billed till excess load is removed or contract load is enhanced.
- b) Where the recording facility of demand is available, the billing on account of excess supply shall be restricted to the recorded month only.

Favourable points for the University:

- No capacitors need to be installed in the LV1 domestic supply.

Improvements to be done in the university according to the bill:

- All the LT Non domestic connections (LV2ND3) need to ensure the PF should be more than 0.85 by installing the LT capacitors.
- Connected load of most of the connections under the LV2ND3 category are greater than the contracted load which should be enhanced at the earliest.

5.0 DEPARTMENT OR BUILDING VIA DETAILS:

I. MEASUREMENTS TAKEN ON 25-11-2015:

A. GUEST HOUSE:

Building : Guesthouse
Consumer No : 1000144880
Service No : 405439

1. Electrical Bill Analysis:

Base line data given below is based on the Electricity bill provided by the supplier of electricity that is CSPDCL. Details obtained from the Electricity bill is as follows.

Base Line Data (based on last 12 months)		
1	Electricity provider	CSPDCL
2	Tariff	LV1DL1GN14 : 3phase
3	Connected load (kw)	51.86
4	Average monthly energy CONSUMPTION (kwh)	2373.41
5	Monthly total electricity cost (avg. In rs)	15853.33
6	Average power factor	-

Observations:

- At present PF values are not included in the bill.

2. Electrical Load analysis:

Department	-	Guest house		
Consumer / meter No	-	405439		
Date & time of measurement		25-11-2015, 10:21		
Actual Energy	kWh	1.22		
Apparent Energy	kVAh	1.57		
Power factor	-	0.777		
Particulars	Units	Minimum	Maximum	Average
Active power	kW	0.54	2.30	0.95
Apparent power	kVA	0.72	2.60	1.23
Voltage (VL)	Volts	239.1	244.6	241.7
Current	Amps	0	16	8
Voltage unbalance	%	0.02	0.6	0.33
Current unbalance	%	47.7	123.8	90.70
THD voltage	%	1.7	2.1	1.90
THD current	%	4.1	41	15.31

Observations:

- PF found to be low in the Guest house during normal operation hours, day time. We expect that it will improve up to 0.85 during the night period when the AC and other light loads gets on.

Suggestions:

- PF can be improved to greater than 0.9 by installing LV capacitors in parallel with the EB Metre.

1. LIGHT & FAN LOAD CONSUMPTION PATTERN

Details	T12	BULB	CEILING FAN NEW	CEILING FAN OLD	EXHAUST FAN
Watts(W)	40	60	60	90	60
Total Nos.	50	2	-	36	2
Total KW	2	0.12	-	3.24	0.12
Net total kW	5.48				

Observations & suggestions:

- All the T12 fluorescent tube lights and CFLs should be replaced with LED tubes and LED bulbs.
- All the old ceiling fans and their resistance type regulators should be replaced by energy efficient BLDC fans and electronic regulators.

4. LUX MEASUREMENTS

According to BEE there is a lighting code to determine the overall energy efficiency of lighting system using measurements and methods which is applicable to all commercial buildings. One of the methods is Illuminance method which is the most practicable one. Lux values at various location in the building is given below in Table-

LOCATION	MEASURED LUX	REQUIRED LUX	REMARKS
Tv room	236	150	Good
Dining hall	229	150	Good
Room 2	189	150	Good
Room 6	206	150	Good
Room 5	224	150	Good
Room 3	324	150	Good
Room 13	204	150	Good
Room 11	197	150	Good
Room 10	241	150	Good
Room 9	213	150	Good
Room 1	229	150	Good
Room 4	198	150	Good

Room 12	278	150	Good
Room 7	219	150	Good
Room 8	196	150	Good

Standards:

- Standard value is taken from the ECBC user guide.
- All the values are taken during the day time.

5. COMPUTER & its ACCESSORIES:

DETAILS	WATTS	TOTAL NO	TOTAL KW
LCD computer	200	2	0.4

7. Air conditioning:

Guest house have installed a total of 4 Split AC and 9 window AC and their efficiency calculations are given below in table.

LOCATION	TYPE	RATED COOLING CAPACITY (TR)	MEASURED COOLING CAPACITY (kW)	RATED POWER ELECTRICAL (kW)	RATED EER	MEASURED EER	REMARKS
Room 2	Split	1.5	4.0	1.818	2.75	2.2	
Room 6	Split	1.5	3.9	1.818	2.75	2.17	
Room 5	Split	1.5	4.2	1.818	2.75	2.31	
Room 3	Split	1.5	3.9	1.818	2.75	2.14	
Room 13	Window	1.5	3.3	2.5	2.10	1.31	To be replaced with 5 star rated split air conditioners.
Room 11	Window	1.5	3.1	2.5	2.10	1.24	
Room 10	Window	1.5	3.4	2.5	2.10	1.34	
Room 9	Window	1.5	3.6	2.5	2.10	1.43	
Room 1	Window	1.5	3.0	2.5	2.10	1.18	
Room 4	Window	1.5	3.2	2.5	2.10	1.27	
Room 12	Window	1.5	3.1	2.5	2.10	1.22	
Room 7	Window	1.5	2.8	2.5	2.10	1.11	
Room 8	Window	1.5	3.6	2.5	2.10	1.43	

Suggestions:

- All the window AC should be replace with 4star split AC.
- Set temperature of air conditioner to be maintained at 26°C

8. Water consumption:

Guest house building consumes water for various purposes like

- Drinking.
- Cooking.
- Toilet flushing's
- Cleaning

Note:

- Water consumption is not monitored.
- Two stage flushing control should be used in toilets for reducing water wastage.

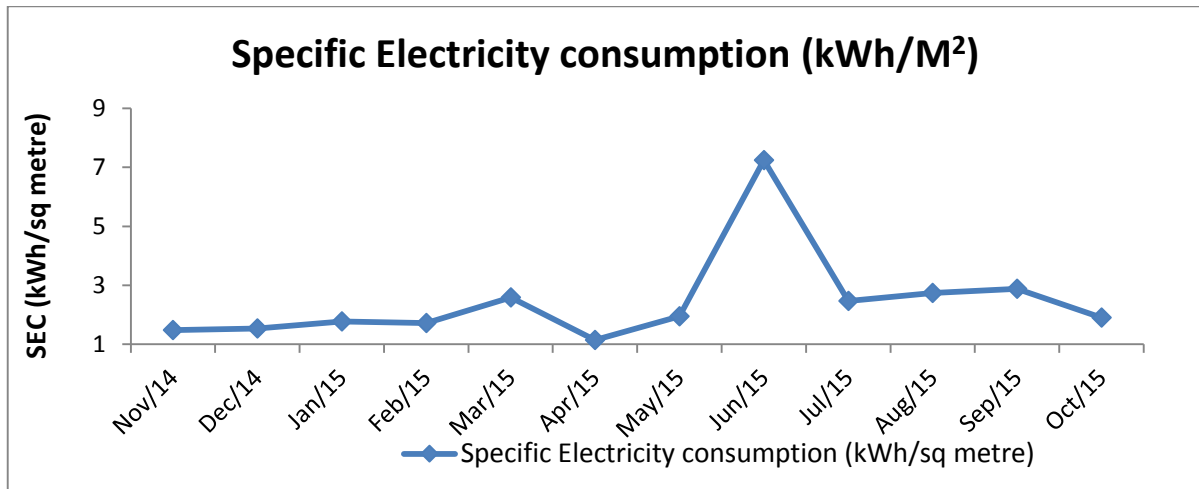
9. EFFICIENCY ANALYSIS:

1. Specific electricity consumption:

Specific electricity is calculated based on electricity consumed per building area in square meters. The details of specific electricity consumption for last few months are given below in table.

MONTH 2014-15	ELECTRICITY CONSUMPTION (kWh)	Area of the building (M ²)	SPECIFIC ELECTRICITY CONSUMPTION (kWh/M ²)
Nov-14	1433	967.98	1.48
Dec-14	1477	967.98	1.53
Jan-15	1714	967.98	1.77
Feb-15	1666	967.98	1.72
Mar-15	2508	967.98	2.59
Apr-15	1107	967.98	1.14
May-15	1890	967.98	1.95
Jun-15	7011	967.98	7.24
Jul-15	2394	967.98	2.47
Aug-15	2649	967.98	2.74
Sep-15	2788	967.98	2.88
Oct-15	1844	967.98	1.90

The energy performance index is plotted in the below chart.



Chart

Note:

- **The sudden increase in the SEC in the month of June was found to be unnatural. High SEC in June due to building renovation**
- Specific electricity consumption found to be varying in all those months.
- Maximum units consumed during the month of June-2015.
- SEC is highly depended on the occupation of rooms in the guest house. Variations are observed in specific electricity consumption due to energy usage variation in different climatic conditions of the year.

B.GANDHI HOSTEL:

Building : Gandhi Hostel
Consumer No : 1000143819
Service No : 403267

1. Electricity Bill Analysis:

Base line data given below is based on the Electricity bill provided by the supplier of electricity CSPDCL. Details obtained from the Electricity bill is as follows.

Base Line Data (based on last 12 months)		
1	Electricity Provider	CSPDCL
2	Tariff	LV1DL1GN14 : 3phase
3	Connected Load (kW)	9.96
4	Average monthly energy consumption (Kwh)	2293.33
5	Monthly Total Electricity Cost (Avg. In Rs)	13836.66

Observations:

- At present PF values are not included in the bill.

2. Electrical Load analysis:

Department	-	Gandhi hostel		
Consumer / meter No	-	403267		
Date & time of measurement		25-11-2015, 16:10		
Actual Energy	kWh	1.071		
Apparent Energy	kVAh	1.43		
Power factor	-	0.748		
Particulars	Units	Minimum	Maximum	Average
Active power	kW	2.01	2.23	2.09
Apparent power	kVA	2.67	2.69	2.80
Voltage (VL)	Volts	236.4	240.3	239.67
Current	Amps	2.08	6.58	3.89
Voltage unbalance	%	0.5	1.2	0.95
Current unbalance	%	46.4	69.3	58.11
THD voltage	%	2.3	2.8	2.47
THD current	%	6.3	21.4	11.94

Observations:

- PF found to be low during the logging period.

3. LIGHT & FAN LOAD CONSUMPTION PATTERN

Details	T12	CFL	Incandescent Bulb	Ceiling Fan New	Ceiling Fan Old	Exhaust Fan
Watts(W)	40	15	40	60	90	60
Total Nos.	79	5	-		56	4
Total KW	3.16	0.075	-		5.04	0.24
Net total kW				8.515		

Observations & suggestions:

- All the T12 fluorescent tube lights and CFLs should be replaced with LED tubes and LED bulbs.
- All the old ceiling fans and their resistance type regulators should be replaced by energy efficient BLDC fans.

4. LUX MEASUREMENTS

According to BEE there is a lighting code to determine the overall energy efficiency of lighting system using measurements and methods, which is applicable to all commercial buildings. One of the methods is Illuminance method, which is the most practicable one. Lux values at various location in the building is given below in Table-

Location	Measured Lux	Required Lux	Remarks
Mess hall	321	150	Good
Corridors	86	80	Good
Average lux in rooms	179	150	Good

Note:

- Standard value is taken from the ECBC user guide.
- All the values are taken during the day time.
- LPD value is given in the Annexure-2

5. COMPUTER & its ACCESSORIES:

Details	Watts	Total No	Total KW
Laptop	100	5	0.5

6. Water consumption:

Gandhi Hostel consumes water for various purposes like

- Drinking.
- Toilets
- Cleaning.
- Washing.

Observations & Suggestions:

- Water consumption is not monitored.
- Two stage flushing control should be used in toilets for reducing water wastage.
- Water leakage was found in the pipes in the toilets and should be fixed soon.

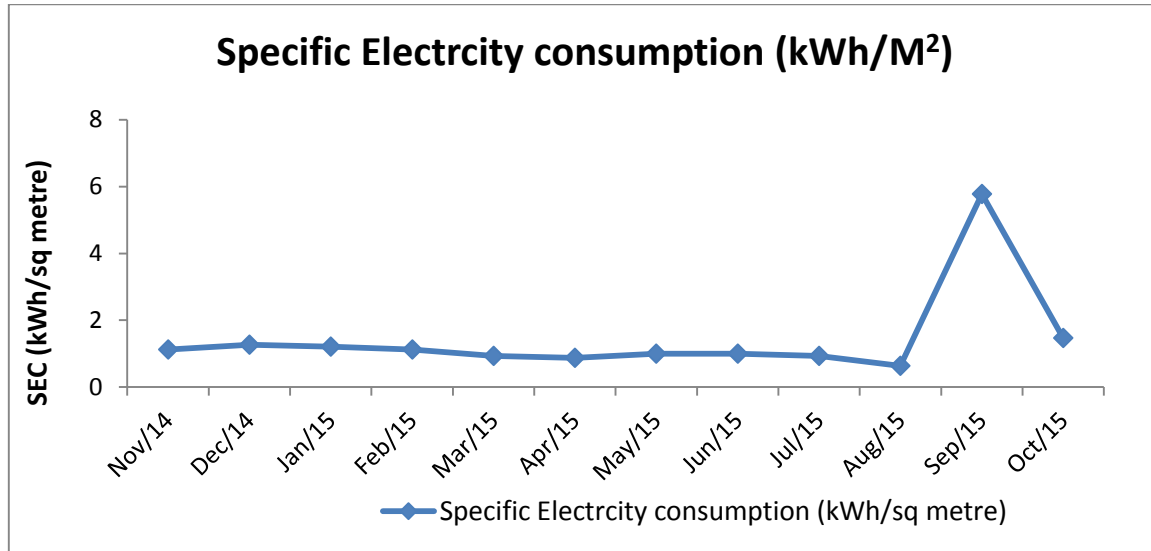
7. EFFICIENCY ANALYSIS:

Specific electricity consumption:

Specific electricity is calculated based on electricity consumed per building area in square meters. The details of specific electricity consumption for last few months are given below in table.

Month 2014-15	Electricity Consumption CSEB (Kwh)	Area Of The Building (M ²)	Specific Electricity Consumption (Kwh/M ²)
Nov-14	1780	1589.46	1.12
Dec-14	2015	1589.46	1.27
Jan-15	1920	1589.46	1.21
Feb-15	1780	1589.46	1.12
Mar-15	1481	1589.46	0.93
Apr-15	1389	1589.46	0.87
May-15	1580	1589.46	0.99
Jun-15	1580	1589.46	0.99
Jul-15	1475	1589.46	0.93
Aug-15	1003	1589.46	0.63
Sep-15	9181	1589.46	5.78
Oct-15	2336	1589.46	1.47

The energy performance index is plotted in the below chart.



Chart

Note:

- **The sudden increase in the SEC in the month of September was found to be unnatural. High SEC in June due to building renovation.**
- Specific electricity consumption found to be constant in all other months.
- Maximum SEC measured in the Sep-2015 and is 5.78 kWh/m².
- SEC is highly depended on the occupants in the hostel. Variations are also possible in specific electricity consumption due to energy usage variation in different seasons of the year.

C. PG GIRLS HOSTEL:

Building : PG GIRLS HOSTEL
Consumer No : 1000143820
Service No : 403268

1. Electrical Bill Analysis:

Base line data given below is based on the Electricity bill provided by the supplier of electricity CSPDCL. Details obtained from the Electricity bill is as follows in table-.

Base Line Data (based on last 12 months)		
1	Electricity Provider	CSPDCL
2	Tariff	LV1DL1GN14
3	Connected Load (KW)	3.7
4	Average monthly energy consumption (Kwh)	1378.41
5	Monthly Total Electricity Cost (Avg. In Rs)	7352.5
6	Average Power Factor	-

Observations:

- At present PF values are not included in the bill.

2. Electrical Load analysis:

Department	-	P.G ladies hostel		
Consumer / meter No	-	403268		
Date & time of measurement		25-11-2015, 11:21		
Actual Energy	kWh	3.86		
Apparent Energy	kVAh	5.45		
Power factor	-	0.708		
Particulars	Units	Minimum	Maximum	Average
Active power	kW	3.09	3.86	3.53
Apparent power	kVA	4.39	5.40	4.98
Voltage (VL)	Volts	244.2	250.1	247.4
Current	Amps	5.41	8.41	6.61
Voltage unbalance	%	0.01	0.6	0.35
Current unbalance	%	1.4	22.8	12.87
THD voltage	%	1.6	2.3	1.87
THD current	%	10.6	14.1	12.15

Observations:

- PF found to be low during the logging period.

Suggestions:

- PF should be improving using the LV capacitors to more than 0.90 to avoid the penalty in future. At present no penalisation has been done in the bill.

3. LIGHT & FAN LOAD CONSUMPTION PATTERN :-

Details	T12	SVL	CEILING FAN NEW	CEILING FAN OLD	EXHAUST FAN
Watts(W)	40	250	60	90	60
Total Nos.	112	2	-	66	1
Total KW	4.48	0.5	-	5.94	0.06
Net total	10.98				

Observations & suggestions:

- All the T12 fluorescent tube lights and CFLs should be replaced with LED tubes and LED bulbs.
- All the old ceiling fans and their resistance type regulators should be replaced by energy efficient BLDC fans and electronic regulators.

4. LUX MEASUREMENTS

According to BEE there is a lighting code to determine the overall energy efficiency of lighting system using measurements and methods which is applicable to all commercial buildings. One of the methods is Illuminance method which is the most practicable one. Lux values at various location in the building is given below in Table-

LOCATION	MEASURED LUX	REQUIRED LUX	REMARKS
Corridors	198	120	Good
Average lux in rooms	162	150	Good

Observations & suggestions:

- Light intensity is found to be good at the measured locations.

5. COMPUTER & its ACCESSORIES:

DETAILS	WATTS	TOTAL NO	TOTAL KW
LCD computer	200	6	1.2
Laptop	100	5	0.5
TOTAL KW			1.7

6. Water consumption:

PG ladies hostel consumes water for various purposes like

- Drinking.
- Toilets

- Cleaning.
- Washing.

Note:

- Water consumption is not monitored.
- Two stage flushing control should be used in toilets for reducing water wastage.

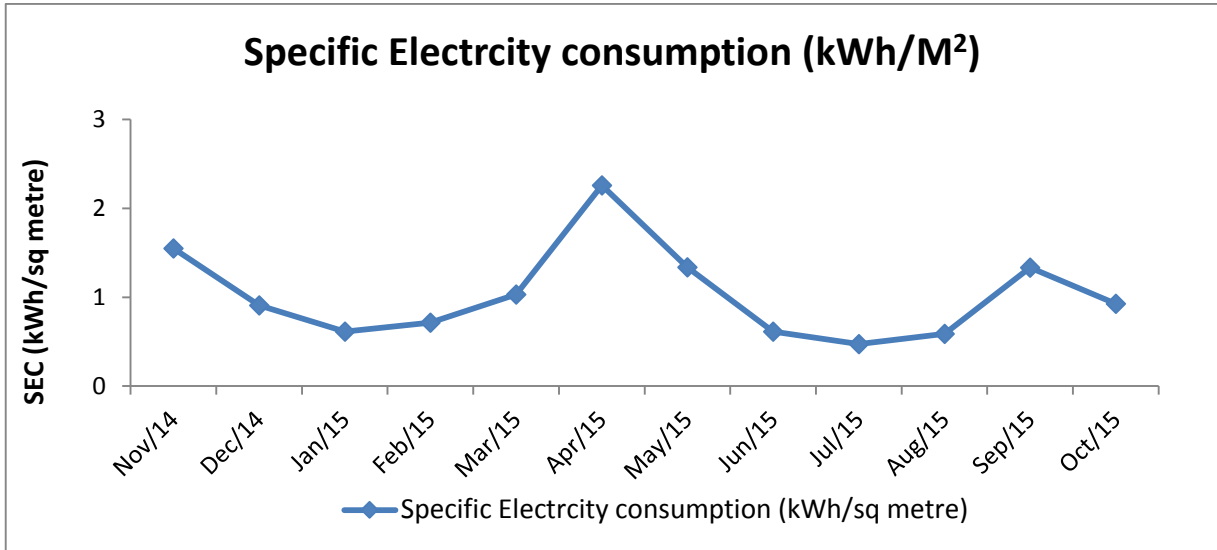
7. EFFICIENCY ANALYSIS:

Specific electricity consumption:

Specific electricity is calculated based on electricity consumed per building area in square meters. The details of specific electricity consumption for last few months are given below in table.

MONTH 2014-15	ELECTRICITY CONSUMPTION KSEB (kWh)	Area of the building (M ²)	SPECIFIC ELECTRICITY CONSUMPTION (kWh/M ²)
Nov-14	2076	1339.52	1.55
Dec-14	1218	1339.52	0.91
Jan-15	824	1339.52	0.62
Feb-15	959	1339.52	0.72
Mar-15	1380	1339.52	1.03
Apr-15	3025	1339.52	2.26
May-15	1791	1339.52	1.34
Jun-15	822	1339.52	0.61
Jul-15	632	1339.52	0.47
Aug-15	789	1339.52	0.59
Sep-15	1785	1339.52	1.33
Oct-15	1240	1339.52	0.93

The energy performance index is plotted in the below chart.



Chart

Note:

- Specific electricity consumption found to be varying in all those months.
- Maximum SEC measured in the Apr-2015 and is 2.26 kWh/m².
- SEC is highly depended on the occupants in the hostel. Variations are also possible in specific electricity consumption due to energy usage variation in different seasons of the year.

D.TEACHERS HOSTEL:

Building : TEACHERS HOSTEL
Consumer No : 11000143832
Service No : 403288

1. Electrical Bill Analysis:

Base line data given below is based on the Electricity bill provided by the supplier of electricity CSPDCL. Details obtained from the Electricity bill is as follows.

Base Line Data (based on last 12 months)		
1	Electricity Provider	CSPDCL
2	Tariff	LV2ND1OT14
3	Connected Load (KW)	3.7
4	Average Monthly Energy Consumption (Kwh)	519.58
5	Monthly Total Electricity Cost (Avg. In Rs)	5342.5
6	Average Power Factor	-

Observations:

- At present PF values are not included in the bill.

2. Electrical Load analysis:

Department	-	Teachers hostel		
Consumer / meter No	-	403288		
Date & time of measurement		25/11/2015 11:12:30		
Actual Energy	kWh	1.2		
Apparent Energy	kVAh	2.70		
Power factor	-	0.44		
Particulars	Units	Minimum	Maximum	Average
Active power	kW	1	1.37	1.20
Apparent power	kVA	2.22	3.21	2.70
Voltage (V _L)	Volts	240.56	252.75	245.77
Current	Amps	0.3	5.43	2.50
Voltage unbalance	%	1.79	3.39	2.26
Current unbalance	%	3.91	6.49	5.64
THD voltage	%	1.80	2.24	2.04
THD current	%	4.85	9.13	7.26

Standards:

- Permissible voltage limit as per CEA standards on grid connectivity is 230 plus or minus 10%, which means 254V is the maximum allowable.

Observations:

- At present maximum voltage came to around 252V which is at the brim. Slight increase in voltage leads damage to the instruments and equipment's

Suggestions:

- Check the voltage level frequently and ascertain that it is within the limits.
- Inform electricity board authorities.

3. LIGHT & FAN LOAD CONSUMPTION PATTERN

Details	T8	T12	CEILING FAN NEW	CEILING FAN OLD	EXHAUST FAN
Watts(W)	36	40	60	90	60
Total Nos.	4	52	-	25	2
Total KW	0.14	2.08	-	2.25	0.12
Net total kW	4.59				

Observations & suggestions:

- All the T12 fluorescent tube lights and CFLs should be replaced with LED tubes and LED bulbs.
- All the old ceiling fans and their resistance type regulators should be replaced by energy efficient BLDC fans.

4. LUX MEASUREMENTS

According to BEE there is a lighting code to determine the overall energy efficiency of lighting system using measurements and methods, which is applicable to all commercial buildings. One of the methods is Illuminance method, which is the most practicable one. Lux values at various location in the building is given below in Table-

LOCATION	MEASURED LUX	REQUIRED LUX	REMARKS
Corridors	225	150	Good
Average lux in rooms	177	150	Good
Mess hall	123	150	Good

Notes:

- Lux measurements are taken during the day time.

5. Computer & Its Accessories:

DETAILS	WATTS	TOTAL NO	TOTAL KW
Laptop	100	5	0.5

6. Water consumption:

Teachers Hostel consumes water for various purposes like

- Drinking.
- Cooking.
- Toilet flushing's
- Cleaning.
- Washing.

Note:

- Water consumption is not monitored.
- Two stage flushing control should be used in toilets for reducing water wastage.

7. EFFICIENCY ANALYSIS:

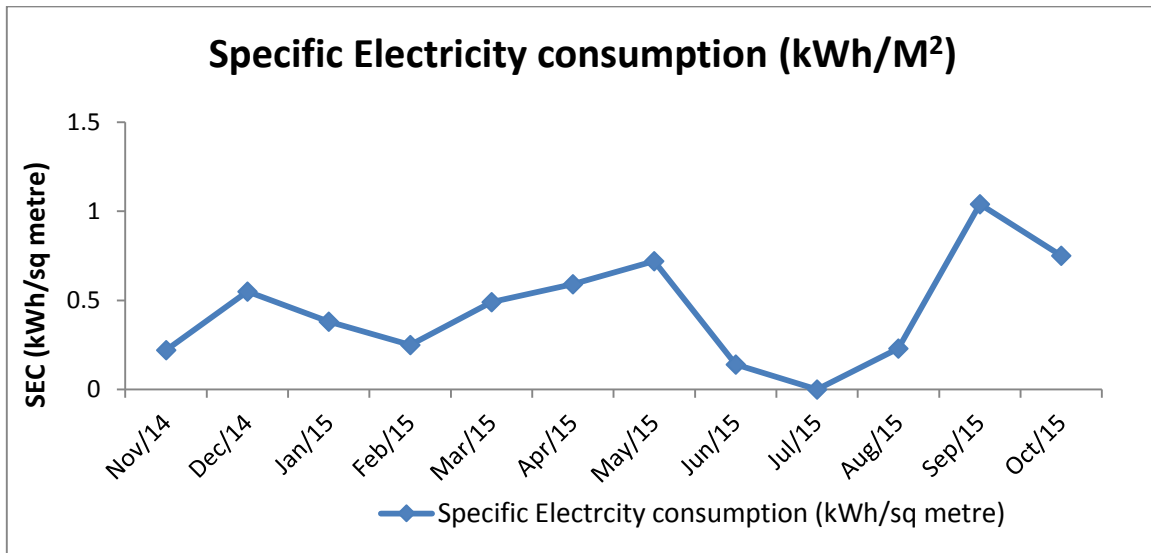
A. Specific electricity consumption:

Specific electricity is calculated based on electricity consumed per building area in square meters. The details of specific electricity consumption for last few months are given below in table.

MONTH 2014-15	ELECTRICIY CONSUMPTION KSEB (kWh)	Area of the building (M ²)	SPECIFIC ELECTRICITY CONSUMPTION (kWh/M ²)
Nov-14	259	1163.4	0.22
Dec-14	638	1163.4	0.55
Jan-15	444	1163.4	0.38
Feb-15	296	1163.4	0.25
Mar-15	566	1163.4	0.49
Apr-15	688	1163.4	0.59
May-15	840	1163.4	0.72
Jun-15	159	1163.4	0.14
Jul-15	0	1163.4	0.00
Aug-15	265	1163.4	0.23

Sep-15	1209	1163.4	1.04
Oct-15	871	1163.4	0.75

The energy performance index is plotted in the below chart.



Chart

Note:

- Specific electricity consumption found to be varying in all those months.
- Maximum SEC measured in the Sep-2015 and is 1.04 kWh/m².
- SEC is highly depended on the occupants in the hostel. Variations are also possible in specific electricity consumption due to energy usage variation in different seasons of the year.

E. AZAD HOSTEL:

Building : AZAD HOSTEL
Consumer No : 1000143929
Service No : 404408

1. Electrical Bill Analysis:

Base line data given below is based on the Electricity bill provided by the supplier of electricity CSPDCL. Details obtained from the Electricity bill is as follows.

Base Line Data (based on last 12 months)		
1	Electricity provider	CSPDCL
2	Tariff	LV2ND10T14
3	Connected load (kw)	2.1
6	Average monthly energy consumption (kWh)	1149
7	Monthly total electricity cost (avg. In rs)	8050
9	Average power factor	-

Observations:

- At present, PF is not included in the bill.

2. Electrical Load analysis:

Department	-	Azad hostel		
Consumer / meter No	-	404408		
Date & time of measurement		25-11-2015, 15:41		
Actual Energy	kWh	2.443		
Apparent Energy	kVAh	3.268		
Power factor	-	0.747		
Particulars	Units	Minimum	Maximum	Average
Active power	kW	2.09	7.79	3.37
Apparent power	kVA	2.90	9.94	4.50
Voltage (V _L)	Volts	231.93	246.002	239.92
Current	Amps	3.21	14.08	6.06
Voltage unbalance	%	0.5	0.9	0.7
Current unbalance	%	1.2	12.5	8.5
THD voltage	%	2.35	3.32	2.71
THD current	%	5.48	15.87	9.36

Observations:

- PF found to be low. It should be increase to more than 0.90 using the LV capacitors.

3. LIGHT & FAN LOAD CONSUMPTION PATTERN

Details	T12	SVL	CEILING FAN NEW	CEILING FAN OLD	EXHAUST FAN
Watts(W)	40	250	60	90	60
Total Nos.	76	2	-	48	2
Total KW	2.88	0.5	-	4.32	0.12
Net total kW	7.82				

Observations & suggestions:

- All the T12 fluorescent tube lights and CFLs should be replaced with LED tubes and LED bulbs.
- All the old ceiling fans and their resistance type regulators should be replaced by energy efficient BLDC fans.

4. LUX MEASUREMENTS

According to BEE there is a lighting code to determine the overall energy efficiency of lighting system using measurements and methods which is applicable to all commercial buildings. One of the methods is Illuminance method which is the most practicable one. Lux values at various location in the building is given below in Table-

LOCATION	MEASURED LUX	REQUIRED LUX	REMARKS
Average lux in rooms	177	150	Good
Corridors	98	150	Poor
Mess hall	212	150	Good

Standards:

- Light intensity measured during the day time.
- Standard lux value based on the ECBC user guide.

5. COMPUTER & its ACCESSORIES:

DETAILS	WATTS	TOTAL NO	TOTAL KW
LCD computer	200	6	1.2
CRT computer	250	--	--
Laptop	100	5	.5
TOTAL KW			1.7

6. Water consumption:

Azad Hostel consumes water for various purposes like

- Drinking.
- Cooking.
- Toilet
- Cleaning.
- Washing.

Note:

- Water consumption is not monitored.
- Two stage flushing control should be used in toilets for reducing water wastage.

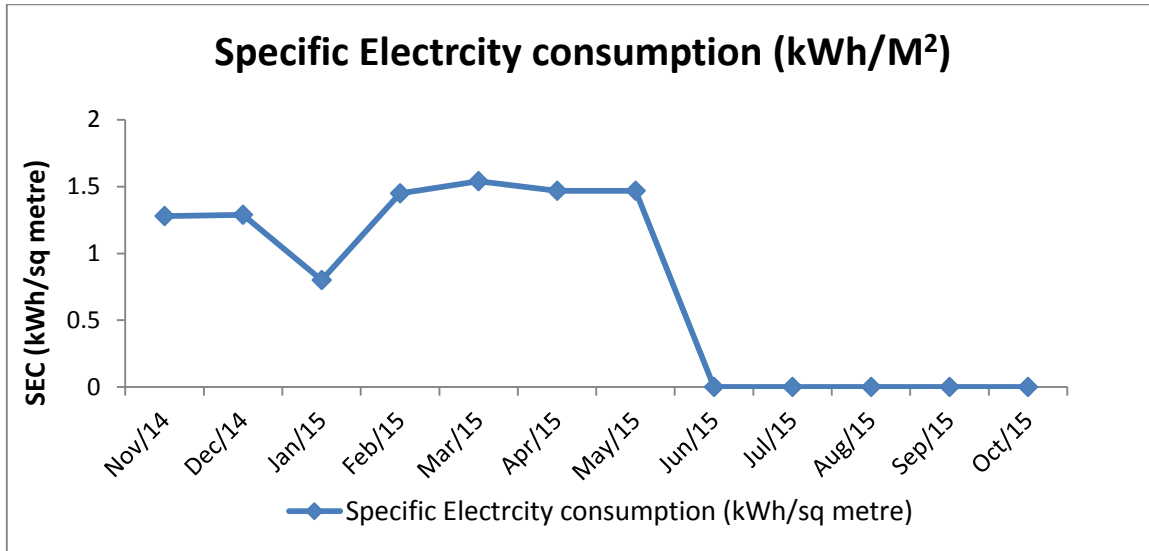
7. EFFICIENCY ANALYSIS:

A. Specific electricity consumption:

Specific electricity is calculated based on electricity consumed per building area in square meters. The details of specific electricity consumption for last few months are given below in table.

MONTH 2014-15	ELECTRICITY CONSUMPTION KSEB (kWh)	Area of the building (M ²)	SPECIFIC ELECTRICITY CONSUMPTION (kWh/M ²)
Nov-14	1897	1484	1.28
Dec-14	1907	1484	1.29
Jan-15	1183	1484	0.80
Feb-15	2150	1484	1.45
Mar-15	2279	1484	1.54
Apr-15	2186	1484	1.47
May-15	2186	1484	1.47

The energy performance index is plotted in the below chart.



Chart

Note:

- **Energy meter was not working and the unit consumption is not recorded in the bill.**
- Specific electricity consumption found to be varying in all those months.
- Maximum SEC measured in the Mar-2015 and is 1.54 kWh/m².
- SEC is highly depended on the occupants in the hostel. Variations are also possible in specific electricity consumption due to energy usage variation in different seasons of the year.

F. RESEARCH HOSTEL GIRLS:

Building : RESEARCH HOSTEL GIRLS
Consumer No : 1000147723
Service No : 771284

1. Electrical Bill Analysis:

Base line data given below is based on the Electricity bill provided by the supplier of electricity CSPDCL. Details obtained from the Electricity bill is as follows.

Base Line Data (based on last 12 months)		
1	Electricity provider	CSPDCL
2	Tariff	LV2ND1OT14
3	Connected load (kw)	2.25
4	Average monthly energy consumption (kwh)	2135.6
5	Monthly total electricity cost (avg. In rs)	14954
6	Average power factor	-

Observations:

- At present, PF is not included in the bill.

2. Electrical Load analysis:

Department	-	Research hostel girls		
Consumer / meter No	-	771284		
Date & time of measurement		25-11-2015, 11:21		
Actual Energy	kWh	3.86		
Apparent Energy	kVAh	5.45		
Power factor	-	0.708		
Particulars	Units	Minimum	Maximum	Average
Active power	kW	3.09	3.86	3.53
Apparent power	kVA	4.39	5.40	4.98
Voltage (VL)	Volts	244.2	250.1	247.4
Current	Amps	5.41	8.41	6.61
Voltage unbalance	%	.01	0.6	0.35
Current unbalance	%	1.4	22.8	12.87
THD voltage	%	1.6	2.3	1.87
THD current	%	10.6	14.1	12.15

Observations:

- PF found to be low.

3. LIGHT & FAN LOAD CONSUMPTION PATTERN

Details	T8	T12	SVL	CEILING FAN NEW	CEILING FAN OLD	EXHAUST FAN
Watts(W)	36	40	250	60	90	60
Total Nos.	9	45	2	-	26	2
Total KW	0.324	1.8	0.5	-	2.34	0.12
Net total kW	5.08					

Observations & suggestions:

- All the T12 fluorescent tube lights and CFLs should be replaced with LED tubes and LED bulbs.
- All the old ceiling fans and their resistance type regulators should be replaced by energy efficient BLDC fans and electronic regulators.

4. LUX MEASUREMENTS

According to BEE there is a lighting code to determine the overall energy efficiency of lighting system using measurements and methods which is applicable to all commercial buildings. One of the methods is Illuminance method which is the most practicable one. Lux values at various location in the building is given below in Table-

LOCATION	MEASURED LUX	REQUIRED LUX	REMARKS
Average lux in rooms	167	150	Good
Corridors	118	150	Good

Note:

- The entire measurement taken during the day time.
- Standard lux is based on the ECBE user guide.

5. COMPUTER & its ACCESSORIES:

DETAILS	WATTS	TOTAL NO	TOTAL KW
LCD computer	200	---	----
CRT computer	250	5	1.25
Laptop	100	10	1
TOTAL KW			2.25

6. Water consumption:

Research hostel girls consumes water for various purposes like

- Drinking.
- Cooking.
- Toilet
- Cleaning.
- Washing.

Note:

- Water consumption is not monitored.
- Two stage flushing control should be used in toilets for reducing water wastage.

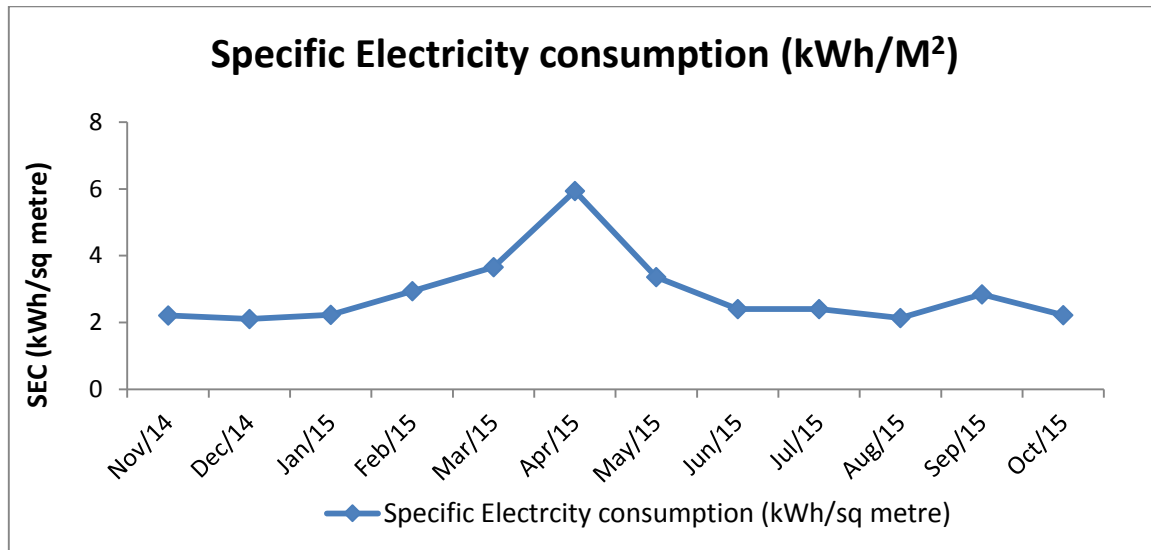
7. EFFICIENCY ANALYSIS:

Specific electricity consumption:

Specific electricity is calculated based on electricity consumed per building area in square meters. The details of specific electricity consumption for last few months are given below in table.

MONTH 2014-15	ELECTRICITY CONSUMPTION KSEB (kWh)	Area of the building (M ²)	SPECIFIC ELECTRICITY CONSUMPTION (kWh/M ²)
Nov-14	1643	744	2.21
Dec-14	1563	744	2.10
Jan-15	1662	744	2.23
Feb-15	2189	744	2.94
Mar-15	2719	744	3.65
Apr-15	4418	744	5.94
May-15	2500	744	3.36
Jun-15	1790	744	2.41
Jul-15	1790	744	2.41
Aug-15	1588	744	2.13
Sep-15	2113	744	2.84
Oct-15	1653	744	2.22

The energy performance index is plotted in the below chart.



Chart

Note:

- Specific electricity consumption found to be varying in all those months.
- Maximum SEC measured in the Apr-2015 and is 5.94 kWh/m².
- SEC is highly depended on the occupants in the hostel. Variations are also possible in specific electricity consumption due to energy usage variation in different seasons of the year.

G.PROFESSIONAL GIRLS HOSTEL:

Building : GIRLS HOSTEL
Consumer No : 1000150618
Service No : 774229

1. Electrical Bill Analysis:

Base line data given below is based on the Electricity bill provided by the supplier of electricity CSPDCL. Details obtained from the Electricity bill is as follows.

Base Line Data (based on last 12 months)		
1	Electricity provider	CSPDCL
2	Tariff	LV2ND1OT14
3	Connected load (kw)	7.4
4	Average monthly energy consumption (kwh)	2483.66
5	Monthly total electricity cost (avg. In rs)	18066.66
6	Average power factor	-

Observations:

- At present, PF is not included in the bill.

2. Electrical Load analysis:

Department	-	Professional girls hostel		
Consumer / meter No	-	774229		
Date & time of measurement		25-11-2015,13:11		
Actual Energy	kWh	1.36		
Apparent Energy	kVAh	2.10		
Power factor	-	0.64		
Particulars	Units	Minimum	Maximum	Average
Active power	kW	1.77	2.02	1.90
Apparent power	kVA	2.77	3.07	2.93
Voltage (VL)	Volts	249.7	256.5	252.49
Current	Amps	3.24	4.21	3.94
Voltage unbalance	%	0.4	1.3	0.86
Current unbalance	%	10.6	16.23	11.4
THD voltage	%	1.7	2.5	2.20
THD current	%	6.9	12.2	9.79

Standards:

- Permissible voltage limit as per CEA standards on grid connectivity is 230 plus or minus 10%, which means 254V is the maximum allowable.

Observations:

- At present maximum voltage exceeded the permissible limit which should be taken care of by reporting it to the supplier.
- Increase in the voltage increases the consumption of electricity and also the failure frequency of the equipment.

3. LIGHT & FAN LOAD CONSUMPTION PATTERN

Details	T12	SVL	BULB	CEILING FAN NEW	CEILING FAN OLD	EXHAUST FAN
Watts(W)	40	250	40	60	90	60
Total Nos.	72	2	2	-	39	3
Total KW	2.88	0.5	0.08	-	3.51	0.18
Net total kW	7.15					

Observations & suggestions:

- All the T12 fluorescent tube lights and CFLs should be replaced with LED tubes and LED bulbs.
- All the old ceiling fans and their resistance type regulators should be replaced by energy efficient BLDC fans.

4. LUX MEASUREMENTS

According to BEE there is a lighting code to determine the overall energy efficiency of lighting system using measurements and methods, which is applicable to all commercial buildings. One of the methods is Illuminance method, which is the most practicable one.

LOCATION	MEASURED LUX	REQUIRED LUX	REMARKS
Average lux in rooms	225	150	Good
Average lux corridors	189	150	Good

Note:

- The entire measurement taken during the day time.
- Standard lux is based on the ECBC user guide.

5. Computer & Its Accessories:

DETAILS	WATTS	TOTAL NO	TOTAL KW
Laptop	100	5	0.5

6. Water consumption:

Girls' hostel consumes water for various purposes like

- Drinking.
- Cooking.
- Toilet flushing's
- Cleaning

Note:

- Water consumption is not monitored.
- Two stage flushing control should be used in toilets for reducing water wastage.

7. EFFICIENCY ANALYSIS:

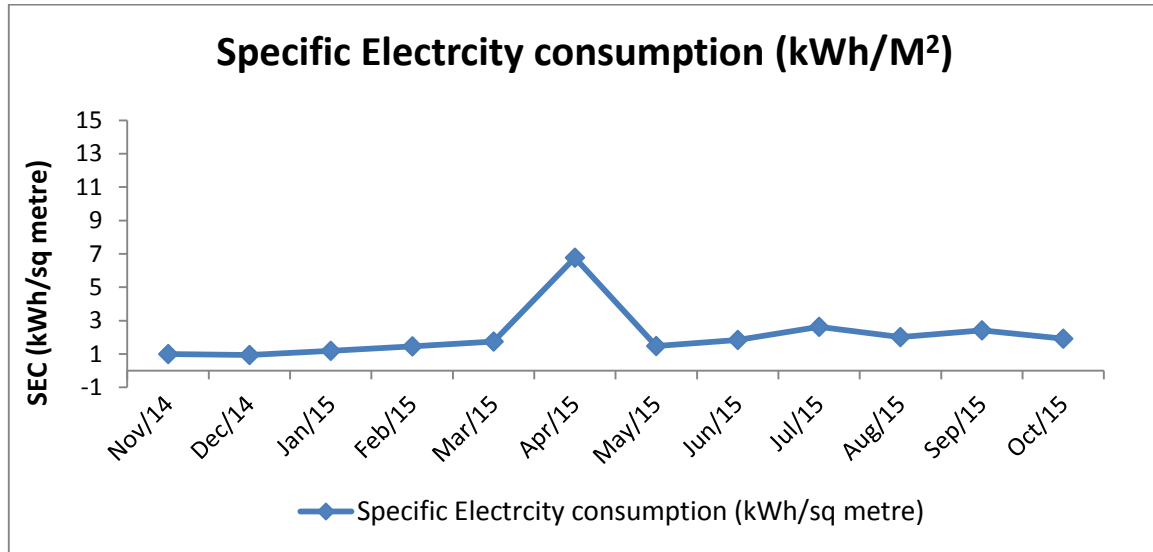
Specific electricity consumption:

Specific electricity is calculated based on electricity consumed per building area in square meters. The details of specific electricity consumption for last few months are given below in table.

MONTH 2014-15	ELECTRICITY CONSUMPTION KSEB (kWh)	Area of the building (M ²)	SPECIFIC ELECTRICITY CONSUMPTION (kWh/M ²)
Nov-14	1185	1172.4	1.01
Dec-14	1115	1172.4	0.95
Jan-15	1400	1172.4	1.19
Feb-15	1710	1172.4	1.46
Mar-15	2060	1172.4	1.76
Apr-15	7926	1172.4	6.76
May-15	1725	1172.4	1.47
Jun-15	2153	1172.4	1.84
Jul-15	3077	1172.4	2.62
Aug-15	2368	1172.4	2.02
Sep-15	2839	1172.4	2.42

Oct-15	2246	1172.4	1.92
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The energy performance index is plotted in the below chart.



Chart

Note:

- Specific electricity consumption found to be varying in all those months.
- Maximum SEC measured in the Apr-2015 and is 6.76 kWh/m².
- SEC is highly depended on the occupants in the hostel. Variations are also possible in specific electricity consumption due to energy usage variation in different seasons of the year.
- Variation in SEC due to the variation in accommodation

H. RESEARCH BOYS HOSTEL:

Building : RESEARCH BOYS HOSTEL
Consumer No : 1000604598
Service No : 606167

1. Electrical Bill Analysis:

Base line data given below is based on the Electricity bill provided by the supplier of electricity CSPDCL. Details obtained from the Electricity bill is as follows.

Base Line Data (based on last 12 months)		
1	Electricity provider	CSPDCL
2	Tariff	LV1DL1GN14
3	Connected load (kw)	3.94
4	Average monthly energy consumption (kwh)	345.5
5	Monthly total electricity cost (avg. In rs)	1414.16
6	Average power factor	-

Observations:

- PF is not mentioned in the EB bill.

2. Electrical Load analysis:

Department	-	Research boys hostel		
Consumer / meter No	-	606167		
Date & time of measurement		25-11-2015, 15:32		
Actual Energy	KWh	.032		
Apparent Energy	KVAh	.044		
Power factor	-	0.72		
Particulars	Units	Minimum	Maximum	Average
Active power	Kw	0.15	0.19	0.16
Apparent power	Kva	0.20	0.29	0.21
Voltage (V _L)	Volts	238.3	241.3	239.3
Current	Amps	0	0.96	0.34
Voltage unbalance	%	0.1	0.8	0.41
Current unbalance	%	109.3	136.1	112.8
THD voltage	%	2.9	3	2.9
THD current	%	3.2	4.1	2.30

Notes:

PF found to be low during the logging period.

3. LIGHT & FAN LOAD CONSUMPTION PATTERN

Details	T12	CFL	BULB	CEILING FAN NEW	CEILING FAN OLD	EXHAUST FAN
Watts(W)	40	36	40	60	90	60
Total Nos.	34	1	2	-	25	2
Total KW	1.36	0.036	.08	-	2.25	0.12
Net total kW	3.84					

Observations & suggestions:

- All the T12 fluorescent tube lights and CFLs may be replaced with LED tubes and LED bulbs.
- All the old ceiling fans and their resistance type regulators may be replaced by energy efficient fans.

4. Lux Measurements

According to BEE there is a lighting code to determine the overall energy efficiency of lighting system using measurements and methods which is applicable to all commercial buildings. One of the methods is Illuminance method which is the most practicable one.

Location	Measured	Required	Remarks
Average lux in rooms	189	150	Good
Corridors	226	150	Good

Note:

- The entire measurement taken during the day time.
- Standard lux is based on the ECBC user guide.

5. Computer & Its Accessories:

DETAILS	WATTS	TOTAL NO	TOTAL KW
Laptop	100	5	0.5

6. WATER CONSUMPTION:

Electronics and photonics department consumes water for various purposes like

- Drinking.
- Cooking.
- Toilet flushing's
- Cleaning

Note:

- Water consumption is not monitored.
- Two stage flushing control may be used in toilets for reducing water wastage.

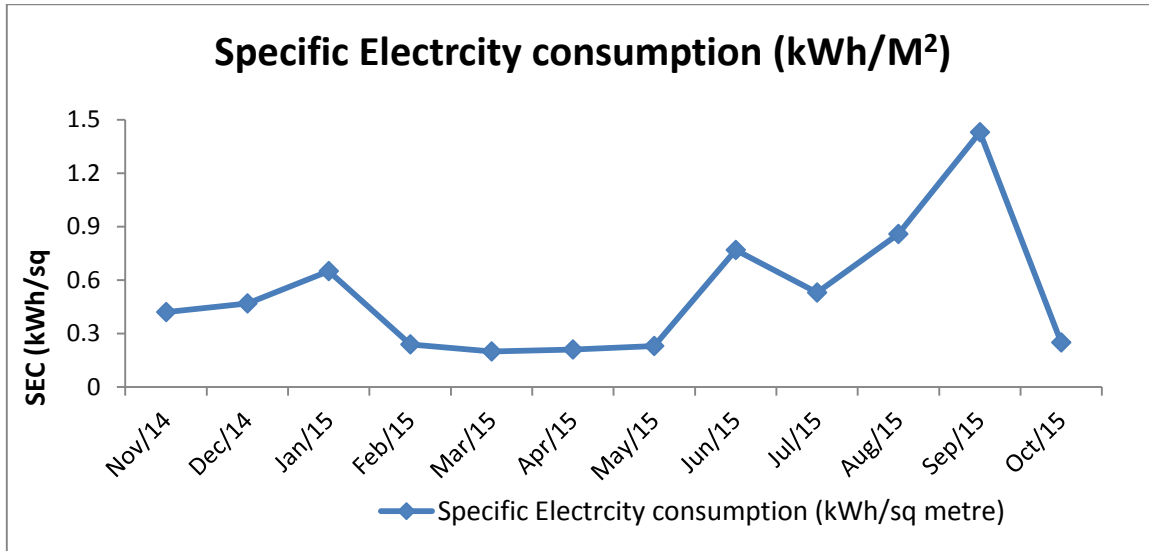
7. EFFICIENCY ANALYSIS:

Specific electricity consumption:

Specific electricity is calculated based on electricity consumed per building area in square meters. The details of specific electricity consumption for last few months are given below in table.

MONTH 2014-15	ELECTRICITY CONSUMPTION KSEB (kWh)	Area of the building (M²)	SPECIFIC ELECTRICITY CONSUMPTION (kWh/M²)
Nov-14	281	656	0.42
Dec-14	314	656	0.47
Jan-15	432	656	0.65
Feb-15	158	656	0.24
Mar-15	135	656	0.20
Apr-15	140	656	0.21
May-15	157	656	0.23
Jun-15	506	656	0.77
Jul-15	348	656	0.53
Aug-15	565	656	0.86
Sep-15	940	656	1.43
Oct-15	170	656	0.25

The energy performance index is plotted in the below chart.



Chart

Note:

- Specific electricity consumption found to be varying in all those months.
- Maximum SEC measured in the Sep-2015 and is 1.43 kWh/m².
- SEC is highly depended on the occupants in the hostel. Variations are also possible in specific electricity consumption due to energy usage variation in different seasons of the year.

I. GIRLS HOSTEL PUMP HOUSE:

Building : Near GIRLS HOSTEL
 Consumer No : 1000145454
 Service No : 406131

1. Electrical Bill Analysis:

Base line data given below is based on the Electricity bill provided by the supplier of electricity CSPDCL. Details obtained from the Electricity bill is as follows.

Base Line Data (based on last 12 months)		
1	Electricity provider	CSPDCL
2	Tariff	LV2ND10T14
3	Connected load (kw)	3.73
4	Average monthly energy consumption (kwh)	983.5
5	Monthly total electricity cost (avg. In rs)	6405
6	Average power factor	-

Observations:

- At present, PF is not included in the bill.

2. Electrical Load analysis:

Submersible pumps is used in the premises to pump the water to geography, Girls hostel, Registrar bungalow, Teachers colony etc. Rated power found to be 5HP and the rated discharge and head was not available at the university records.

Department	-	Pump room		
Consumer / meter No	-	406131		
Date & time of measurement		25-11-2015, 16:54		
Actual Energy	kWh	0.387		
Apparent Energy	kVAh	0.602		
Power factor	-	0.642		
Particulars	Units	Minimum	Maximum	Average
Active power	kW	3.01	3.13	3.03
Apparent power	kVA	4.69	4.77	4.61
Voltage (VL)	Volts	251.1	254.1	252.4
Current	Amps	6.01	6.43	6.22
Voltage unbalance	%	0.3	0.4	0.37
Current unbalance	%	2.8	3.5	3.08
THD voltage	%	1.7	2.0	1.89
THD current	%	2.3	2.6	2.44

Standards:

- Permissible voltage limit as per CEA standards on grid connectivity is 230 plus or minus 10%, which means 254V is the maximum allowable.

Observations:

- At present maximum voltage exceeded the permissible limit which should be taken care of by reporting it to the supplier.
- Increase in the voltage increases the consumption of electricity and also the failure frequency of the equipment.
- PF found to be low should be increase to more than 0.9 using the LV capacitor

Specific electricity consumption:

- Area was not available for the pump house thus SEC couldn't calculate.

J. Street Light:

Consumer No : 1000145454

1. Electrical Bill Analysis:

Base line data given below is based on the Electricity bill provided by the supplier of electricity CSPDCL. Details obtained from the Electricity bill is as follows.

Base Line Data (based on last 12 months)		
1	Electricity provider	CSPDCL
2	Tariff	LV6PU3SL14
3	Connected load (kw)	23.76
4	Average monthly energy consumption (kwh)	4756
5	Monthly total electricity cost (avg. In rs)	25,000
6	Average power factor	0.93

Observations:

- At present, maximum demand is not provided in the bill.**
- PF found to be within the prescribed limit.**

2. Electrical Load analysis:

The whole university street lights are supplied from this single metre which is a good practice. Operating hours of street lights found to be 12 hours. Using the power quality analyser street lights are logged for half an hour and details are given below in table

Department	-	Street light
Consumer / meter No	-	1002273059
Date & time of measurement		25/11/2015 16:54:00
Active Energy	kWh	10.50
Apparent Energy	kVAh	15.89

Power factor	-	0.66		
Particulars	Units	Minimum	Maximum	Average
Active power	kW	13.24	14.0	13.69
Apparent power	kVA	19.84	21.51	20.73
Voltage (V _L)	Volts	241.23	263.21	251.87
Current	Amps	10.10	36.26	21.13
Voltage unbalance	%	0.2	0.9	0.5
Current unbalance	%	1.5	15.2	10.5
THD voltage	%	1.41	2.09	1.75
THD current	%	22.34	42.00	30.23

Standards:

- Permissible voltage limit as per CEA standards on grid connectivity is 230 plus or minus 10%, which means 254V is the maximum allowable.

Observations:

- At present, maximum voltage exceeded the permissible limit which should be taken care of by reporting it to the supplier.
- Increase in the voltage increases the consumption of electricity and also the failure frequency of the equipment.

3. LIGHT LOAD DETAILS:

Details	T8	SVL
Watts(W)	36	300
Total Nos.	30	60
Total KW	1.08	18
Net total kW	19.08	

Specific electricity consumption:

- Area was not available for the pump house thus SEC couldn't calculate.

II. MEASUREMENTS TAKEN ON 26-11-2015

A. SOS IN ELECTRONICS AND PHOTONICS:

Building : ELECTRONICS AND PHOTONICS
 Department : ELECTRONICS AND PHOTONICS
 Consumer No : 1000147721
 Service No : 771282

1. Electrical Bill Analysis:

Base line data given below is based on the Electricity bill provided by the supplier of electricity CSPDCL. Details obtained from the Electricity bill is as follows.

Base Line Data (based on last 12 months)		
1	Electricity provider	CSPDCL
2	Tariff	LV2ND1OT14
3	Connected load (kw)	34.3
4	Average monthly energy consumption (kwh)	1150.09
5	Monthly total electricity cost (avg. In rs)	18684.5
6	Average power factor	-

Observations:

- At present, PF is not included in the bill.

2. Electrical Load analysis:

Department	-	Electronics and photonics		
Consumer / meter No	-	771282		
Date & time of measurement		26/11/2015 11:25		
Actual Energy	kWh	4.81		
Apparent Energy	kVAh	5.75		
Power factor	-	0.83		
Particulars	Units	Minimum	Maximum	Average
Active power	kW	2.29	11.5	4.78
Apparent power	kVA	3.1	12.3	5.71
Voltage (V _L)	Volts	240	248.2	244.94
Current	Amps	0	38.18	8.08
Voltage unbalance	%	1.2	2	1.41
Current unbalance	%	99.2	199.3	149.72
THD voltage	%	1.7	2.3	2.0
THD current	%	6.3	84	26.21

Observations:

- PF found to be low in the department.

3. LIGHT & FAN LOAD CONSUMPTION PATTERN

Details	T12	CFL	CEILING FAN NEW	CEILING FAN OLD	EXHAUST FAN
Watts(W)	40	15	60	90	60
Total Nos.	3J5	3	5	13	1
Total KW	1.4	0.045	0.3	1.17	.06
Net total kW	2.975				

Observations & suggestions:

- All the T12 fluorescent tube lights and CFLs should be replaced with LED tubes and LED bulbs.
- All the old ceiling fans and their resistance type regulators should be replaced by energy efficient BLDC fans.

4. LUX MEASUREMENTS

According to BEE there is a lighting code to determine the overall energy efficiency of lighting system using measurements and methods, which is applicable to all commercial buildings. One of the methods is Illuminance method, which is the most practicable one.

LOCATION	MEASURED LUX	REQUIRED LUX	REMARKS
Embedded lab	334	250	Good
Mr. Tiwary's cabin	221	150	Good
Ms. Kavitha Takur's	196	150	Good
Class room	210	150	Good
HOD cabin	264	150	Good
Office	256	250	Good
Photonics lab	351	250	Good
M-Tech class room	267	150	Good

Note:

- The entire measurement taken during the day time.
- Standard lux is based on the ECBC user guide.

5. COMPUTER & its ACCESSORIES:

DETAILS	WATTS	TOTAL NO	TOTAL KW
LCD computer	200	13	2.6
CRT computer	250	16	4
Laptop	100	-	-
Scanner	200	2	0.5
Xerox	350	1	0.35
Laser	200	2	0.4
3 in one printer	300	2	0.6
TOTAL KW			8.45

6. Air conditioning:

Electronics and photonics department have installed a total of 13 Split AC in the department including office, class rooms, laboratories etc. and their efficiency calculations are given below in table.

LOCATION	TYPE	COOLING CAPACITY (TR)	MEASURED COOLING CAPACITY (KW)	RATED POWER ELECTRICAL (kW)	RATED EER	MEASURED EER	REMARKS
Embedded lab	Split 1	2		NO AIR FLOW			To be check
Embedded lab	Split 2	2	4.8	2.3	2.8	2.09	
Tiwari sir cabin	Split	1.5	4.3	1.773	2.72	2.45	
Kavitha takur cabin	Split	1.5	4.1	1.773	2.72	2.33	
Class room	Split 1	1.5	4.2	1.875	2.75	2.29	
Class room	Split 2	1.5	4.10	1.9	2.66	2.16	
Hod cabin	Split	1.5	4.3	1.8	2.92	2.42	
Office	Split	1.5	4.02	1.773	2.72	2.27	
Photonics lab	Split	1.5	4.09	1.773	2.76	2.31	
Photonics lab	Split	1.5	3.9	1.773	2.76	2.24	
Photonics lab	Split	1.5	4.1	1.773	2.76	2.36	
M-Tech class room	Split	2	Not connected				Check
M-Tech class room	Split	2	Not connected				Check

Notes:

- General suggestions are given in the annexure:
- Most of the AC found to be new and are working well.

7. Water consumption:

Electronics and photonics department consumes water for various purposes like

- Drinking.
- Toilet flushing's
- Cleaning

Note:

- Water consumption is not monitored.
- Two stage flushing control should be used in toilets for reducing water wastage.

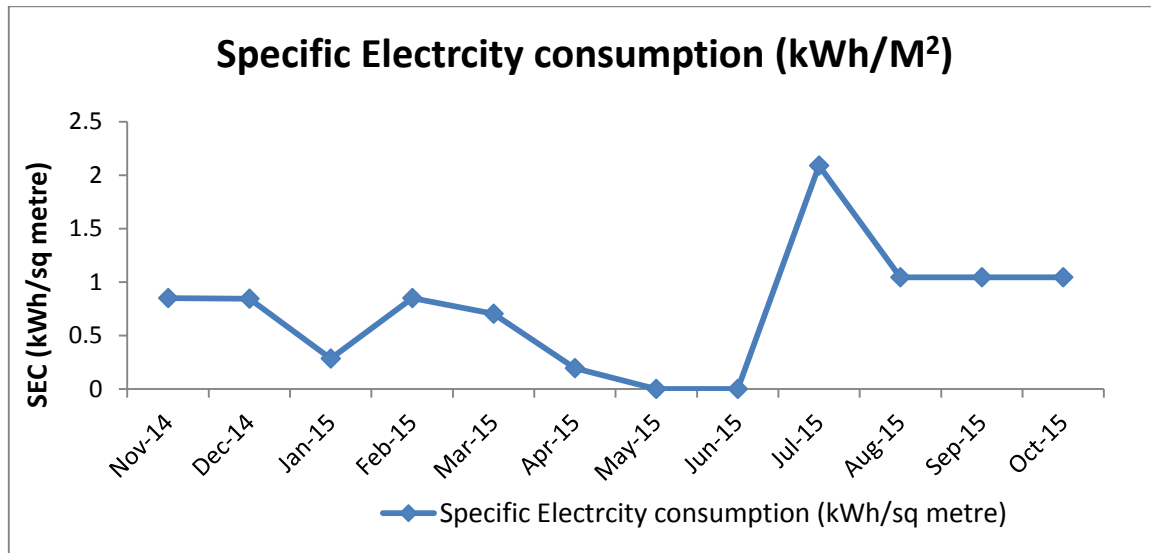
8. EFFICIENCY ANALYSIS:

A. Specific electricity consumption:

Specific electricity is calculated based on electricity consumed per building area in square meters. The details of specific electricity consumption for last few months are given below in table.

MONTH 2014-15	ELECTRICITY CONSUMPTION (kWh)	Area of the building (M ²)	SPECIFIC ELECTRICITY CONSUMPTION (kWh/M ²)
Nov-14	1201	1409.44	0.85
Dec-14	1193	1409.44	0.845
Jan-15	403	1409.44	0.285
Feb-15	1202	1409.44	0.85
Mar-15	997	1409.44	0.705
Apr-15	280	1409.44	0.195
May-15	-	1409.44	0
Jun-15	-	1409.44	0
Jul-15	2950	1409.44	2.09
Aug-15	1475	1409.44	1.045
Sep-15	1475	1409.44	1.045
Oct-15	1475	1409.44	1.045

The energy performance index is plotted in the below chart.



Chart

Note:

- Specific electricity consumption found to be varying in all those months.
- Maximum SEC measured in the Jul-2015 and is 2.09 kWh/m².
- SEC is highly depended on the occupants in the hostel. Variations are also possible in specific electricity consumption due to energy usage variation in different seasons of the year.

B. SOS IN COMPUTER SCIENCE & IT :

- i. Building : OLD COMPUTER BUILDING
 Department : SOS IN COMPUTER SCIENCE & IT
 Consumer No : 1000298132
 Service No : 773349

1. Electrical Bill Analysis:

Base line data given below is based on the Electricity bill provided by the supplier of electricity CSPDCL. Details obtained from the Electricity bill is as follows.

Base Line Data (based on last 12 months)		
1	Electricity provider	CSPDCL
2	Tariff	LV2ND3OT14
3	Connected load (kw)	20
4	Average monthly energy consumption (kwh)	1335.5
5	Monthly total electricity cost (avg. In rs)	13303.33
6	Average power factor	0.86

Observations:

- PF is found to be greater than 0.85 which is the limit in last 6 months electricity bill which is good practice.

2. Electrical Load analysis:

Department	-	Old Computer science building		
Consumer / meter No	-	773349		
Date & time of measurement		26/11/2015 16:08:30		
Actual Energy	KWh	1.28		
Apparent Energy	KVAh	2.30		
Power factor	-	0.55		
Particulars	Units	Minimum	Maximum	Average
Active power	Kw	2.26	4.32	3.49
Apparent power	Kva	3.82	7.96	6.29
Voltage (V _L)	Volts	249.62	256.22	252.84
Current	Amps	2.10	13.33	5.62
Voltage unbalance	%	0.5	1.1	0.8
Current unbalance	%	2.5	25.6	12.5
THD voltage	%	2.92	3.51	3.32
THD current	%	11.51	37.95	22.0

Standards:

- Permissible voltage limit as per CEA standards on grid connectivity is 230 plus or minus 10%, which means 254V is the maximum allowable.

Observations:

- At present maximum voltage exceeded the permissible limit which should be taken care of by reporting it to the supplier.
- Increase in the voltage increases the consumption of electricity and also the failure frequency of the equipment.

ii. Building : NEW COMPUTER BUILDING
 Department : SOS IN COMPUTER SCIENCE & IT
 Consumer No : 1001927961
 Service No : 406284

1. Electrical Bill Analysis:

Base line data given below is based on the Electricity bill provided by the supplier of electricity CSPDCL. Details obtained from the Electricity bill is as follows.

Base Line Data (based on last 12 months)		
1	Electricity provider	CSPDCL
2	Tariff	LV2ND3OT14
3	Connected load (kW)	40
4	Average monthly energy consumption (kWh)	923.25
5	Monthly total electricity cost (avg. In Rs)	19356.66
6	Average power factor	0.96

Observations:

- PF found to be good according to the EB bill

2. Electrical Load analysis:

Department	-	Computer science New building		
Consumer / meter No	-	406284		
Date & time of measurement		26/11/2015 15:54		
Actual Energy	kWh	0.52		
Apparent Energy	kVAh	0.76		
Power factor	-	0.68		
Particulars	Units	Minimum	Maximum	Average
Active power	kW	0.58	0.84	0.75
Apparent power	kVA	0.80	1.2	1.09

Voltage (VL)	Volts	246.1	259.3	252.1
Current	Amps	0	2.25	1.53
Voltage unbalance	%	2.4	2.98	2.7
Current unbalance	%	61.8	112.1	72.96
THD voltage	%	3.1	3.6	3.29
THD current	%	9.4	54.2	19.0

Standards:

- Permissible voltage limit as per CEA standards on grid connectivity is 230 plus or minus 10%, which means 254V is the maximum allowable.

Observations:

- At present maximum voltage exceeded the permissible limit which should be taken care of by reporting it to the supplier.
- Increase in the voltage increases the consumption of electricity and also the failure frequency of the equipment.

iii. Building : COMPUTER SERVER ROOM
 Department : SOS IN COMPUTER SCIENCE & IT
 Consumer No : 1001980067
 Service No : 406285

1. Electrical Bill Analysis:

Base line data given below is based on the Electricity bill provided by the supplier of electricity CSPDCL. Details obtained from the Electricity bill is as follows.

Base Line Data (based on last 12 months)		
1	Electricity provider	CSPDCL
2	Tariff	LV2ND3OT14
3	Connected load (kW)	10
4	Average monthly energy consumption (kWh)	3167.91
5	Monthly total electricity cost (avg. In Rs)	28151.66
6	Average power factor	0.83

Observations:

- **PF found to be low. It should be increased to more than 0.85 to avoid the penalty from the CSPDCL. At present, no penalty issued by the CSPDCL in this regard.**

2. Electrical Load analysis:

Department	-	Computer science server room
Consumer / meter No	-	406285
Date & time of measurement		26/11/2015 15:11
Actual Energy	kWh	0.48

Apparent Energy	kVAh	4.54		
Power factor	-	0.10		
Particulars	Units	Minimum	Maximum	Average
Active power	kW	0.22	1.08	0.66
Apparent power	kVA	4.38	8.25	6.20
Voltage (VL)	Volts	243.9	264.3	252.2
Current	Amps	4.62	13.38	7.09
Voltage unbalance	%	0.6	0.85	0.65
Current unbalance	%	5.3	36.3	22.1
THD voltage	%	3.03	4.20	3.49
THD current	%	23.17	96	69.5

Standards:

- Permissible voltage limit as per CEA standards on grid connectivity is 230 plus or minus 10%, which means 254V is the maximum allowable.

Observations:

- At present maximum voltage exceeded the permissible limit which should be taken care of by reporting it to the supplier.
- Increase in the voltage increases the consumption of electricity and also the failure frequency of the equipment.

3. LIGHT & FAN LOAD CONSUMPTION PATTERN

Details	T12	CFL	CFL	CEILING FAN NEW	CEILING FAN OLD	EXHAUST FAN
Watts(W)	40	36	15	60	90	60
Total Nos.	125	5	2	33	50	3
Total KW	5	0.18	0.03	1.98	4.5	0.18
Net total Kw	13.76					

Observations & suggestions:

- All the T12 fluorescent tube lights and CFLs should be replaced with LED tubes and LED bulbs.
- All the old ceiling fans and their resistance type regulators should be replaced by energy efficient BLDC fans.

4. Lux Measurements

According to BEE there is a lighting code to determine the overall energy efficiency of lighting system using measurements and methods, which is applicable to all commercial buildings. One of the methods is Illuminance method, which is the most practicable one. Light intensity at the various locations are given below in table-

LOCATION	MEASURED LUX	REQUIRED LUX	REMARKS
Average lux in class rooms	175	150	Good
Faculty room	198	150	Good
Dr Sanjay kumar	202	150	Good
Dr UK. Patel	189	150	Good
Seminar hall	221	150	Good
Computer lab ground floor	342	250	Good
Computer lab first floor	369	250	Good

Note:

- The entire measurement taken during the day time.
- Standard lux is based on the ECBC user guide.

5. Computer & Its Accessories:

DETAILS	WATTS	TOTAL NO	TOTAL KW
LCD computer	200	67	13.4
CRT computer	250	-	-
Laptop	100	2	0.2
Scanner	200	1	0.2
Xerox	350	1	0.35
Laser	200	3	0.6
3 in one printer	300	-	-
TOTAL KW			14.75

6. Air conditioning:

Computer science department have installed a total of 22 Split AC in the department including office, class rooms, laboratories etc. and their efficiency calculations are given below in table.

LOCATION	TYPE	COOLING CAPACITY (TR)	MEASURED COOLING CAPACITY KW	RATED POWER ELECTRICAL (KW)	RATED EER	MEASURED EER
Dr.Sanjay	Split	2	6.4	2.5	2.7	2.56
Dr.VK Patel	Split	2	6.2	2.5	2.7	2.49
Computer lab FF	Split 1	1.5	4.9	1.55	3.4	3.21
	Split 2	1.5	5.1	1.55	3.4	3.3
	Split 3	1.5	5.06	1.55	3.4	3.27

	Split 4	1.5	4.82	1.55	3.4	3.11
	Split 5	1.5	5.05	1.55	3.4	3.26
	Split 6	1.5	5.14	1.55	3.4	3.32
	Split 7	1.5	5.03	1.55	3.4	3.25
	Split 8	1.5	4.80	1.55	3.4	3.10
	Split 9	1.5	5.14	1.55	3.4	3.32
	Split 10	1.5	4.78	1.55	3.4	3.09
	Split 11	1.5	4.99	1.55	3.4	3.22
	Split 12	1.5	4.89	1.55	3.4	3.16
	Split 13	1.5	4.99	1.55	3.4	3.22
	Split 14	1.5	4.91	1.55	3.4	3.17
	Split 15	1.5	5.11	1.55	3.4	3.30
	Split 16	1.5	4.89	1.55	3.4	3.16
	Split 17	1.5	5.02	1.55	3.4	3.24
	Split 18	1.5	5.09	1.55	3.4	3.29
	Split 19	1.5	4.92	1.55	3.4	3.18
	Split 20	1.5	5.06	1.55	3.4	3.27
Computer lab gf	Split 1	Not working				
	Split 2	Not working				
	Split 3	1.5	3.4	2.5	2.11	1.36
Seminar hall	12 split ac	Damaged				

Notes:

- In seminar hall Split AC are in poor condition and are not working. Change the Split AC in the seminar hall with new one.

7. WATER CONSUMPTION:

Computer science department consumes water for various purposes like

- Drinking.
- Toilet
- Cleaning

Note:

- Water consumption is not monitored.
- Two stage flushing control should be used in toilets for reducing water wastage.

8. EFFICIENCY ANALYSIS:

Specific electricity consumption:

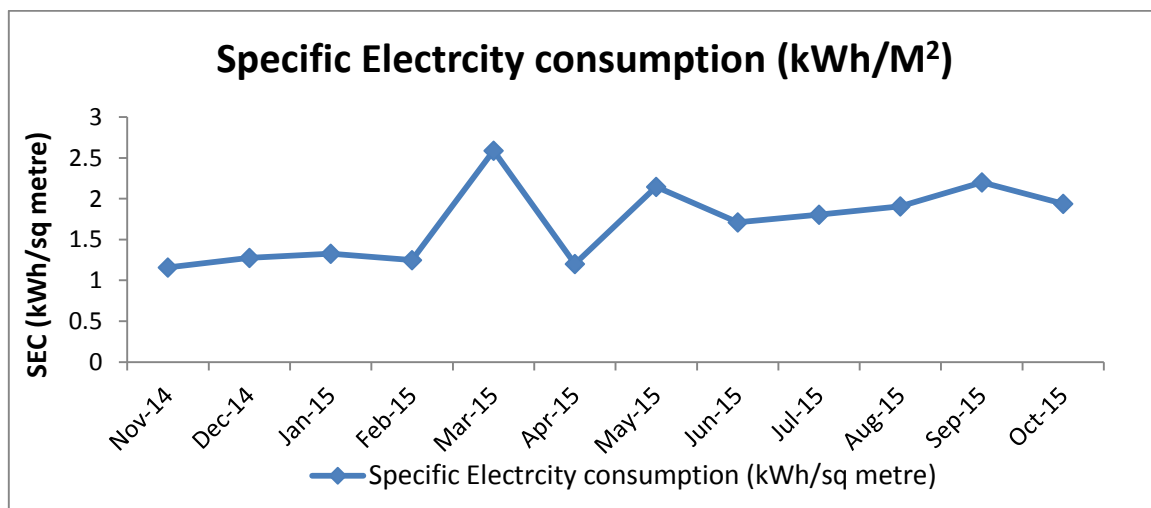
Specific electricity is calculated based on electricity consumed per building area in square meters. The details of specific electricity consumption for last few months are given below in table.

MONTH 2014-15	ELECTRICITY CONSUMPTION KSEB (kWh)	Area of the building (M ²)	SPECIFIC ELECTRICITY CONSUMPTION (kWh/M ²)
Nov-14	3690	3171.36	1.16
Dec-14	4048	3171.36	1.275
Jan-15	4205	3171.36	1.325
Feb-15	3975	3171.36	1.25
Mar-15	8216	3171.36	2.59
Apr-15	3813	3171.36	1.2
May-15	6817	3171.36	2.145
Jun-15	5428	3171.36	1.71
Jul-15	5736	3171.36	1.805
Aug-15	6049	3171.36	1.905
Sep-15	6986	3171.36	2.2
Oct-15	6157	3171.36	1.94

Note:

- The electricity consumption taken from the last 12 months electricity bill. It's the sum of units consumed through the three meter installed in the computer science building

The energy performance index is plotted in the below chart.



Note:

- Specific electricity consumption found to be varying in all those months.
- Maximum SEC measured in the Mar-2015 and is 2.59 kWh/m².
- SEC is highly depended on the seasonal changes and the number of working days in a month. Variations are also possible in specific electricity consumption due to energy usage variation in different seasons of the year

C. HUMAN REOURCES DEVELOPMENT CENTRE:

Building : HRDC
Department : HRDC
Consumer No : 1005795195

1. Electrical Bill Analysis:

Base line data given below is based on the Electricity bill provided by the supplier of electricity CSPDCL. Details obtained from the Electricity bill is as follows.

Base Line Data (based on last 12 months)		
1	Electricity provider	CSPDCL
2	Tariff	LV2ND3OT14
3	Connected load (kW)	40
4	Average power factor	0.85

Observations:

- PF found to be good in the department.
- New metre installed in the premises and the previous data are not available.

1. Electrical Load analysis:

Department	-	HRDC		
Consumer / meter No	-	1005795195		
Date & time of measurement		26/11/2015 14:59		
Actual Energy	kWh	3.42		
Apparent Energy	kVAh	3.74		
Power factor	-	0.91		
Particulars	Units	Minimum	Maximum	Average
Active power	kW	3.05	5.17	4.02
Apparent power	kVA	3.44	5.53	4.40
Voltage (V _L)	Volts	250.1	255.2	252.0
Current	Amps	2.43	9.55	5.80
Voltage unbalance	%	0.7	0.9	0.81

Current unbalance	%	32.6	84.6	59.43
THD voltage	%	3	4.4	3.55
THD current	%	7	47.2	29.43

Standards:

- Permissible voltage limit as per CEA standards on grid connectivity is 230 plus or minus 10%, which means 254V is the maximum allowable.

Observations:

- At present maximum voltage exceeded the permissible limit which should be taken care of by reporting it to the supplier.
- Increase in the voltage increases the consumption of electricity and also the failure frequency of the equipment.
- PF found to be good in the system.

2. LIGHT & FAN LOAD CONSUMPTION PATTERN

Details	T12	CFL	BULB	CEILING FAN NEW	CEILING FAN OLD	EXHAUST FAN
Watts(W)	40	15	40	60	90	60
Total Nos.	90	6	-	-	57	3
Total KW	3.6	.09	-	-	5.13	0.18
Net total Kw	9					

Observations & suggestions:

- All the T12 fluorescent tube lights and CFLs should be replaced with LED tubes and LED bulbs.
- All the old ceiling fans and their resistance type regulators should be replaced by energy efficient BLDC fans.

3. Lux Measurements

According to BEE there is a lighting code to determine the overall energy efficiency of lighting system using measurements and methods which is applicable to all commercial buildings. One of the methods is Illuminance method which is the most practicable one.

LOCATION	MEASURED LUX	REQUIRED LUX	REMARKS
Director room	207	150	Good
Dr.Aravind Agarwal	172	150	Good
Lecture hall	189	150	Good
Computer lab	266	250	Good
Lecture hall 1	196	150	Good
Lecture hall 2	201	150	Good
Seminar hall	226	150	Good

Faculty room	241	150	Good
Library	223	250	Average

Note:

- The entire measurement taken during the day time.
- Standard lux is based on the ECBC user guide.

4. Computer & Its Accessories:

DETAILS	WATTS	TOTAL NO	TOTAL KW
LCD computer	200	20	4
Scanner	200	1	0.2
Xerox	350	1	0.35
Laser	200	4	0.8
3 in one printer	300	1	0.3
TOTAL KW			5.65

5. Air conditioning:

HRDC department have installed a total of 17 Split AC in the department including office, class rooms, laboratories etc. and their efficiency calculations are given below in table.

LOCATION	TYPE	COOLING CAPACITY (TR)	MEASURE D COOLING CAPACITY (KW)	RATED POWER ELECTRICAL (KW)	RATE D EER	MEASURE D EER
Store room	Split	1.5	5.16	1.55	3.4	3.33
Director room	Split	1.5	5.14	1.55	3.4	3.32
Dr.Aravind	Split	1.5	5.25	1.55	3.4	3.39
Lecture hall	Split	1.5	5.22	1.55	3.4	3.37
	Split	1.5	5.23	1.55	3.4	3.38
Computer lab	Split	1.5	5.20	1.55	3.4	3.36
	Split	1.5	5.23	1.55	3.4	3.38
Lecture hall 1	Split	1.5	5.17	1.55	3.4	3.34
	Split	1.5	5.19	1.55	3.4	3.35
Lecture hall 2	Split	1.5	5.25	1.55	3.4	3.39
	Split	1.5	5.23	1.55	3.4	3.38
Seminar hall	Split	1.5	5.17	1.55	3.4	3.34
	Split	1.5	5.14	1.55	3.4	3.32
	Split	1.5	5.19	1.55	3.4	3.35
	Split	1.5	5.17	1.55	3.4	3.34
Faculty room	Split	1.5	5.17	1.55	3.4	3.34
Library	Split	1.5	5.13	1.55	3.4	3.31
	Split	1.5	5.16	1.55	3.4	3.33

6. WATER CONSUMPTION:

HRDC department consumes water for various purposes like

- Drinking.
- Toilet flushing's
- Cleaning

Note:

- Water consumption is not monitored.
- Two stage flushing control should be used in toilets for reducing water wastage.

D. INSTITUTE OF MANAGEMENT:

Building : MBA
 Department : MBA
 Consumer No : 100298314
 Service No : 773578

1. Electrical Bill Analysis:

Base line data given below is based on the Electricity bill provided by the supplier of electricity CSPDCL. Details obtained from the Electricity bill is as follows.

Base Line Data (based on last 12 months)		
1	Electricity provider	CSPDCL
2	Tariff	LV2ND3OT14
3	Connected load (kW)	51.7
4	Average monthly energy consumption (kWh)	1883.33
5	Monthly total electricity cost (avg. In Rs)	64740
6	Average power factor	0.80

Observations:

- **PF found to be low in the building. Increase the PF to above 0.9 by installing the LV capacitors**

2. Electrical Load analysis:

Department	-	MBA dept		
Consumer / meter No	-	773578		
Date & time of measurement		26/11/2015 12:58		
Actual Energy	kWh	5.26		
Apparent Energy	kVAh	7.23		
Power factor	-	0.72		
Particulars	Units	Minimum	Maximum	Average
Active power	kW	4.25	6.28	5.26
Apparent power	kVA	5.84	8.61	7.23

Voltage (VL)	Volts	251.8	255.1	253.2
Current	Amps	0.77	16.31	10.07
Voltage unbalance	%	0.1	0.6	0.35
Current unbalance	%	62.5	90.7	76.3
THD voltage	%	2.7	3.2	2.9
THD current	%	6.1	15.5	8.38

Standards:

- Permissible voltage limit as per CEA standards on grid connectivity is 230 plus or minus 10%, which means 254V is the maximum allowable.

Observations:

- At present maximum voltage exceeded the permissible limit which should be taken care of by reporting it to the supplier.
- Increase in the voltage increases the consumption of electricity and also the failure frequency of the equipment.

3. LIGHT & FAN LOAD CONSUMPTION PATTERN

Details	T12	CFL	CFL	WALL FAN	CEILING FAN OLD	EXHAUST FAN
Watts(W)	40	15	36	60	90	60
Total Nos.	126	7	8	2	81	1
Total KW	5.04	0.105	0.288	0.12	7.29	0.06
Net total Kw	12.90					

Observations & suggestions:

- All the T12 fluorescent tube lights and CFLs should be replaced with LED tubes and LED bulbs.
- All the old ceiling fans and their resistance type regulators should be replaced by energy efficient BLDC fans.

4. Lux Measurements

According to BEE there is a lighting code to determine the overall energy efficiency of lighting system using measurements and methods which is applicable to all commercial buildings. One of the methods is Illuminance method which is the most practicable one.

LOCATION	MEASURED LUX	REQUIRED LUX	REMARKS
AK Srivasthava	298	150	Good
RP Das	276	150	Good
Computer lab	298	250	Good
Faculty room	176	150	Good
Office	203	150	Good

Average lux in class rooms	231	150	Good
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Observations & suggestions:

- The entire measurement taken during the day time.
- Standard lux is based on the ECBC user guide.

5. Computer & Its Accessories:

DETAILS	WATTS	TOTAL NO	TOTAL KW
LCD computer	200	9	1.8
CRT computer	250	20	5
Scanner	200	1	0.2
Xerox	350	1	0.35
Laser	200	4	0.8
3 in one printer	300	1	0.3
Total kW			8.45

6. Air conditioning:

Management department have installed a total of 7 Split AC in the department including office, class rooms, laboratories etc. and their efficiency calculations are given below in table.

LOCATION	TYPE	COOLING CAPACITY (TR)	MEASURED COOLING CAPACITY KW	RATED POWER ELECTRICAL (Kw)	RATED EER	MEASURED EER
Ak Srivasthava	Split	1.5	4.02	1.8	2.9	2.24
RP Das	Split	1.5	3.65	1.8	2.9	2.31
Computer lab	Split	2	Not working			
Computer lab	Split	2	Not working			
Computer lab	Split	2	Not working			
Computer lab	Split	2	Not working			
Computer lab	Split	2	Not working			

Note:

- **Computer Lab AC is found to be old and not working. It needs an urgent replacement with Five star split AC.**

7. WATER CONSUMPTION:

The institute of management consumes water for various purposes like

- Drinking.
- Toilet

- Cleaning

Note:

- Water consumption is not monitored.
- Two stage flushing control should be used in toilets for reducing water wastage.

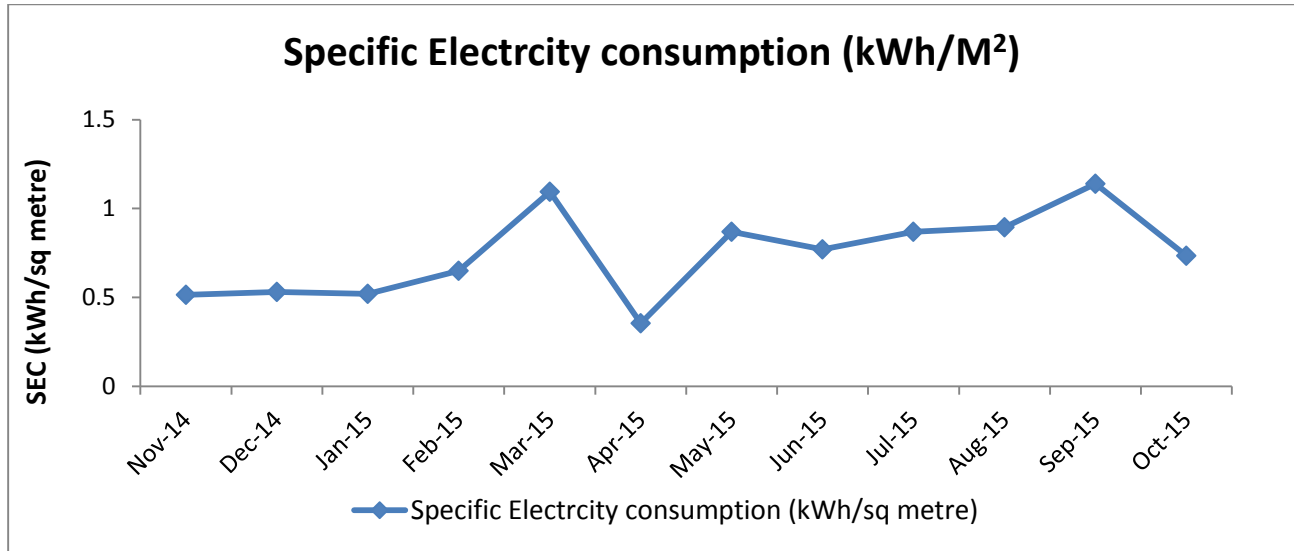
8. EFFICIENCY ANALYSIS:

Specific electricity consumption:

Specific electricity is calculated based on electricity consumed per building area in square meters. The details of specific electricity consumption for last few months are given below in table.

MONTH 2014-15	ELECTRICITY CONSUMPTION KSEB (kWh)	Area of the building (M ²)	SPECIFIC ELECTRICITY CONSUMPTION (kWh/M ²)
Nov-14	1300	2514.02	0.515
Dec-14	1340	2514.02	0.53
Jan-15	1320	2514.02	0.52
Feb-15	1640	2514.02	0.65
Mar-15	2760	2514.02	1.095
Apr-15	900	2514.02	0.355
May-15	2200	2514.02	0.87
Jun-15	1940	2514.02	0.77
Jul-15	2200	2514.02	0.87
Aug-15	2260	2514.02	0.895
Sep-15	2880	2514.02	1.14
Oct-15	1860	2514.02	0.735

The energy performance index is plotted in the below chart.



Note:

- Specific electricity consumption found to be varying in all those months.
- Maximum SEC measured in the Mar-2015 and is 1.01 kWh/m².
- SEC is highly depended on the seasonal changes and the number of working days in a month. Variations are also possible in specific electricity consumption due to energy usage variation in different seasons of the year.

E. NATIONAL CENTRE FOR NATURAL RECOURCES:

Building : CENTRE FOR NATURAL RECOURCES
Department : CENTRE FOR NATURAL RECOURCES
Consumer No : 1005248369

1. Electrical Bill Analysis:

Base line data given below is based on the Electricity bill provided by the supplier of electricity CSPDCL. Details obtained from the Electricity bill is as follows.

Base Line Data (based on last 12 months)		
1	Electricity provider	CSPDCL
2	Tariff	LV2ND3OT14
3	Connected load (kW)	30.6
4	Average monthly energy consumption (kWh)	1351
5	Monthly total electricity cost (avg. In Rs)	13510
6	Average power factor	0.87

Observations:

- PF found to be good in the building.

2. Electrical Load analysis:

Department	-	National Centre for natural resource		
Consumer / meter No	-	1005248369		
Date & time of measurement		26/11/2015 13:16		
Actual Energy	kWh	2.87		
Apparent Energy	kVAh	7.25		
Power factor	-	0.39		
Particulars	Units	Minimum	Maximum	Average
Active power	kW	2.55	4.21	2.87
Apparent power	kVA	6.69	11.29	7.25
Voltage (VL)	Volts	251.46	255.70	254.37
Current	Amps	0.07	18.08	4.39
Voltage unbalance	%	1.2	2.5	2.3
Current unbalance	%	6.2	22.1	15.6
THD voltage	%	2.95	3.46	3.16
THD current	%	11.19	31.13	23.11

Standards:

- Permissible voltage limit as per CEA standards on grid connectivity is 230 plus or minus 10%, which means 254V is the maximum allowable.

Observations:

- At present maximum voltage exceeded the permissible limit which should be taken care of by reporting it to the supplier.
- Increase in the voltage increases the consumption of electricity and also the failure frequency of the equipment.

3. LIGHT & FAN LOAD CONSUMPTION PATTERN

Details	T8	T12	CFL	CEILING FAN NEW
Watts(W)	36	40	15	60
Total Nos.	15	12	8	8
Total KW	0.54	0.48	0.12	0.48
Net total Kw	1.62			

Observations & suggestions:

- All the T12 fluorescent tube lights and CFLs should be replaced with LED tubes and LED bulbs.
- All the old ceiling fans and their resistance type regulators should be replaced by energy efficient BLDC fans.

3. Lux Measurements

According to BEE there is a lighting code to determine the overall energy efficiency of lighting system using measurements and methods, which is applicable to all commercial buildings. One of the methods is Illuminance method, which is the most practicable one.

LOCATION	MEASURED LUX	REQUIRED LUX	REMARKS
NMR	234	150	Good
Data processing lab	277	250	Good
HPLC	301	250	Good

Note:

- The entire measurement taken during the day time.
- Standard lux is based on the ECBC user guide.

4. Computer & Its Accessories:

DETAILS	WATTS	TOTAL NO	TOTAL KW
LCD computer	200	5	1
CRT computer	250	-	
Laptop	100	4	0.4
Scanner	200	1	0.1
Xerox	350	-	-
Laser	200	2	0.4
3 in one printer	300	1	0.3
TOTAL KW			1.2

5. Air conditioning:

The department have installed a total of 11 Split AC in the department and their efficiency calculations are given below in table.

LOCATION	TYPE	COOLING CAPACITY (TR)	MEASURED COOLING CAPACITY KW	RATED POWER ELECTRICAL (kW)	RATED EER	MEASURED EER
NMR	Split	2	6.01	1.98	3.1	3.04
	Split	2	6.07	1.98	3.1	3.07
HPLC	Split	2	5.95	1.98	3.1	3.01
	Split	2	6.05	1.98	3.1	3.06
Data processing lab	Split	1.5	5.17	1.55	3.4	3.34
	Split	1.5	5.22	1.55	3.4	3.37
	Split	1.5	5.13	1.55	3.4	3.31
	Split	1.5	5.13	1.55	3.4	3.31
	Split	1.5	5.23	1.55	3.4	3.38
	Split	1.5	5.16	1.55	3.4	3.33
	Split	1.5	5.22	1.55	3.4	3.37
Store room	Split	1.5	5.25	1.57	3.1	3.35

Note:

- All the Split AC are new and found to be working well

6. WATER CONSUMPTION:

The NCNR department consumes water for various purposes like

- Drinking.
- Toilet flushing's
- Cleaning

Note:

- Water consumption is not monitored.
- Two stage flushing control should be used in toilets for reducing water wastage.

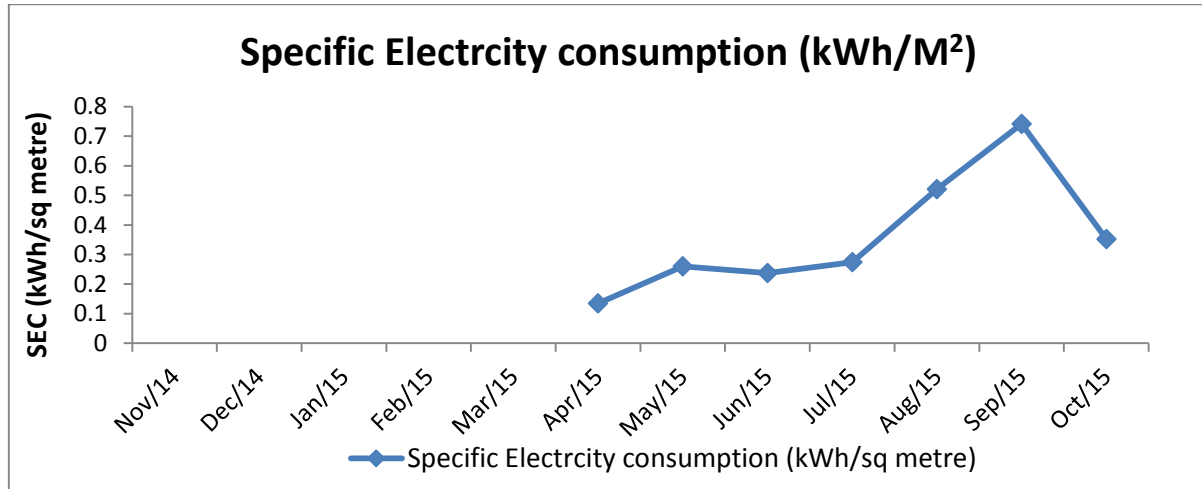
7. EFFICIENCY ANALYSIS:

Specific electricity consumption:

Specific electricity is calculated based on electricity consumed per building area in square meters. The details of specific electricity consumption for last few months are given below in table.

MONTH 2014-15	ELECTRICIY CONSUMPTION KSEB (kWh)	Area of the building (M ²)	SPECIFIC ELECTRICITY CONSUMPTION (kWh/M ²)
Apr-15	504	3754.54	0.134
May-15	975	3754.54	0.260
Jun-15	890	3754.54	0.237
Jul-15	1027	3754.54	0.274
Aug-15	1955	3754.54	0.521
Sep-15	2785	3754.54	0.742
Oct-15	1323	3754.54	0.352

The energy performance index is plotted in the below chart.



Chart

Note:

- Specific electricity consumption found to be varying in all those months.
- Maximum SEC measured in the Sep-2015 and is 0.742 kWh/m².
- SEC is highly depended on the seasonal changes and the number of working days in a month. Variations are also possible in specific electricity consumption due to energy usage variation in different seasons of the year.

F. SOS IN PHYSICS AND CHEMISTRY:

- i. Building : PHYSICS & CHEMISTRY
 Department : PHYSICS & CHEMISTRY
 Consumer No : 1000143839
 Service No : 404300

1. Electrical Bill Analysis:

Base line data given below is based on the Electricity bill provided by the supplier of electricity CSPDCL. Details obtained from the Electricity bill is as follows.

Base Line Data (based on last 12 months)		
1	Electricity provider	CSPDCL
2	Tariff	LV2ND3OT14
3	Connected load (kW)	69.8
4	Average monthly energy consumption (kWh)	6995.08
5	Monthly total electricity cost (avg. In Rs)	65150
6	Average power factor	0.85

Observations:

- PF found to be in brim. It should be greater than 0.85 to avoid the penalty. At present PF penalty is not imposed by the CSPDCL to the department.

2. Electrical Load analysis:

Department	-	Physics and chemistry dept		
Consumer / meter No	-	404300		
Date & time of measurement		26/11/2015 10:58		
Actual Energy	kWh	10.53		
Apparent Energy	kVAh	13.75		
Power factor	-	0.76		
Particulars	Units	Minimum	Maximum	Average
Active power	kW	9.31	11.63	10.53
Apparent power	kVA	11.99	15.50	13.75
Voltage (VL)	Volts	237.11	249.67	244.85
Current	Amps	13.64	24.30	17.99
Voltage unbalance	%	0.5	0.9	0.65
Current unbalance	%	5.2	26.5	15.6
THD voltage	%	1.96	2.81	2.30
THD current	%	5.04	19.17	7.29

Standards:

- PF found to be low during the logging period which should be increased to above 0.85 to avoid the penalty.

ii. Building : PHYSICS & CHEMISTRY
 Department : PHYSICS & CHEMISTRY
 Consumer No : 1000297278
 Service No : 406134

1. Electrical Bill Analysis:

Base line data given below is based on the Electricity bill provided by the supplier of electricity CSPDCL. Details obtained from the Electricity bill is as follows.

Base Line Data (based on last 12 months)		
1	Electricity provider	CSPDCL
2	Tariff	LV2ND3OT14
3	Connected load (kW)	71.9
4	Average monthly energy consumption (kWh)	3732.75
5	Monthly total electricity cost (avg. In Rs)	40093.33
6	Average power factor	0.78

Observations:

- **PF found to be low in the CSPDCL bill. PF should be greater than 0.85 to avoid the penalty.**
- **Install LV capacitors to increase the PF is parallel with the MSB.**

2. Electrical Load analysis:

Department	-	PHYSICS AND CHEMISTRY		
Consumer / meter No	-	406134		
Date & time of measurement		26/11/2015 12:10		
Actual Energy	kWh	3.38		
Apparent Energy	kVAh	6.52		
Power factor	-	0.51		
Particulars	Units	Minimum	Maximum	Average

Active power	kW	3.14	7.45	6.25
Apparent power	kVA	4.41	15.29	12.03
Voltage (VL)	Volts	246.12	254.58	250.20
Current	Amps	3.57	21.76	15.57
Voltage unbalance	%	0.3	1.5	1.0
Current unbalance	%	25.6	32.1	27.5
THD voltage	%	2.04	2.71	2.34
THD current	%	3.71	5.94	4.78

Standards:

- Permissible voltage limit as per CEA standards on grid connectivity is 230 plus or minus 10%, which means 254V is the maximum allowable.

Observations:

- At present maximum voltage exceeded the permissible limit which should be taken care of by reporting it to the supplier.
- Increase in the voltage increases the consumption of electricity and also the failure frequency of the equipment.

3. LIGHT & FAN LOAD CONSUMPTION PATTERN

Details	T12	CFL	WALL FAN	CEILING FAN NEW	CEILING FAN OLD	EXHAUST FAN
Watts(W)	40	15	60	60	90	60
Total Nos.	235	48	5	18	99	21
Total KW	9.4	0.72	0.3	1.08	8.91	1.20
Net total Kw	21.61					

Observations & suggestions:

- All the T12 fluorescent tube lights and CFLs should be replaced with LED tubes and LED bulbs.
- All the old ceiling fans and their resistance type regulators should be replaced by energy efficient BLDC fans

4. Lux Measurements

According to BEE there is a lighting code to determine the overall energy efficiency of lighting system using measurements and methods which is applicable to all commercial buildings. One of the methods is Illuminance method which is the most practicable one.

LOCATION	MEASURED LUX	REQUIRED LUX	REMARKS
HOD room	194	150	Good
KK Khose - lab	234	250	Good
Computer lab	264	250	Good
Research lab	272	250	Good

Environmental lab	301	250	Good
Nano technology lab	275	250	Good
MK.Deb	197	150	Good
CV Raman hall	165	150	Good
Office	334	150	Good
Room 202	164	150	Good
Room 205	174	150	Good
Room 201	168	150	Good

Standards:

- The entire measurement taken during the day time.
- Standard lux is based on the ECBC user guide.

5. Computer & Its Accessories:

DETAILS	WATTS	TOTAL NO	TOTAL KW
LCD computer	200	63	12.6
CRT computer	250	6	1.5
Laptop	100	4	0.4
Scanner	200	2	0.4
Xerox	350	4	1.4
Laser	200	26	5.2
3 in one printer	300	2	0.6
TOTAL KW			22.1

6. Air conditioning:

The physics and chemistry department have installed a total of 27 Split AC in the department including office, class rooms, laboratories etc. and their efficiency calculations are given below in table.

LOCATION	TYPE	COOLING CAPACITY (TR)	MEASURED COOLING CAPACITY (KW)	RATED POWER ELECTRICAL (KW)	RATE D EER	MEASURE D EER
PHYSICS DEPARTMENT						
Room 101	SPLIT	1.5	3.63	1.925	2.6	1.89
Room 103	SPLIT	1.5	3.86	1.925	2.6	2.01
Room 104	SPLIT	1.5	4.44	1.538	3.15	2.89
Room 104	WINDOW	1.5	3.9	2.5	2.08	1.56

Room 105	Window	1.5	4.02	2.5	2.08	1.61	
Room 106	Window	1.5	4.3	2.5	2.08	1.72	
CV Raman hall	Split	1.5	3.86	1.86	2.54	2.08	
CV Raman hall	Split	1.5	3.79	1.86	2.54	2.04	
CV Raman hall	Split	1.5	3.68	1.86	2.54	1.98	
CV Raman hall	Split	1.5	3.55	1.86	2.54	1.91	
CV Raman hall	Split	1.5	3.70	1.86	2.54	1.99	
Room 202	Window	1.5	5.1	2.5	2.08	2.04	
Room 205	Window	1.5	4.72	2.5	2.08	1.89	
Room 201	Split	1.5	4.83	1.55	3.4	3.12	
	Split	1.5	4.88	1.55	3.4	3.15	
Room 203	Window	1.5	3.6	2.5	2.08	1.44	
	Window	1.5	3.42	2.5	2.08	1.37	
			CHEMISTRY DEPARTMENT				
HOD room	Window	1.5	NOT WORKING				
KK Khose - lab	Split	1.5	4.68	1.55	3.4	3.02	
KK Khose - lab	Split	1.5	4.77	1.55	3.4	3.08	
Computer lab	Window	1.5	3.69	2.545	2.39	1.45	
Computer lab	Window	1.5	3.51	2.545	2.39	1.38	
Research lab	Split	1.5	4.1	2.5	2.1	1.64	
Environmental lab	Split	1.5	3.9	2.5	2.1	1.56	
Nano technology lab	Split	1.5	4.03	1.74	3	2.32	

MK.Deb	Split	2	4.55	2.21	2.9	2.06
MK.DEB	Split	1.5	2.88	1.8	2.9	1.56

Table

Note:

- **Window AC should be converted into Five star split AC to reduce the electricity consumption.**
- Most of the AC are more than five years old. Damaged AC which are more than Five years old should be replace with new one.

7. WATER CONSUMPTION:

The department consumes water for various purposes like

- Drinking.
- Toilet
- Cleaning

Note:

- Water consumption is not monitored.
- Two stage flushing control should be used in toilets for reducing water wastage.

8. EFFICIENCY ANALYSIS:

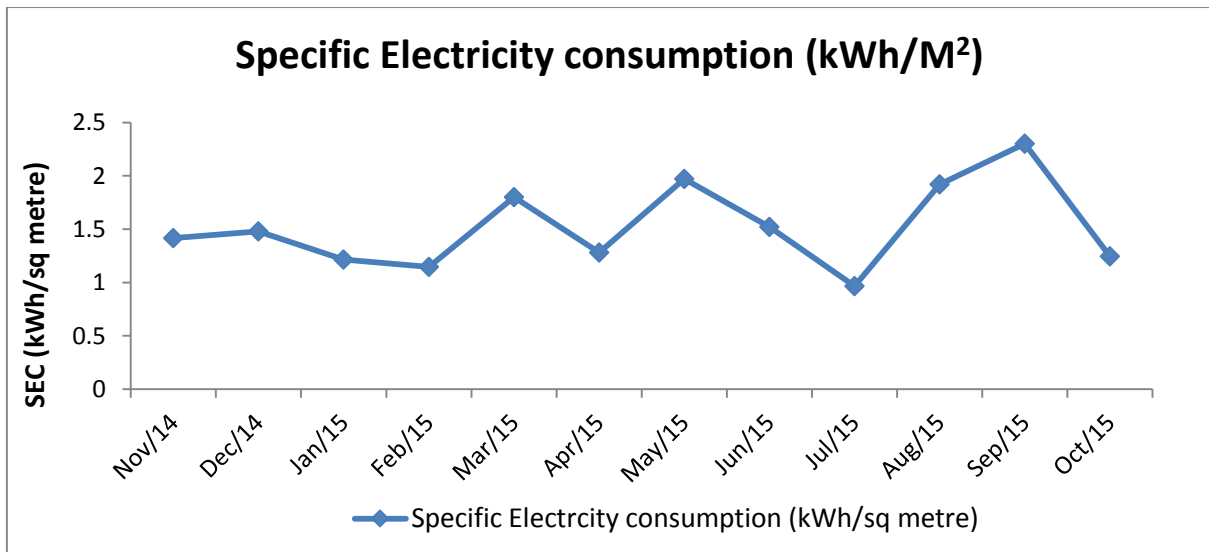
Specific electricity consumption:

Specific electricity is calculated based on electricity consumed per building area in square meters. The details of specific electricity consumption for last few months are given below in table.

MONTH 2014-15	ELECTRICIY CONSUMPTION KSEB (kWh)	Area of the building (M ²)	SPECIFIC ELECTRICITY CONSUMPTION (kWh/M ²)
Nov-14	5135	3616.34	1.415
Dec-14	5366	3616.34	1.48
Jan-15	4405	3616.34	1.215
Feb-15	4149	3616.34	1.145
Mar-15	6516	3616.34	1.8
Apr-15	4638	3616.34	1.28
May-15	7128	3616.34	1.97
Jun-15	5506	3616.34	1.52

Jul-15	3492	3616.34	0.965
Aug-15	6955	3616.34	1.92
Sep-15	8327	3616.34	2.3
Oct-15	4520	3616.34	1.245

The energy performance index is plotted in the below chart.



Chart

Note:

- Specific electricity consumption found to be varying in all those months.
- Maximum SEC measured in the Aug-2015 and is 2.3 kWh/m².
- SEC is highly depended on the seasonal changes and the number of working days in a month. Variations are also possible in specific electricity consumption due to energy usage variation in different seasons of the year.

G. USIC:

Building : USIC
 Department : USIC
 Consumer No : 1000297281
 Service No : 406148

1. Electrical Bill Analysis:

Base line data given below is based on the Electricity bill provided by the supplier of electricity CSPDCL. Details obtained from the Electricity bill is as follows.

Base Line Data (based on last 12 months)		
1	Electricity provider	CSPDCL
2	Tariff	LV2ND3OT14
3	Connected load (kW)	9
4	Average monthly energy consumption (kWh)	366.75
5	Monthly total electricity cost (avg. In Rs)	3504.54
6	Average power factor	0.89

Observations:

- PF found to be good in the section

2. Electrical Load analysis:

Department	-	USIC workshop		
Consumer / meter No	-	406148		
Date & time of measurement		26/11/2015 11:37		
Actual Energy	kWh	9.99		
Apparent Energy	kVAh	11.42		
Power factor	-	0.87		
Particulars	Units	Minimum	Maximum	Average
Active power	kW	7.39	14.72	10.71
Apparent power	kVA	9.08	16.18	12.24
Voltage (VL)	Volts	241.9	249.2	244.68
Current	Amps	6.39	26.38	17.21
Voltage unbalance	%	0.6	1.2	0.97
Current unbalance	%	1.5	56.3	30.33
THD voltage	%	2	2.5	2.26
THD current	%	5.3	21.4	10.44

Note:

- Ascertain the above readings during the no load period. All the motors in the lathe, drilling machine are no load.

3. LIGHT & FAN LOAD CONSUMPTION PATTERN

Details	T8	T12	CFL	CEILING FAN NEW	CEILING FAN OLD	EXHAUST FAN
Watts(W)	36	40	15	60	90	60
Total Nos.	2	16	1	-	7	-
Total KW	0.072	0.64	0.015	-	0.63	-
Net total Kw	1.35					

Observations & suggestions:

- All the T12 fluorescent tube lights and CFLs should be replaced with LED tubes and LED bulbs.
- All the old ceiling fans and their resistance type regulators should be replaced by energy efficient BLDC fans.

4. Lux Measurements

According to BEE there is a lighting code to determine the overall energy efficiency of lighting system using measurements and methods, which is applicable to all commercial buildings. One of the methods is Illuminance method, which is the most practicable one.

LOCATION	MEASURED LUX	REQUIRED LUX	REMARKS
Average lux in workshop	436	250	Good

Standards:

- The entire measurement taken during the day time.
- Standard lux is based on the ECBC user guide.

5. WATER CONSUMPTION:

The department consumes water for various purposes like

- Lathe purpose
- Toilets.

Note:

- Water consumption is not monitored.
- Two stage flushing control should be used in toilets for reducing water wastage.

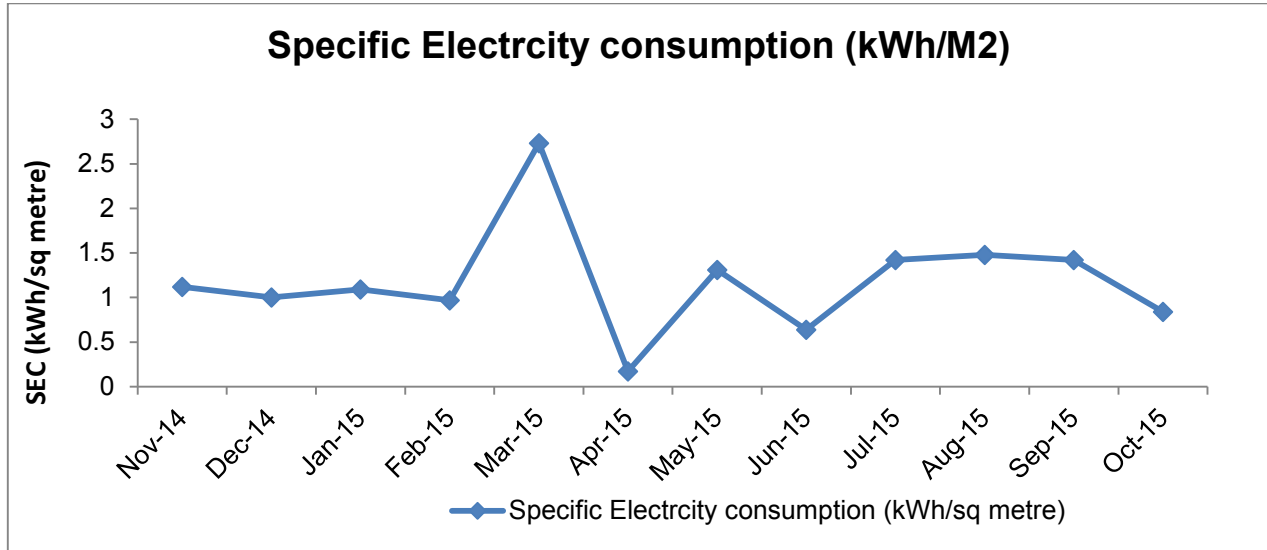
6. EFFICIENCY ANALYSIS:

Specific electricity consumption:

Specific electricity is calculated based on electricity consumed per building area in square meters. The details of specific electricity consumption for last few months are given below in table.

MONTH 2014-15	ELECTRICITY CONSUMPTION KSEB (kWh)	Area of the building (M ²)	SPECIFIC ELECTRICITY CONSUMPTION (kWh/M ²)
Nov-14	348	308.83	1.12
Dec-14	310	308.83	1.00
Jan-15	337	308.83	1.09
Feb-15	301	308.83	0.97
Mar-15	845	308.83	2.73
Apr-15	54	308.83	0.17
May-15	405	308.83	1.31
Jun-15	200	308.83	0.64
Jul-15	441	308.83	1.42
Aug-15	460	308.83	1.48
Sep-15	440	308.83	1.42
Oct-15	260	308.83	0.84

The energy performance index is plotted in the below chart.



Chart

Note:

- Specific electricity consumption found to be varying in all those months.
- Maximum SEC measured in the Mar-2015 and is 2.73 kWh/m².
- SEC is highly depended on the seasonal changes and the number of working days in a month. Variations are also possible in specific electricity consumption due to energy usage variation in different seasons of the year.

iii. MEASUREMENTS TAKEN ON 27-11-2015:

A. SOS IN GEOLOGY AND WATER RESOURCES MANAGEMENT:

Building : GEOLOGY
Department : GEOLOGY
Consumer No : 1000297294
Service No : 406195

1. Electrical Bill Analysis:

Base line data given below is based on the Electricity bill provided by the supplier of electricity CSPDCL. Details obtained from the Electricity bill is as follows.

Base Line Data (based on last 12 months)		
1	Electricity provider	CSPDCL
2	Tariff	LV2ND1OT14
3	Connected load (kW)	22.5
4	AVERAGE MONTHLY ENERGY CONSUMPTION (kWh)	2773.41
5	Monthly total electricity cost (avg. In Rs)	22133.33
6	Average power factor	0.87

Observations:

- PF found to be good in the department.

2. Electrical Load analysis:

Department	-	Geology dept		
Consumer / meter No	-	406195		
Date & time of measurement		27/11/2015 12:51		
Actual Energy	kWh	1.50		
Apparent Energy	kVAh	1.98		
Power factor	-	0.75		
Particulars	Units	Minimum	Maximum	Average
Active power	kW	1.94	2.44	2.23
Apparent power	kVA	2.70	3.17	2.95
Voltage (VL)	Volts	246.5	253.9	250.88
Current	Amps	2.51	5.6	3.80
Voltage unbalance	%	0.5	1.1	0.79
Current unbalance	%	15.4	51.1	30.95
THD voltage	%	2.3	3.4	2.85
THD current	%	8.5	42.3	17.54

Standards:

- Permissible voltage limit as per CEA standards on grid connectivity is 230 plus or minus 10%, which means 254V is the maximum allowable.

Observations:

- At present maximum voltage exceeded the permissible limit which should be taken care of by reporting it to the supplier.
- Increase in the voltage increases the consumption of electricity and also the failure frequency of the equipment.

3. LIGHT & FAN LOAD CONSUMPTION PATTERN

Details	T12	CFL	CFL	CEILING FAN NEW	CEILING FAN OLD	EXHAUST FAN
Watts(W)	40	15	36	60	90	60
Total Nos.	76	2	1	-	42	2
Total KW	3.04	0.03	0.036	-	3.78	0.12
Net total Kw	7.006					

Observations & suggestions:

- All the T12 fluorescent tube lights and CFLs should be replaced with LED tubes and LED bulbs.
- All the old ceiling fans and their resistance type regulators should be replaced by energy efficient BLDC fans.

4. Lux Measurements

According to BEE there is a lighting code to determine the overall energy efficiency of lighting system using measurements and methods, which is applicable to all commercial buildings. One of the methods is Illuminance method, which is the most practicable one.

LOCATION	MEASURED LUX	REQUIRED LUX	REMARKS
Prof.Bodhanker	196	150	Good
Prof. Hari	201	150	Good
Average lux in class rooms	174	150	Good
Optical metrology lab	255	250	Good
Store room	136	150	Average

Note:

- The entire measurement taken during the day time.
- Standard lux is based on the ECBC user guide.

5. Computer & Its Accessories:

DETAILS	WATTS	TOTAL NO	TOTAL KW
LCD computer	200	15	3
CRT computer	250	1	0.25
Xerox	350	1	0.35
Laser	200	2	0.4
TOTAL KW			4

6. Air conditioning:

The department have installed a total of 3 Split AC in the department and their efficiency calculations are given below in table.

LOCATION	TYPE	COOLING CAPACITY (TR)	MEASURED COOLING CAPACITY KW	RATED POWER ELECTRICAL (Kw)	RATED EER	MEASURED EER
Prof. Bodhanker	SPLIT	1.5	4.6	1.55	3.3	3.02
Prof. Hari	SPLIT	1.5	4.75	1.55	3.4	3.07
Optical metrology lab	SPLIT	1.5	4.46	1.55	3.2	2.88

Table

7. WATER CONSUMPTION:

The department consumes water for various purposes like

- Drinking.
- Toilet flushing's
- Cleaning

Note:

- Water consumption is not monitored.
- Two stage flushing control should be used in toilets for reducing water wastage.

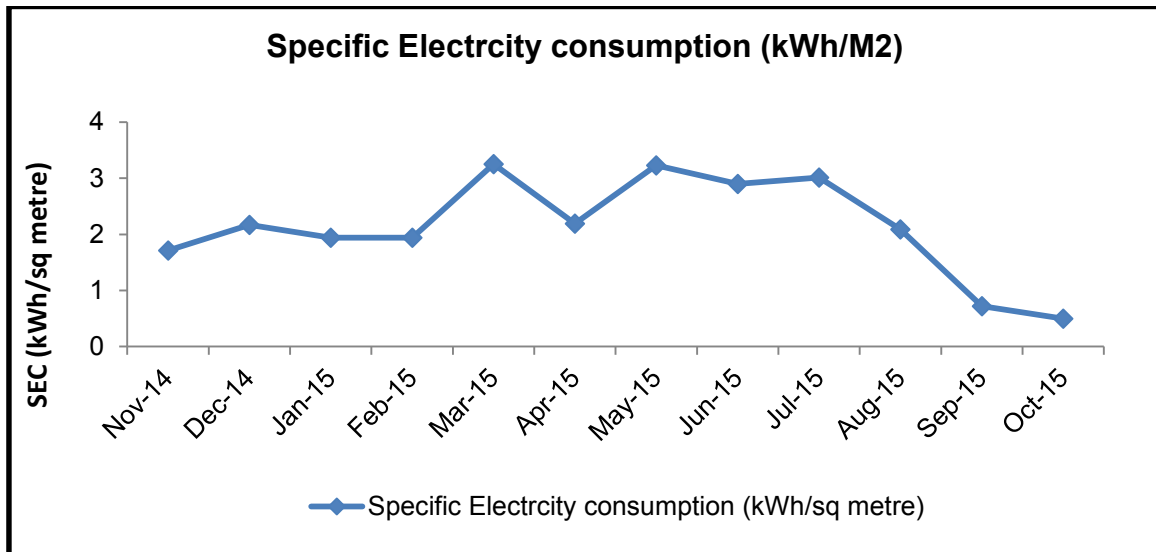
8. EFFICIENCY ANALYSIS:

Specific electricity consumption:

Specific electricity is calculated based on electricity consumed per building area in square meters. The details of specific electricity consumption for last few months are given below in table.

MONTH 2014-15	ELECTRICITY CONSUMPTION KSEB (kWh)	Area of the building (M ²)	SPECIFIC ELECTRICITY CONSUMPTION (kWh/M ²)
Nov-14	2225	1294.34	1.71
Dec-14	2819	1294.34	2.17
Jan-15	2515	1294.34	1.94
Feb-15	2522	1294.34	1.94
Mar-15	4214	1294.34	3.25
Apr-15	2842	1294.34	2.19
May-15	4188	1294.34	3.23
Jun-15	3756	1294.34	2.9
Jul-15	3908	1294.34	3.015
Aug-15	2707	1294.34	2.09
Sep-15	935	1294.34	0.72
Oct-15	650	1294.34	0.5

The energy performance index is plotted in the below chart.



Chart

Note:

- Specific electricity consumption found to be varying in all those months.
- Maximum SEC measured in the Mar-2015 and is 3.25 kWh/m².
- SEC is highly depended on the seasonal changes and the number of working days in a month. Variations are also possible in specific electricity consumption due to energy usage variation in different seasons of the year.

B. LIFE SCIENCE POWER METER:

- I. Building : LIFE SCIENCE
 Department : SOS IN LIFE SCIENCE
 Consumer No : 1000297294
 Service No : 406147

1. Electrical Bill Analysis:

Base line data given below is based on the Electricity bill provided by the supplier of electricity CSPDCL. Details obtained from the Electricity bill is as follows.

Base Line Data (based on last 12 months)		
1	Electricity provider	CSPDCL
2	Tariff	LV2ND3OT14
3	Connected load (kW)	10.444
4	Average monthly energy consumption (kWh)	2651.25
5	Monthly total electricity cost (avg. In Rs)	20496.91
6	Average power factor	0.89

Observations:

- PF found to be good in the department.

2. Electrical Load analysis:

Department	-	LIFE SCIENCE POWER METER		
Consumer / meter No	-	406147		
Date & time of measurement		27/11/2015 16:02		
Actual Energy	kWh	1.28		
Apparent Energy	kVAh	1.79		
Power factor	-	0.71		
Particulars	Units	Minimum	Maximum	Average
Active power	kW	3.15	5.52	4.06
Apparent power	kVA	2.15	7.67	4.53
Voltage (VL)	Volts	197.8	238.98	234.3
Current	Amps	6.48	11.85	7.51
Voltage unbalance	%	0.5	1.2	0.8
Current unbalance	%	1.5	32.1	20.2
THD voltage	%	1.92	3.03	2.45
THD current	%	15.18	48.92	30.95

II. LIFE SCIENCE METER

Building : LIFE SCIENCE
Consumer No : 1000297270
Service No : 404446

I. Electrical Bill Analysis:

Base line data given below is based on the Electricity bill provided by the supplier of electricity CSPDCL. Details obtained from the Electricity bill is as follows.

Base Line Data (based on last 12 months)		
1	Electricity Provider	CSPDCL
2	Tariff	LV2ND3OT14
3	Connected Load (kW)	9.04
4	Average monthly energy consumption (kWh)	2061
5	Monthly Total Electricity Cost (Avg. In Rs)	15450
6	Average Power Factor	0.83

Observations:

- PF found to be low in the department. PF should be increase to more than 0.85 to avoid the penalty. At present, no penalty is imposed in the EB bill.

II. Electrical Load analysis:

Department	-	Life science-3		
Consumer / meter No	-	404446		
Date & time of measurement		27/11/2015 15:22		
Actual Energy	KWh	5.02		
Apparent Energy	KVAh	6.41		
Power factor	-	0.78		
Particulars	Units	Minimum	Maximum	Average
Active power	Kw	5.75	9.78	8.03
Apparent power	Kva	8.56	11.46	10.27
Voltage (VL)	Volts	228.22	239.48	234.40
Current	Amps	8.31	18.38	13.78
THD voltage	%	2.03	3.06	2.52
THD current	%	4.97	11.15	8.61

III. BIO SCIENCE LAB

Building : LIFE SCIENCE
 Department : SOS IN LIFE SCIENCES
 Consumer No : 1000147655
 Service No : 771215

1. Electrical Bill Analysis:

Base line data given below is based on the Electricity bill provided by the supplier of electricity CSPDCL. Details obtained from the Electricity bill is as follows.

Base Line Data (based on last 12 months)		
1	Electricity provider	CSPDCL
2	Tariff	LV2ND1OT14
3	Connected load (kW)	4.0
4	Average monthly energy consumption (kWh)	1749.75
5	Monthly total electricity cost (avg. In Rs)	12,000
6	Average power factor	----

Observations:

- At present, PF is not included in the bill.

2. Electrical Load analysis:

Department	-	BIOSCIENCE LAB		
Consumer / meter No	-	771215		
Date & time of measurement		27/11/2015 15:40		
Actual Energy	kWh	0.52		
Apparent Energy	kVAh	0.58		
Power factor	-	0.89		
Particulars	Units	Minimum	Maximum	Average
Active power	kW	0.50	1.7	0.92
Apparent power	kVA	0.62	1.7	1.03
Voltage (VL)	Volts	234.4	258.8	249.9
Current	Amps	0.44	6.49	1.23
Voltage unbalance	%	0.7	5.9	1.8
Current unbalance	%	75.9	161	121.0
THD voltage	%	2.1	3.3	2.67
THD current	%	7.9	44.6	22.0

Standards:

- Permissible voltage limit as per CEA standards on grid connectivity is 230 plus or minus 10%, which means 254V is the maximum allowable.

Observations:

- At present maximum voltage exceeded the permissible limit which should be taken care of by reporting it to the supplier.
- Increase in the voltage increases the consumption of electricity and also the failure frequency of the equipment.

iv. Building : Life science
 Department : Tissue culture
 Consumer No : 1000297296
 Service No : 406200

1. Electrical Bill Analysis:

Base line data given below is based on the Electricity bill provided by the supplier of electricity CSPDCL. Details obtained from the Electricity bill is as follows.

Base Line Data (based on last 12 months)		
1	Electricity Provider	CSPDCL
2	Tariff	LV2ND1OT14
3	Connected Load (Kw)	9.0
4	Average Monthly Energy Consumption (Kwh)	660
5	Monthly Total Electricity Cost (Avg. In Rs)	12,000
6	Average Power Factor	0.87

Observations:

2. Electrical Load analysis:

- As the supply was not provided after the re routing of wires we couldn't analyse the power consumption in tissue culture.
- Supply was not provided for the last one week from the date of measurement of audit.

3. LIGHT & FAN LOAD CONSUMPTION PATTERN

Details	T12	CFL	T8	CEILING FAN NEW	CEILING FAN OLD	EXHAUST FAN
Watts(W)	40	15	36	60	90	60
Total Nos.	320	88	44	-	138	4
Total KW	12.8	1.32	1.584	-	12.42	0.24
Net total Kw	28.364					

Observations & suggestions:

- All the T12 fluorescent tube lights and CFLs should be replaced with LED tubes and LED bulbs.
- All the old ceiling fans and their resistance type regulators should be replaced by energy efficient BLDC fans.

4. Lux Measurements

According to BEE there is a lighting code to determine the overall energy efficiency of lighting system using measurements and methods which is applicable to all commercial buildings. One of the methods is Illuminance method which is the most practicable one.

LOCATION	MEASURED	REQUIRED	REMARKS
HOD Room	191	150	Good
Professor NC Naithani	202	150	Good
Parasitology Lab	276	250	Good
Endocrinology Lab	324	250	Good
Network Lab	279	250	Good
Seed Biology Lab	345	250	Good
Chronobiology Lab	339	250	Good
Dr.Arathi Praganitha	208	250	Good
Professor V.Koche Cabin	336	150	Good
Microbiology Lab	421	250	Good
Dr Gupta Cabin	309	150	Good
Seminar Hall	225	150	Good
Aquarium	241	150	Good
Animal House	234	150	Good

Note:

- The entire measurement taken during the day time.
- Standard lux is based on the ECBC user guide.

5. Computer & Its Accessories:

DETAILS	WATTS	TOTAL NO	TOTAL KW
LCD Computer	200	28	5.6
CRT Computer	250	5	1.25
Laptop	100	4	0.4

Scanner	200	2	0.4
Xerox	350	1	0.35
Laser	200	11	2.2
3 In One Printer	300	3	0.9
TOTAL kW			11.1

6. Air conditioning:

The department have installed Split AC & window AC in the department and their efficiency calculations are given below in table.

Location	TYPE	COOLING CAPACITY (TR)	MEASURED COOLING CAPACITY KW	RATED POWER ELECTRICAL (kW)	RATED EER	MEASURED EER
Inoculation Room	Window	1.5	Not working			
Culture Room	Split	1.5	No supply			
	Split	1.5	No supply			
	Split	1.5	No supply			
HOD Room NC	Split	2	5.59	2.22	2.9	2.52
Professor	Split	1.5	4.73	1.925	2.6	2.46
	Split	1.5	4.58	1.925	2.6	2.39
Seed Biology	Split	1.5	4.55	1.8	2.9	2.53
Chronobiology Lab	Window	1.5	3.37	2.5	2.08	1.35
	Window	1.5	Not working			
Professor V.Koche	Window	1.5	Damaged			
Dr.Arathi Praganitha	Split	1.5	3.72	2.5	2.08	1.49
Network Lab	Split	1.5	4.47	1.85	2.84	2.42
Parasitology Lab	Window	1	2.68	1.21	2.89	2.22
Endocrinology Lab	Window	1.5	Not working			
Culture room first floor	Split	2	5.71	1.81	3.29	3.16

LOCATION	TYPE	COOLING CAPACITY (TR)	MEASURED COOLING CAPACITY KW	RATED POWER ELECTRICAL (kW)	RATED EER	MEASURED EER
Microbiology Lab	Split	2	6.06	2.10	3	2.89
	Split	1.5	4.26	1.67	2.95	2.56
Dr Gupta	Split	2	5.44	2.23	2.89	2.44
Seminar Hall	Window	1.5	3.9	2.5	2.1	1.59
	Window	1.5	4.0	2.5	2.1	1.58
Ak Patil	Split	2	4.05	2.8	2.1	1.62
Animal House	Window	1.5	Not working			
	Split	1.5	Not working			
Aquarium	Split	1.5	4.6	1.65	3.2	2.81
	Split	1.5	4.49	1.85	2.8	2.43
	Split	1.5	4.45	1.85	2.8	2.41
	Split	1.5	4.42	1.85	2.8	2.39
	Split	1.5	4.42	1.85	2.8	2.39

- Supply to the culture room was terminated due to some civil works in the area during the period of audit.

7. WATER CONSUMPTION:

The department consumes water for various purposes like

- Drinking.
- Toilet flushing's
- Cleaning

Note:

- Water consumption is not monitored.
- Two stage flushing control should be used in toilets for reducing water wastage.

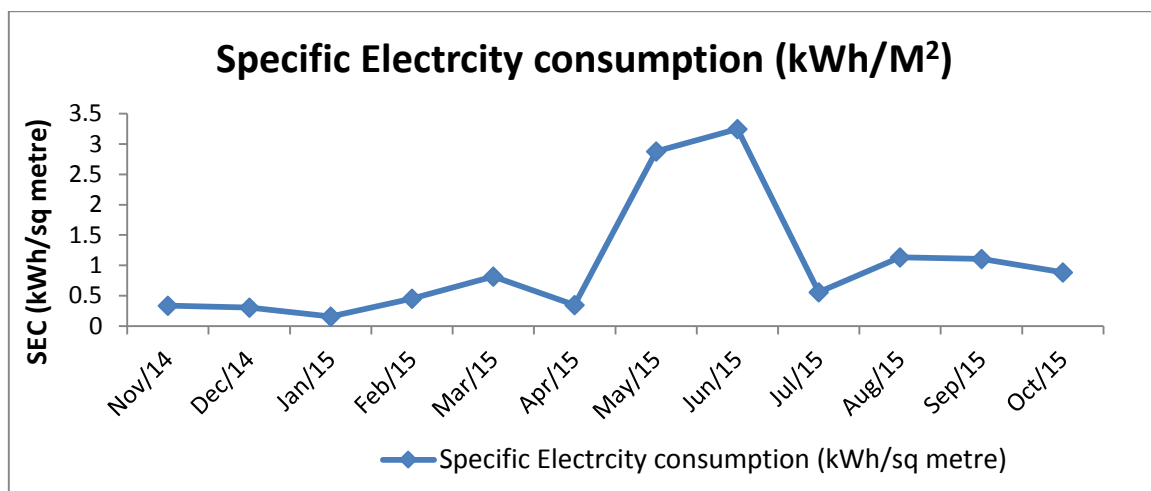
8. EFFICIENCY ANALYSIS:

Specific electricity consumption:

Specific electricity is calculated based on electricity consumed per building area in square meters. The details of specific electricity consumption for last few months are given below in table.

MONTH 2014-15	ELECTRICITY CONSUMPTION KSEB (kWh)	Area of the building (M ²)	SPECIFIC ELECTRICITY CONSUMPTION (kWh/M ²)
Nov-14	820	2441.28	0.34
Dec-14	749	2441.28	0.31
Jan-15	386	2441.28	0.16
Feb-15	1103	2441.28	0.45
Mar-15	1996	2441.28	0.82
Apr-15	847	2441.28	0.35
May-15	7026	2441.28	2.88
Jun-15	7936	2441.28	3.25
Jul-15	1368	2441.28	0.56
Aug-15	2766	2441.28	1.13
Sep-15	2706	2441.28	1.11
Oct-15	2156	2441.28	0.88

The energy performance index is plotted in the below chart.



Note:

- Specific electricity consumption found to be varying in all those months.
- Maximum SEC measured in the Jun-2015 and is 3.25 kWh/m².
- The department has informed us that during the month of May and June-15 construction work was going on in the Life science which was supplied from this metre

C. SOS IN PHARMACY:

Building : SOS IN PHARMACY
 Department : SOS IN PHARMACY
 Consumer No : 1000298133
 Service No : 773533

1. Electrical Bill Analysis:

Base line data given below is based on the Electricity bill provided by the supplier of electricity CSPDCL. Details obtained from the Electricity bill is as follows.

Base Line Data (based on last 12 months)		
1	Electricity Provider	CSPDCL
2	Tariff	LV2ND3OT14
3	Connected Load (Kw)	74.99
4	Average Monthly Energy Consumption (Kwh)	2940.33
5	Monthly Total Electricity Cost (Avg. In Rs)	35778.33
6	Average Power Factor	0.89

Observations:

- PF found to be good when analysed the electricity bill

2. Electrical Load analysis:

Department	-	Pharmacy dept.		
Consumer / meter No	-	773533		
Date & time of measurement		27/11/2015 10:46		
Actual Energy	kWh	16.6		
Apparent Energy	kVAh	20.30		
Power factor	-	0.81		
Particulars	Units	Minimum	Maximum	Average
Active power	kW	12.18	23.37	16.93
Apparent power	kVA	15.95	27.29	20.65
Voltage (VL)	Volts	241.2	252.3	247
Current	Amps	16.07	46.38	28.09
Voltage unbalance	%	1.4	2.2	1.6
Current unbalance	%	5.6	48.7	28.7
THD voltage	%	1.8	2.3	1.97
THD current	%	2.7	8.1	4.7

Standards:

- Permissible voltage limit as per CEA standards on grid connectivity is 230 plus or minus 10%, which means 254V is the maximum allowable.

Observations:

- At present maximum voltage exceeded the permissible limit which should be taken care of by reporting it to the supplier.
- Increase in the voltage increases the consumption of electricity and also the failure frequency of the equipment.

3. LIGHT & FAN LOAD CONSUMPTION PATTERN

Details	T12	CFL	CFL	WALL FAN	CEILING FAN OLD	EXHAUST FAN
Watts(W)	40	15	36	60	90	60
Total Nos.		32	26	4	106	6
Total KW	8.04	0.48	0.936	0.24	9.54	0.36
Net total Kw						19.59

Observations & suggestions:

- All the T12 fluorescent tube lights and CFLs should be replaced with LED tubes and LED bulbs.
- All the old ceiling fans and their resistance type regulators should be replaced by energy efficient BLDC fans.

4. Lux Measurements

According to BEE there is a lighting code to determine the overall energy efficiency of lighting system using measurements and methods, which is applicable to all commercial buildings. One of the methods is Illuminance method, which is the most practicable one.

LOCATION	MEASURED LUX	REQUIRED LUX	REMARKS
Sophisticated Instruments Lab	324	250	Good
Computer Lab	321	250	Good
Biotechnology Lab	433	250	Good
Dr.Preethi Suresh Room	187	150	Good
Dr.Manju Sing Room	194	150	Good
Cosmetics Lab	345	250	Good
Professor Room	201	150	Good
PhD Students Room	184	150	Good
HOD Room	166	150	Good
Professor.Dharwal	171	150	Good

Note:

- The entire measurement taken during the day time.
- Standard lux is based on the ECBC user guide.

5. Computer & Its Accessories:

DETAILS	WATTS	TOTAL NO	TOTAL KW
LCD Computer	200	25	5
Laptop	100	2	0.2
Xerox	350	1	0.35
Laser	200	5	1
3 In One Printer	300	1	0.3
TOTAL KW			6.85

6. Air conditioning:

The department have installed Split AC and Window AC in the department and their efficiency calculations are given below in table.

LOCATION	TYPE	COOLING CAPACITY (TR)	MEASURED COOLING CAPACITY (KW)	RATED POWER ELECTRICAL (KW)	RATED EER	MEASURED EER
Sophisticated Instruments Lab	SPLIT	2	5.88	2.8	2.4	2.01
	Window	1.5	3.7	2.5	2.08	1.48
Computer Lab	Split	2	Wiring problem			
Biotechnology	Window	1.5	3.8	2.5	2.08	1.52
	Window	1.5	4.1	2.5	2.08	1.64
Dr.Preethi	Split	1.5	5.25	1.55	3.4	3.39
Dr.Manju Singh	Split	1.5	5.19	1.55	3.4	3.35
Professor Room	Split	1.5	5.19	1.55	3.4	3.35
Seminar Hall	Split	1.5	5.16	1.55	3.4	3.33
	Split	1.5	4.85	1.55	3.4	3.13
	Split	1.5	4.91	1.55	3.4	3.17
Cosmetics Lab	Split	1.5	4.96	1.55	3.4	3.20
	Split	1.5	3.47	2.5	2.08	1.39
PhD Students	Split	1.5	Not working			
HOD Room	Split	1.5	3.55	2.5	2.08	1.42
	Split	1.5	3.5	2.5	2.08	1.40
Professor Dharwal	Window	1.5	Not working			
Sailendra Rao	Split	1.5	3.35	2.5	2.08	1.34

7. WATER CONSUMPTION:

The department consumes water for various purposes like

- Drinking.
- Toilet flushing's
- Cleaning

Note:

- Water consumption is not monitored.
- Two stage flushing control should be used in toilets for reducing water wastage.

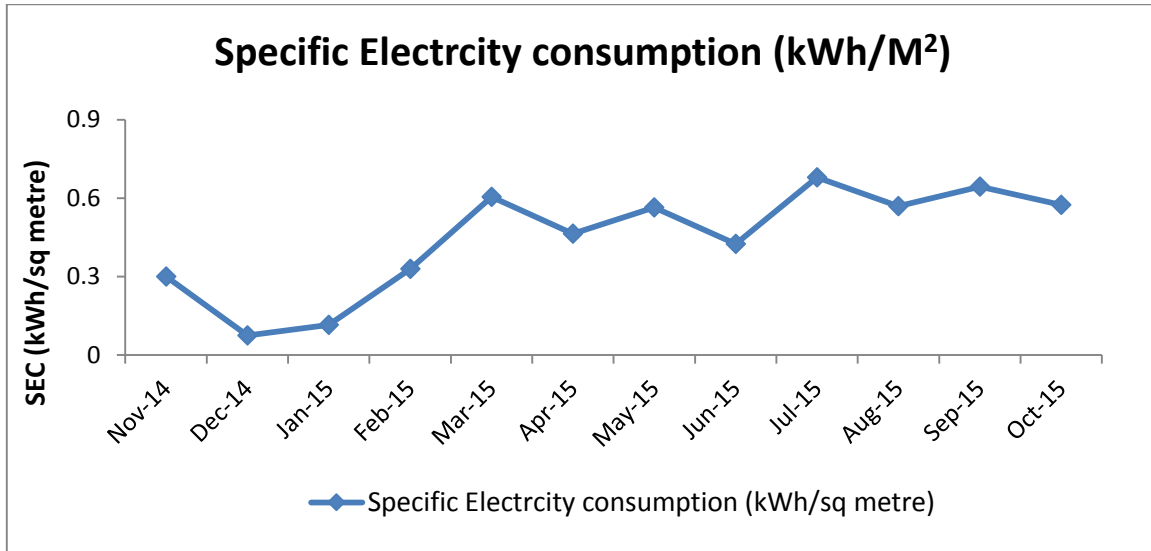
8. EFFICIENCY ANALYSIS:

Specific electricity consumption:

Specific electricity is calculated based on electricity consumed per building area in square meters. The details of specific electricity consumption for last few months are given below in table.

MONTH 2014-15	ELECTRICITY CONSUMPTION KSEB (kWh)	Area of the building (M ²)	SPECIFIC ELECTRICITY CONSUMPTION (kWh/M ²)
Nov-14	2000	6558.98	0.3
Dec-14	517	6558.98	0.075
Jan-15	758	6558.98	0.115
Feb-15	2196	6558.98	0.33
Mar-15	3986	6558.98	0.605
Apr-15	3054	6558.98	0.465
May-15	3730	6558.98	0.565
Jun-15	2800	6558.98	0.425
Jul-15	4464	6558.98	0.68
Aug-15	3761	6558.98	0.57
Sep-15	4234	6558.98	0.645
Oct-15	3784	6558.98	0.575

The energy performance index is plotted in the below chart.



Chart

Note:

- Specific electricity consumption found to be varying in all those months.
- Maximum SEC measured in the Jul-2015 and is 0.68 kWh/m².
- SEC is highly depended on the seasonal changes and the number of working days in a month. Variations are also possible in specific electricity consumption due to energy usage variation in different seasons of the year.

D. SOS IN STATISTICS & MATHEMATICS:

Building : STATISTICS& MATHEMATICS
 Department : SOS IN STATISTICS
 Consumer No : 1000150617
 Service No : 774228

1. Electrical Bill Analysis:

Base line data given below is based on the Electricity bill provided by the supplier of electricity CSPDCL. Details obtained from the Electricity bill is as follows.

Base Line Data (based on last 12 months)		
1	Electricity provider	CSPDCL
2	Tariff	LV2ND3OT14
3	Connected load (kW)	12
4	Average monthly energy consumption (kWh)	1721.5
5	Monthly total electricity cost (avg. In Rs)	11,153
6	Average power factor	0.85

Observations:

2. Electrical Load analysis:

Department	-	Statistics dept		
Consumer / meter No	-	774228		
Date & time of measurement		27/11/2015 12:19		
Actual Energy	kWh	4.27		
Apparent Energy	kVAh	6.35		
Power factor	-	0.67		
Particulars	Units	Minimum	Maximum	Average
Active power	kW	4.13	5.15	4.57
Apparent power	kVA	6.20	7.86	6.81
Voltage (VL)	Volts	245.16	253.24	248.70
Current	Amps	4.41	13.61	7.40
Voltage unbalance	%	0.5	1.2	0.8
Current unbalance	%	1.8	26.2	15.2
THD voltage	%	2.44	3.55	2.95
THD current	%	6.84	26.68	15.56

Standards:

- Permissible voltage limit as per CEA standards on grid connectivity is 230 plus or minus 10%, which means 254V is the maximum allowable.

Observations:

- At present maximum voltage exceeded the permissible limit which should be taken care of by reporting it to the supplier.
- Increase in the voltage increases the consumption of electricity and also the failure frequency of the equipment.

3. LIGHT & FAN LOAD CONSUMPTION PATTERN

Details	T12	CFL	SVL	CEILING FAN NEW	CEILING FAN OLD	EXHAUST FAN
Watts(W)	40	15	250	60	90	60
Total Nos.	32	30	1	-	38	-
Total KW	1.2	0.45	0.25	-	3.42	-
Net total Kw	5.32					

Observations & suggestions:

- All the T12 fluorescent tube lights and CFLs should be replaced with LED tubes and LED bulbs.
- All the old ceiling fans and their resistance type regulators should be replaced by energy efficient BLDC fans.

4. Lux Measurements

According to BEE there is a lighting code to determine the overall energy efficiency of lighting system using measurements and methods, which is applicable to all commercial buildings. One of the methods is Illuminance method, which is the most practicable one.

LOCATION	MEASURED LUX	REQUIRED LUX	REMARKS
Computer Lab	287	150	Good
Average Lux In Class Rooms	168	150	Good
HOD Room	189	150	Good
Gouri Shankar Room	224	150	Good
Prabha Rohtagi Room	239	150	Good
Shailendra Kumar Room	198	150	Good

Note:

- The entire measurement taken during the day time.
- Standard lux is based on the ECBC user guide.

5. Computer & Its Accessories:

DETAILS	WATTS	TOTAL NO	TOTAL KW
LCD Computer	200	5	0.5
CRT Computer	250	15	3.75
Laptop	100	-	-
Scanner	200	1	0.2
Xerox	350	-	-
Laser	200	5	1
3 In One Printer	300	1	0.3
TOTAL KW			5.75

6. Air conditioning:

The department have installed 6 Split AC in the department and their efficiency calculations are given below in table.

LOCATION	TYPE	COOLING CAPACITY (TR)	MEASURED COOLING CAPACITY (KW)	RATED POWER ELECTRICAL (KW)	RATED EER	MEASURED EER
Computer Lab	Split	2	6.421	2.412	2.66	2.12
Computer Lab	Window	1.5	5.2	2.5	2.08	1.34
HOD Room	Split	2	6.421	2.412	2.66	2.23
Gouri Shankar	Window	1.5	5.2	2.5	2.08	1.56
Prabha Rohtagi	Split	1.5	5.325	1.8	2.95	2.59
Shailendra Kumar	Window	1	5.2	2.5	2.08	1.65

7. WATER CONSUMPTION:

The department consumes water for various purposes like

- Drinking.
- Toilet flushing's
- Cleaning

Note:

- Water consumption is not monitored.
- Two stage flushing control should be used in toilets for reducing water wastage.

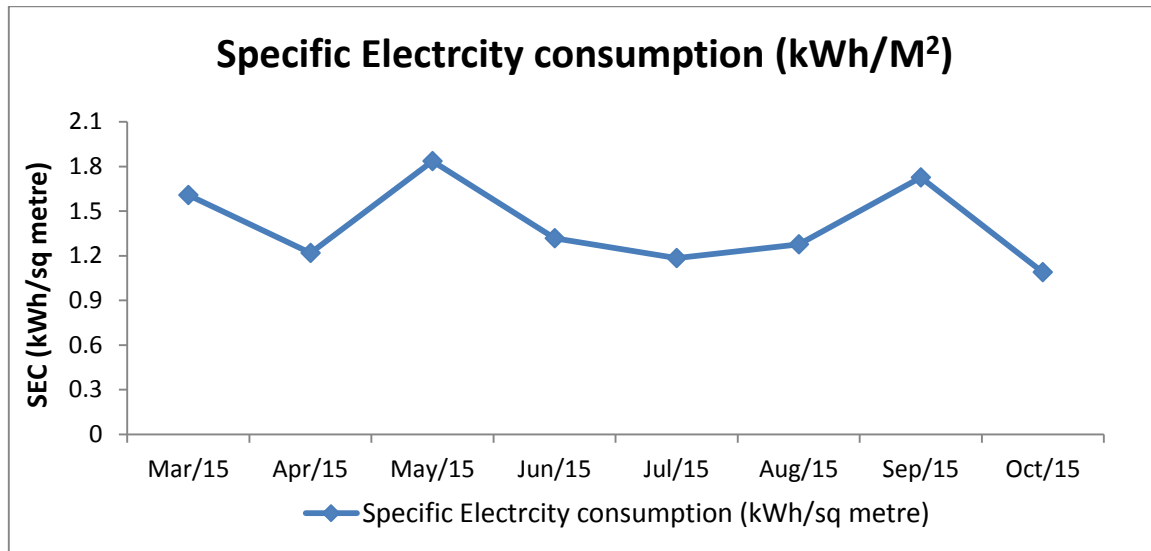
8. EFFICIENCY ANALYSIS:

Specific electricity consumption:

Specific electricity is calculated based on electricity consumed per building area in square meters. The details of specific electricity consumption for last few months are given below in table.

MONTH 2014-15	ELECTRICITY CONSUMPTION KSEB (kWh)	Area of the building (M²)	SPECIFIC ELECTRICITY CONSUMPTION (kWh/M²) kWh/ M²
Mar-15	1967	1223.24	1.61
Apr-15	1492	1223.24	1.22
May-15	2245	1223.24	1.84
Jun-15	1611	1223.24	1.32
Jul-15	1448	1223.24	1.18
Aug-15	1562	1223.24	1.28
Sep-15	2113	1223.24	1.73
Oct-15	1334	1223.24	1.09

The energy performance index is plotted in the below chart.



Note:

- Specific electricity consumption found to be varying in all those months.
- Maximum SEC measured in the May-2015 and is 1.84kWh/m².
- SEC is highly depended on the seasonal changes and the number of working days in a month. Variations are also possible in specific electricity consumption due to energy usage variation in different seasons of the year.

E. UNIVERSITY PRESS

Building : PRESS
Consumer No : 1000143794
Service No : 403232

1. Electrical Bill Analysis:

Base line data given below is based on the Electricity bill provided by the supplier of electricity CSPDCL. Details obtained from the Electricity bill is as follows.

Base Line Data (based on last 12 months)		
1	Electricity provider	CSPDCL
2	Tariff	LV2ND1OT4
3	Connected load (kW)	0.9
4	Average monthly energy consumption (kWh)	517.16
5	Monthly total electricity cost (avg. In Rs)	3462.5
6	Average power factor	-----

Observations:

- At present PF is not mentioned in the bill.
- Also found out that in the last two bills, electricity consumption (units) is not mentioned or remitted by the CSPDCL.

2. Electrical Load analysis:

Department	-	Press		
Consumer / meter No	-	403232		
Date & time of measurement		27/11/2015 13:47		
Actual Energy	kWh	0.98		
Apparent Energy	kVAh	3.52		
Power factor	-	0.27		
Particulars	Units	Minimum	Maximum	Average
Active power	kW	0.77	1.64	0.98
Apparent power	kVA	2.98	5.07	2.52
Voltage (VL)	Volts	239.55	247.0	243.19
Current	Amps	0.04	9.15	2.49
THD voltage	%	2.62	3.35	2.97
THD current	%	4.24	9.90	7.92

Notes:

- Only 2 motors that is hand press in working in the section during the time of audit.
- PF found to be low. All the motors in the press should be installed with corresponding rated capacitors to increase the PF in the system.

3. LIGHT & FAN LOAD CONSUMPTION PATTERN

Details	T12	SVL	WALL FAN	EXHAUST FAN
Watts(W)	40	250	60	60
Total Nos.	40	1	5	-
Total KW	1.6	0.25	0.3	
Net total kW	4.4			

Observations & suggestions:

- All the T12 fluorescent tube lights and CFLs should be replaced with LED tubes and LED bulbs.
- All the old ceiling fans and their resistance type regulators should be replaced by energy efficient BLDC fans.

4. LUX MEASUREMENTS

According to BEE there is a lighting code to determine the overall energy efficiency of lighting system using measurements and methods which is applicable to all commercial buildings. One of the methods is Illuminance method which is the most practicable one.

LOCATION	MEASURED LUX	REQUIRED LUX	REMARKS
Press area	185	250	Poor
Proof reading area	325	500	Poor

Note:

- The entire measurement taken during the day time.
- Standard lux is based on the ECBC user guide.

5. Water consumption:

Press department consumes water for various purposes like

- Drinking.
- Toilet flushing's
- Cleaning

Note:

- Water consumption is not monitored.
- Two stage flushing control should be used in toilets for reducing water wastage.

F. SOS IN REGIONAL STUDY AND RESEARCH:

Building : SOS IN REGIONAL STUDY AND RESEARCH
 Department : SOS IN REGIONAL STUDY AND RESEARCH
 Consumer No : 1000147722
 Service No : 771283

1. Electrical Bill Analysis:

Base line data given below is based on the Electricity bill provided by the supplier of electricity CSPDCL. Details obtained from the Electricity bill is as follows.

Base Line Data (based on last 12 months)		
1	Electricity Provider	CSPDCL
2	Tariff	LV2ND10T14
3	Connected Load (Kw)	2.25
4	AVERAGE MONTHLY ENERGY CONSUMPTION (Kwh)	1599.08
5	Monthly Total Electricity Cost (Avg. In Rs)	10879.06
6	Average Power Factor	---

Observations:

- At present PF is not included in the bill.

2. Electrical Load analysis:

Department	-	Regional study and research		
Consumer / meter No	-	771283		
Date & time of measurement		27/11/2015 13:39		
Actual Energy	kWh	2.85		
Apparent Energy	kVAh	4.05		
Power factor	-	0.70		
Particulars	Units	Minimum	Maximum	Average
Active power	kW	4.2	5.2	4.8
Apparent power	kVA	6	7.42	6.85
Voltage (VL)	Volts	230.2	241.2	236.5
Current	Amps	3.1	5.2	4.4
Voltage unbalance	%	1.1	1.2	1.1
Current unbalance	%	12	65.2	45.1
THD voltage	%	0.1	0.5	0.32
THD current	%	5.3	56.7	25.5

Notes:

- PF found to be low in the department.

3. LIGHT & FAN LOAD CONSUMPTION PATTERN

Details	T12	CFL	BULB	CEILING FAN NEW	CEILING FAN OLD	EXHAUST FAN
Watts(W)	40	15	40	60	90	60
Total Nos.	5	21	5	1	17	-
Total KW	0.2	0.315	0.18	0.04	1.53	-
Net total Kw	2.265					

Observations & suggestions:

- All the T12 fluorescent tube lights and CFLs should be replaced with LED tubes and LED bulbs.
- All the old ceiling fans and their resistance type regulators should be replaced by energy efficient BLDC fans.

4. Lux Measurements

According to BEE there is a lighting code to determine the overall energy efficiency of lighting system using measurements and methods which is applicable to all commercial buildings. One of the methods is Illuminance method which is the most practicable one.

LOCATION	MEASURED	REQUIRED	REMARKS
Average Lux In Class Rooms	197	150	Good
HOD Room	221	150	Good
Faculty Room	214	150	Good

Note:

- The entire measurement taken during the day time.
- Standard lux is based on the ECBC user guide.

5. Computer & Its Accessories:

DETAILS	WATTS	TOTAL NO	TOTAL KW
LCD Computer	200	1	0.2
CRT Computer	250	1	0.25
Xerox	350	3	1.05
Laser	200	1	0.2
3 In One Printer	300	1	03
Total			2.0

6. Air conditioning:

The department have installed a total of Split AC in the department and their efficiency calculations are given below in table.

LOCATION	TYPE	COOLING CAPACITY (TR)	MEASURED COOLING CAPACITY KW	RATED POWER ELECTRICAL (Kw)	RATED EER	MEASURED EER
HOD Room	Split	1.5	4.7	1.55	3.40	3.09
Seminar Hall	Split	1.5	4.8	1.55	3.40	3.15
Class Room	Split	1.5	4.2	1.93	2.55	2.18

7. WATER CONSUMPTION:

The department consumes water for various purposes like

- Drinking.
- Toilet
- Cleaning

Note:

- Water consumption is not monitored.
- Two stage flushing control should be used in toilets for reducing water wastage.

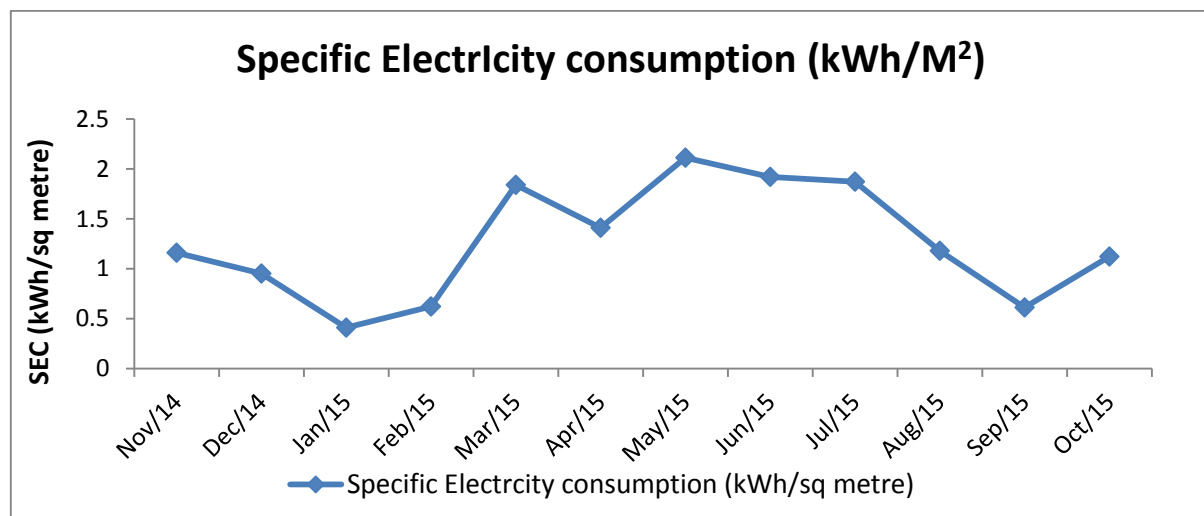
8. EFFICIENCY ANALYSIS:

Specific electricity consumption:

Specific electricity is calculated based on electricity consumed per building area in square meters. The details of specific electricity consumption for last few months are given below in table.

MONTH 2014-15	ELECTRICITY CONSUMPTION KSEB (kWh)	Area of the building (M ²)	SPECIFIC ELECTRICITY CONSUMPTION (kWh/M ²)
Nov-14	651	560.54	1.16
Dec-14	530	560.54	0.95
Jan-15	230	560.54	0.41
Feb-15	349	560.54	0.62
Mar-15	1030	560.54	1.84
Apr-15	791	560.54	1.41
May-15	1185	560.54	2.11
Jun-15	1078	560.54	1.92
Jul-15	1047	560.54	1.87
Aug-15	661	560.54	1.18
Sep-15	342	560.54	0.61
Oct-15	628	560.54	1.12

The energy performance index is plotted in the below chart.



Note:

- Specific electricity consumption found to be varying in all those months.
- Maximum SEC measured in the May-2015 and is 2.11 kWh/m².
- SEC is highly depended on the seasonal changes and the number of working days in a month. Variations are also possible in specific electricity consumption due to energy usage variation in different seasons of the year.

G. SOS IN PHYSICAL EDUCATION:

Building : PHYSICAL EDUCATION
Department : PHYSICAL EDUCATION
Service No : 606210

1. Electrical Bill Analysis:

Base line data given below is based on the Electricity bill provided by the supplier of electricity CSPDCL. Details obtained from the Electricity bill is as follows.

Base Line Data (based on last 12 months)		
1	Electricity Provider	CSPDCL
2	Tariff	
3	Connected Load (Kw)	
4	AVERAGE MONTHLY ENERGY CONSUMPTION (Kwh)	1459.41
5	Monthly Total Electricity Cost (Avg. In Rs)	11528.18
6	Average Power Factor	-

Observations:

- Electricity Bill was not available during the audit.
-

2. Electrical Load analysis:

Department	-	Physical education		
Consumer / meter No	-	606210		
Date & time of measurement		27/11/2015 11:9		
Actual Energy	kWh	1.13		
Apparent Energy	kVAh	1.92		
Power factor	-	0.58		
Particulars	Units	Minimum	Maximum	Average
Active power	kW	0.87	3.9	1.34
Apparent power	kVA	1.12	6.99	2.28
Voltage (VL)	Volts	244.80	251.85	249.03
Current	Amps	0.30	9.79	2.34
THD voltage	%	1.93	2.48	2.13
THD current	%	3.70	20.65	9.40

3. LIGHT & FAN LOAD CONSUMPTION PATTERN

Details	T12	CFL	T8	SVL	MVL	CEILING FAN OLD	EXHAUST FAN
Watts(W)	40	15	36	250	150	90	60
Total Nos.	49	40	25	1	9	65	6
Total KW	1.96	0.6	0.9	0.25	1.35	5.85	0.36
Net total Kw	11.27						

Observations & suggestions:

- All the T12 fluorescent tube lights and CFLs may be replaced with LED tubes and LED bulbs.
- All the old ceiling fans and their resistance type regulators may be replaced by energy efficient fans.
- MVL consumption occurred rarely as it is placed inside the indoor stadium.

4. Lux Measurements

According to BEE there is a lighting code to determine the overall energy efficiency of lighting system using measurements and methods which is applicable to all commercial buildings. One of the methods is Illuminance method which is the most practicable one.

LOCATION	MEASURED	REQUIRED	REMARKS
Professors Cabin	177	150	Good
Conference Hall	159	150	Good
HOD Room	201	150	Good
Average Lux In Classrooms	198	150	Good

Note:

- The entire measurement taken during the day time.
- Standard lux is based on the ECBC user guide.

5. Computer & Its Accessories:

DETAILS	WATTS	TOTAL NO	TOTAL KW
LCD Computer	200	12	2.4
Scanner	200	1	0.2
Laser	200	4	0.8
Total kW			3.4

6. Air conditioning:

The department have installed a total of Split AC in the department including office, class rooms, laboratories etc. and their efficiency calculations are given below in table.

LOCATION	TYPE	COOLING CAPACITY (TR)	MEASURED COOLING CAPACITY KW	RATED POWER ELEC (kW)	RATED EER	MEASURED EER
Professors	Split	1.5	5.25	1.505	3.50	3.49
Conference Hall	Split 1	1.5	5.08	1.465	3.60	3.47
Conference	Split 2	1.5	5.09	1.465	3.60	3.48
Conference	Split 3	1.5	5.09	1.465	3.60	3.48
Conference	Split 4	1.5	5.06	1.465	3.60	3.46

- All the AC was 5 star rated one which gives the higher EER in the Physical education.

7. WATER CONSUMPTION:

The department consumes water for various purposes like

- Drinking.
- Toilet flushing's
- Cleaning

Note:

- Water consumption is not monitored.
- Two stage flushing control may be used in toilets for reducing water wastage.

8. EFFICIENCY ANALYSIS:

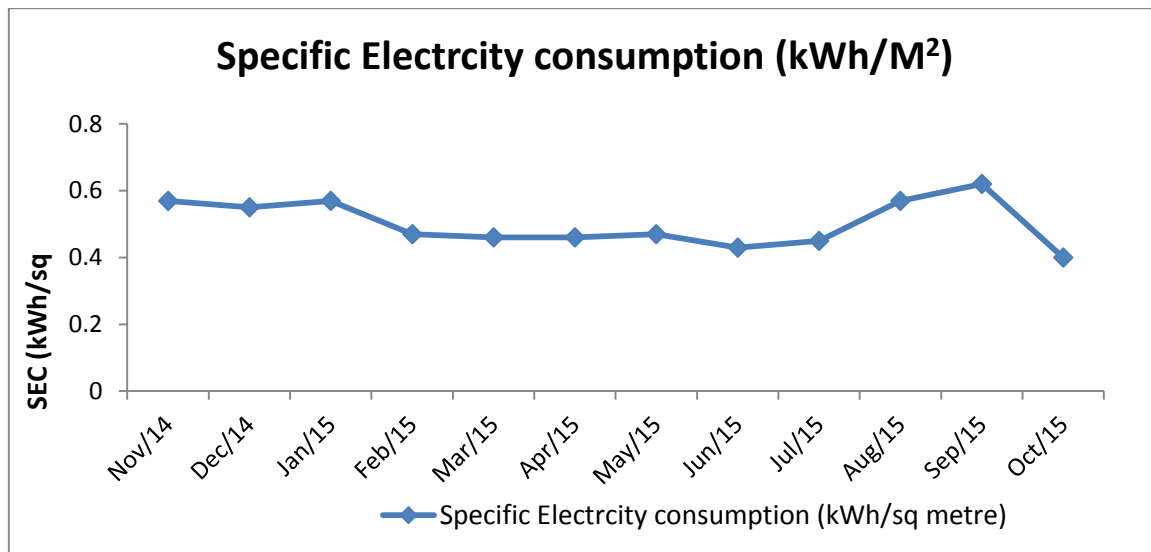
Specific electricity consumption:

Specific electricity is calculated based on electricity consumed per building area in square meters. The details of specific electricity consumption for last few months are given below in table.

MONTH 2014-15	ELECTRICITY CONSUMPTION KSEB (kWh)	Area of the building (M ²)	SPECIFIC ELECTRICITY CONSUMPTION (kWh/M ²)
Nov-14	1657	2905.06	0.57
Dec-14	1589	2905.06	0.55
Jan-15	1669	2905.06	0.57
Feb-15	1357	2905.06	0.47
Mar-15	1350	2905.06	0.46

Apr-15	1345	2905.06	0.46
May-15	1369	2905.06	0.47
Jun-15	1240	2905.06	0.43
Jul-15	1307	2905.06	0.45
Aug-15	1655	2905.06	0.57
Sep-15	1811	2905.06	0.62
Oct-15	1164	2905.06	0.40

The energy performance index is plotted in the below chart.



Chart

Note:

- Specific electricity consumption found to be varying in all those months.
- Maximum SEC measured in the Sep-2015 and is 0.62 kWh/m².
- SEC is highly depended on the seasonal changes and the number of working days in a month. Variations are also possible in specific electricity consumption due to energy usage variation in different seasons of the year.

H. SOS IN LAW:

Building : SOS IN LAW
 Department : SOS IN LAW
 Consumer No : 1000144879
 Service No : 405438

1. Electrical Bill Analysis:

Base line data given below is based on the Electricity bill provided by the supplier of electricity CSPDCL. Details obtained from the Electricity bill is as follows.

Base Line Data (based on last 12 months)		
1	Electricity Provider	CSPDCL
2	Tariff	LV2ND1OT14
3	Connected Load (Kw)	8.72
4	AVERAGE MONTHLY ENERGY CONSUMPTION (Kwh)	1209
5	Monthly Total Electricity Cost (Avg. In Rs)	9319.5
6	Average Power Factor	-

Observations:

- At present, PF is not included in the bill.

2. Electrical Load analysis:

Department	-	SOS IN LAW		
Consumer / meter No	-	405438		
Date & time of measurement		27/11/2015 15:54		
Actual Energy	kWh	1.59		
Apparent Energy	kVAh	1.30		
Power factor	-	0.87		
Particulars	Units	Minimum	Maximum	Average
Active power	kW	2.18	2.47	2.31
Apparent power	kVA	2.47	2.85	2.64
Voltage (VL)	Volts	245.8	250.1	247.74
Current	Amps	0	6.56	3.04
Voltage unbalance	%	0.4	0.7	0.57
Current unbalance	%	94.1	100	99.43
THD voltage	%	2.4	2.8	2.57
THD current	%	7.2	14.7	8.01

3. LIGHT & FAN LOAD CONSUMPTION PATTERN

Details	T12	CFL	BULB	CEILING FAN NEW	CEILING FAN OLD	EXHAUST FAN
Watts(W)	40	15	40	60	90	60
Total Nos.	53	-	-	-	53	1
Total KW	2.12	-	-	-	4.77	0.06
Net total kW	6.95					

Observations & suggestions:

- All the T12 fluorescent tube lights and CFLs may be replaced with LED tubes and LED bulbs.
- All the old ceiling fans and their resistance type regulators may be replaced by energy efficient fans.

4. Lux Measurements

According to BEE there is a lighting code to determine the overall energy efficiency of lighting system using measurements and methods which is applicable to all commercial buildings. One of the methods is Illuminance method which is the most practicable one.

LOCATION	MEASURED	REQUIRED	REMARKS
HOD Cabin	453	150	Good
Office	339	150	Good
Average Lux In Class Room	342	150	Good
Staff Room	267	150	Good

Note:

- The entire measurement taken during the day time.
- Standard lux is based on the ECBC user guide.

5. Computer & Its Accessories:

DETAILS	WATTS	TOTAL NO	TOTAL KW
LCD Computer	200	3	0.6
CRT Computer	250	13	3.25
Scanner	200	1	0.2
Xerox	350	1	0.35
Laser	200	1	0.2
Total kW			4.6

6. Air conditioning:

Law department have installed a total of 3 Split AC in the department and their efficiency calculations are given below in table.

LOCATION	TYPE	COOLING CAPACITY (TR)	MEASURED COOLING CAPACITY KW	RATED POWER ELECTRICITY (Kw)	RATED EER	MEASURED EER	
Room 3	Split	1.5	5.225	1.74	3.40	3.12	
	Split	1.5	5.225	1.74	3.40	3.16	
	Split	Connection problem					

7. WATER CONSUMPTION:

LAW department consumes water for various purposes like

- Drinking.
- Toilet
- Cleaning

Note:

- Water consumption is not monitored.
Two stage flushing control may be used in toilets for reducing water wastage.

8. EFFICIENCY ANALYSIS:

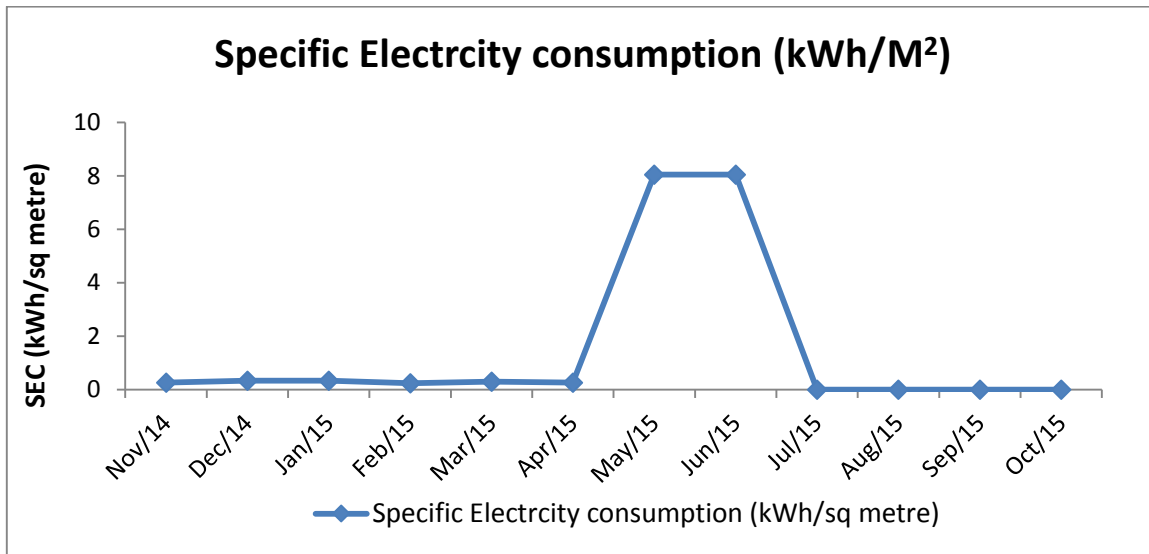
Specific electricity consumption:

Specific electricity is calculated based on electricity consumed per building area in square meters. The details of specific electricity consumption for last few months are given below in table.

MONTH 2014-15	ELECTRICITY CONSUMPTION KSEB (kWh)	Area of the building (M ²)	SPECIFIC ELECTRICITY CONSUMPTION (kWh/M ²)
Nov-14	215	812.71	0.26
Dec-14	275	812.71	0.33
Jan-15	270	812.71	0.33
Feb-15	200	812.71	0.24
Mar-15	245	812.71	0.30
Apr-15	215	812.71	0.26
May-15	6544	812.71	8.05

Jun-15	6544	812.71	8.05
Jul-15	0	812.71	0
Aug-15	0	812.71	0
Sep-15	0	812.71	0
Oct-15	0	812.71	0

The energy performance index is plotted in the below chart.



Chart

Note:

- Specific electricity consumption found to be varying in all those months.
- Maximum SEC measured in the May and June-2015 and is 8.05 kWh/m².
- Unit's consumption was not measured in last 4 months bill.
- SEC is highly depended on the seasonal changes and the number of working days in a month. Variations are also possible in specific electricity consumption due to energy usage variation in different seasons of the year.
- Semester examination of BA LLB examination was held on MAY and June-15. That's the main reason of excess electricity consumption in those months.

IV. MEASUREMENTS TAKEN ON 28-11-2015:

A. AUDITORIUM:

Building : AUDITORIUM
 Department : AUDITORIUM
Consumer No : 1000297274
 Service No : 405914

1. Electrical Bill Analysis:

Base line data given below is based on the Electricity bill provided by the supplier of electricity CSPDCL. Details obtained from the Electricity bill is as follows.

Base Line Data (based on last 12 months)		
1	Electricity provider	CSPDCL
2	Tariff	LV2ND3 OT14
3	Connected load (kW)	13.965
4	Average monthly energy consumption (kWh)	927
5	Monthly total electricity cost (avg. In Rs)	
6	Average power factor	-

Observations:

- Bill couldn't available from the university.

2. Electrical Load analysis:

Department	-	Auditorium		
Consumer / meter No	-	405914		
Date & time of measurement		28/11/2015 15:46		
Actual Energy	kWh	0.64		
Apparent Energy	kVAh	0.68		
Power factor	-	0.94		
Particulars	Units	Minimum	Maximum	Average
Active power	kW	0.90	1.5	0.99
Apparent power	kVA	2.07	3.73	2.29
Voltage (V _L)	Volts	232.8	246.10	237.64
Current	Amps	.05	6.59	1.49
THD voltage	%	2.38	3.18	2.76
THD current	%	3.49	6.14	3.98

3. LIGHT & FAN LOAD CONSUMPTION PATTERN

Details	T12	CFL	SVL	CEILING FAN NEW	CEILING FAN OLD	EXHAUST FAN
Watts(W)	40	36	250	60	90	60
Total Nos.	25	12	1	-	26	-
Total KW	1	0.432	0.25	-	2.34	-
Net total Kw	4.022					

Observations & suggestions:

- All the T12 fluorescent tube lights and CFLs may be replaced with LED tubes and LED bulbs.
- All the old ceiling fans and their resistance type regulators may be replaced by energy efficient fans.

4. Lux Measurements

According to BEE there is a lighting code to determine the overall energy efficiency of lighting system using measurements and methods which is applicable to all commercial buildings. One of the methods is Illuminance method which is the most practicable one.

LOCATION	MEASURED	REQUIRED	REMARKS
Average lux	337	150	Good

Notes:

- The entire measurement taken during the day time.
- Standard lux is based on the ECBC user guide.

5. WATER CONSUMPTION:

The department consumes water for various purposes like

- Drinking.
- Toilet flushing's
- Cleaning

Note:

- Water consumption is not monitored.
- Two stage flushing control may be used in toilets for reducing water wastage.

6. EFFICIENCY ANALYSIS:

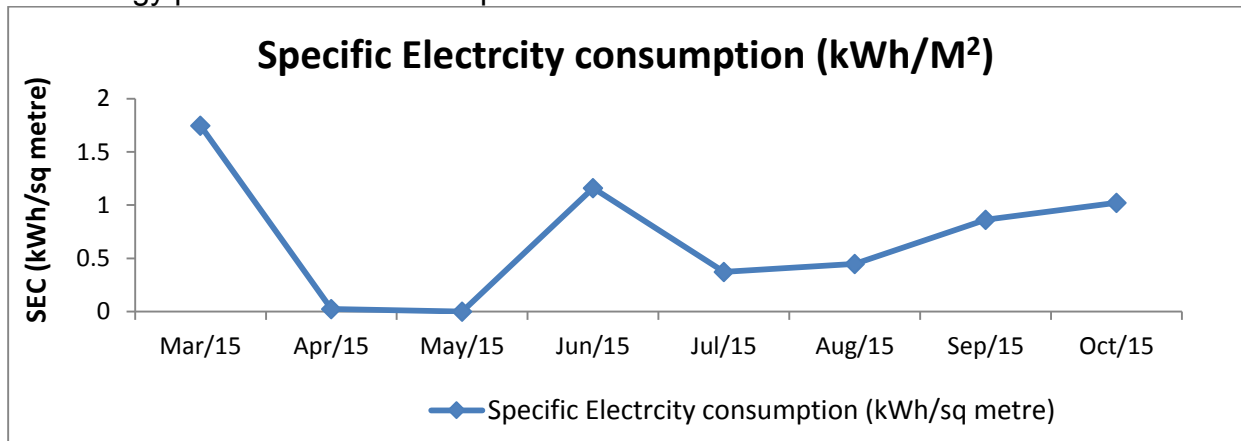
Specific electricity consumption:

Specific electricity is calculated based on electricity consumed per building area in square meters. The details of specific electricity consumption for last few months are given below in table.

MONTH 2014-15	ELECTRICITY CONSUMPTION KSEB (kWh)	Area of the building (M ²)	SPECIFIC ELECTRICITY CONSUMPTION (kWh/M ²)
Mar-15	2300	1315.98	1.75

Apr-15	30	1315.98	0.02
May-15	0	1315.98	0.00
Jun-15	1529	1315.98	1.16
Jul-15	491	1315.98	0.37
Aug-15	590	1315.98	0.45
Sep-15	1137	1315.98	0.86
Oct-15	1344	1315.98	1.02

The energy performance index is plotted in the below chart.



Note:

- SEC highly depends on the frequency of programs conducting in the Auditorium. As the frequency of programs is not readily available, the other base value taken here is month.
- Maximum SEC occurred in the month of March-15.

B. COMMUNITY HALL:

Building : COMMUNITY HALL:
Consumer No : 1002049789
 Service No : 406296

1. Electrical Bill Analysis:

Base line data given below is based on the Electricity bill provided by the supplier of electricity CSPDCL. Details obtained from the Electricity bill is as follows.

Base Line Data (based on last 12 months)		
1	Electricity Provider	CSPDCL
2	Tariff	LV2ND39G14
3	Connected Load (Kw)	8
4	Average Monthly Energy Consumption (Kwh)	183.33
5	Monthly Total Electricity Cost (Avg. In Rs)	2951.81
6	Average Power Factor	0.85

Observations:

- PF found to be good and within the limits.

2. Electrical Load analysis:

Department	-	Community hall		
Consumer / meter No	-	406296		
Date & time of measurement		25-11-2015, 12:05		
Actual Energy	kWh	0.29		
Apparent Energy	kVAh	0.68		
Power factor	-	0.42		
Particulars	Units	Minimum	Maximum	Average
Active power	kW	0.90	1.5	0.99
Apparent power	kVA	2.07	3.73	2.29
Voltage (VL)	Volts	232.8	246.10	237.64
Current	Amps	0.05	6.59	1.49
THD voltage	%	2.38	3.18	2.76
THD current	%	3.49	6.14	3.98

3. LIGHT & FAN LOAD CONSUMPTION PATTERN

Details	T12	CFL	CEILING FAN NEW
Watts(W)	40	15	60
Total Nos.	24	-	31
Total KW	0.96	-	1.86
Net total Kw	2.82		

Observations & suggestions:

- All the T12 fluorescent tube lights and CFLs may be replaced with LED tubes and LED bulbs.
- All the old ceiling fans and their resistance type regulators may be replaced by energy efficient fans.

4. Lux Measurements

According to BEE there is a lighting code to determine the overall energy efficiency of lighting system using measurements and methods which is applicable to all commercial buildings. One of the methods is Illuminance method which is the most practicable one.

LOCATION	MEASURED	REQUIRED	REMARKS
Average Lux	287	150	Good

Notes:

- The entire measurement taken during the day time.
- Standard lux is based on the ECBC user guide

5. WATER CONSUMPTION:

The department consumes water for various purposes like

- Drinking.
- Toilet flushing's
- Cleaning

Note:

- Water consumption is not monitored.
- Two stage flushing control may be used in toilets for reducing water wastage.

6. EFFICIENCY ANALYSIS:

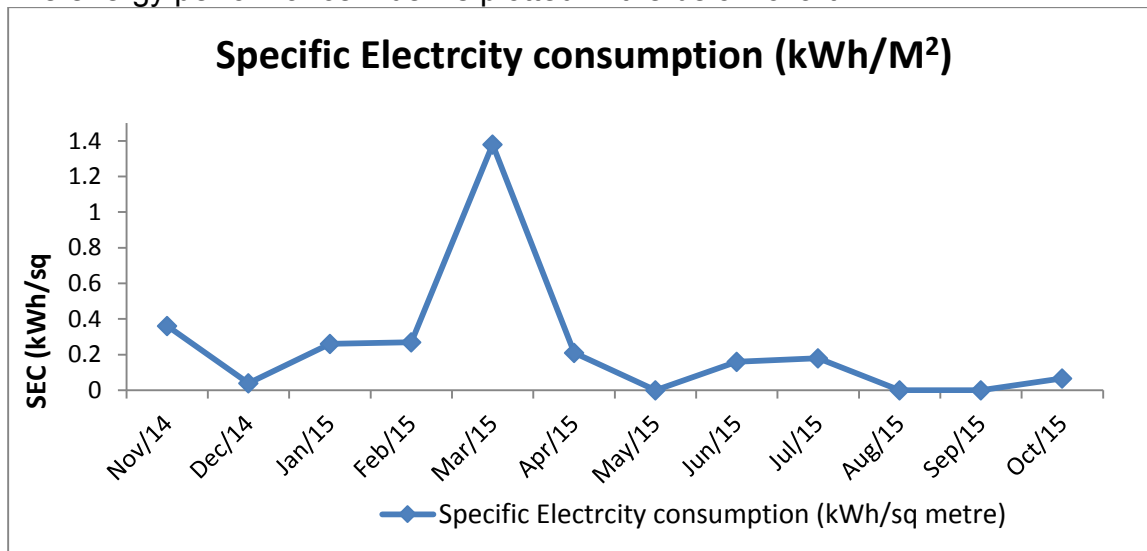
Specific electricity consumption:

Specific electricity is calculated based on electricity consumed per building area in square meters. The details of specific electricity consumption for last few months are given below in table.

MONTH 2014-15	ELECTRICITY CONSUMPTION KSEB (kWh)	Area of the building (M ²)	SPECIFIC ELECTRICITY CONSUMPTION (kWh/M ²)
Nov-14	270	744.18	0.36

Dec-14	36	744.18	0.04
Jan-15	200	744.18	0.26
Feb-15	205	744.18	0.27
Mar-15	1027	744.18	1.38
Apr-15	160	744.18	0.21
May-15	0	744.18	0
Jun-15	123	744.18	0.16
Jul-15	135	744.18	0.18
Aug-15	0	744.18	0
Sep-15	0	744.18	0
Oct-15	50	744.18	0.067

The energy performance index is plotted in the below chart.



Note:

- Specific electricity consumption found to be varying in all those months.
- Maximum SEC measured in the Mar-2015 and is 1.38 kWh/m².
- SEC is highly depended on the seasonal changes and the number of working days in a month. Variations are also possible in specific electricity consumption due to energy usage variation in different seasons of the year.

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C. ENGINEERING DEPARTMENT:

Building : ENGINEERING DEPARTMENT:
Consumer No : 1000145148
 Service No : 405708

1. Electrical Bill Analysis:

Base line data given below is based on the Electricity bill provided by the supplier of electricity CSPDCL. Details obtained from the Electricity bill is as follows.

Base Line Data (based on last 12 months)		
1	Electricity Provider	CSPDCL
2	Tariff	LV2ND1OT14
3	Connected Load (Kw)	3.36
4	Average Monthly Energy Consumption (Kwh)	470.33
5	Monthly Total Electricity Cost (Avg. In Rs)	3571.66
6	Average Power Factor	-

Observations:

- PF is not included in the electricity bill.

2. Electrical Load analysis:

Department	-	Engineering dept.		
Consumer / meter No	-	405708		
Date & time of measurement		2811-2015,11:29		
Actual Energy	kWh	0.85		
Apparent Energy	kVAh	0.97		
Power factor	-	0.87		
Particulars	Units	Minimum	Maximum	Average
Active power	kW	1.2	2.745	1.95
Apparent power	kVA	1.37	3.15	2.24
Voltage (VL)	Volts	236.5	240.5	238.5
Current	Amps	0.9	4.39	2.67
THD voltage	%	0.5	1.5	0.9
THD current	%	12.2	39.5	25.2

3. LIGHT & FAN LOAD CONSUMPTION PATTERN

Details	T12	CFL	CEILING FAN OLD
Watts(W)	40	15	90
Total Nos.	8	-	6
Total KW	0.32	-	0.54
Net total Kw	0.86		

Observations & suggestions:

- All the T12 fluorescent tube lights and CFLs may be replaced with LED tubes and LED bulbs.
- All the old ceiling fans and their resistance type regulators may be replaced by energy efficient fans.

4. Lux Measurements

According to BEE there is a lighting code to determine the overall energy efficiency of lighting system using measurements and methods which is applicable to all commercial buildings. One of the methods is Illuminance method which is the most practicable one.

LOCATION	MEASURED	REQUIRED	REMARKS
Sub engineer electrical	254	150	Good
Engineering head	267	150	Good
Sub engineer mechanical	285	150	Good

Notes:

- The entire measurement taken during the day time.
- Standard lux is based on the ECBC user guide.

5. Computer & Its Accessories:

DETAILS	WATTS	TOTAL NO	TOTAL KW
LCD Computer	200	2	0.4
Laser	200	1	0.2
3 In One Printer	300	-	
Total kW			0.6

6. WATER CONSUMPTION:

The department consumes water for various purposes like

- Drinking.
- Toilet
- Cleaning

Note:

- Water consumption is not monitored.
- Two stage flushing control may be used in toilets for reducing water wastage.

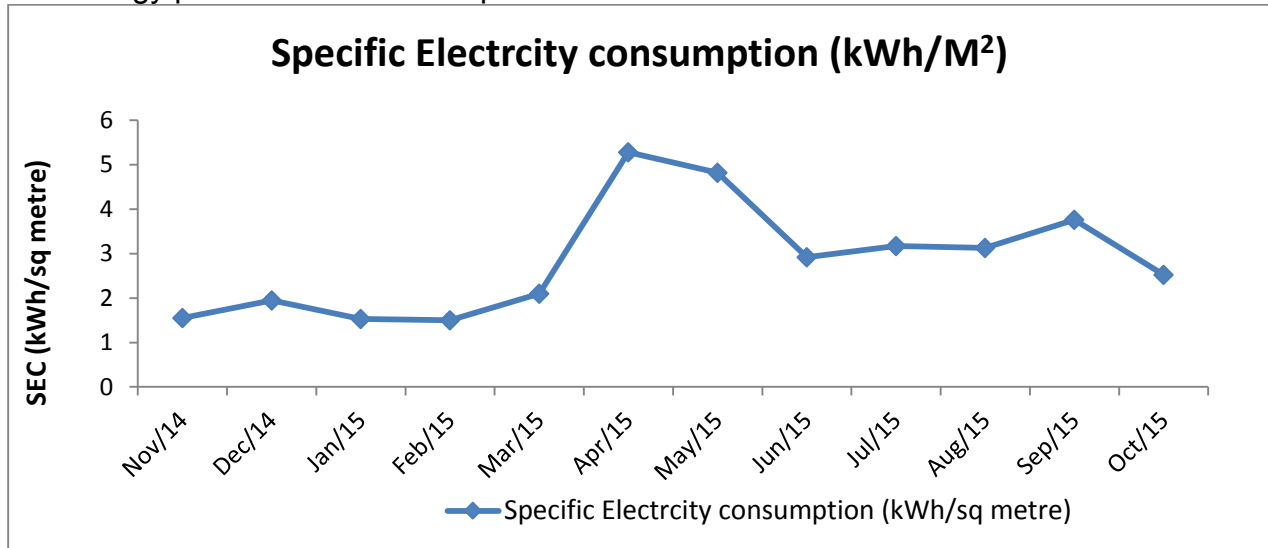
7. EFFICIENCY ANALYSIS:

Specific electricity consumption:

Specific electricity is calculated based on electricity consumed per building area in square meters. The details of specific electricity consumption for last few months are given below in table.

MONTH 2014-15	ELECTRICITY CONSUMPTION KSEB (kWh)	Area of the building (M²)	SPECIFIC ELECTRICITY CONSUMPTION (kWh/M²)
Nov-14	256	164.67	1.55
Dec-14	322	164.67	1.95
Jan-15	253	164.67	1.53
Feb-15	248	164.67	1.50
Mar-15	346	164.67	2.10
Apr-15	870	164.67	5.28
May-15	794	164.67	4.82
Jun-15	481	164.67	2.92
Jul-15	523	164.67	3.17
Aug-15	516	164.67	3.13
Sep-15	620	164.67	3.76
Oct-15	415	164.67	2.52

The energy performance index is plotted in the below chart.



Note:

- Specific electricity consumption found to be varying in all those months.
- Maximum SEC measured in the Apr-2015 and is 5.28 kWh/m².
- SEC is highly depended on the seasonal changes and the number of working days in a month. Variations are also possible in specific electricity consumption due to energy usage variation in different seasons of the year.

D. SOS IN GEOGRAPHY:

Building : GEOGRAPHY
 Department : GEOGRAPHY
Consumer No : 1003103609
 Service No : 606211

1. Electrical Bill Analysis:

Base line data given below is based on the Electricity bill provided by the supplier of electricity CSPDCL. Details obtained from the Electricity bill is as follows.

Base Line Data (based on last 12 months)		
1	Electricity Provider	CSPDCL
2	Tariff	LV2ND3OT14
3	Connected Load (Kw)	33.38
4	Average Monthly Energy Consumption (Kwh)	1170.63
5	Monthly Total Electricity Cost (Avg. In Rs)	11365.33
6	Average Power Factor	-

Observations:

- **PF is not included in the bill.**

2. Electrical Load analysis:

Department	-	GEOGRAPHY		
Consumer / meter No	-	606211		
Date & time of measurement		28-11-2015, 12:36		
Actual Energy	kWh	1.43		
Apparent Energy	kVAh	2.85		
Power factor	-	0.50		
Particulars	Units	Minimum	Maximum	Average
Active power	kW	2.61	3.28	2.87
Apparent power	kVA	5.27	6.26	5.71
Voltage (VL)	Volts	41.83	257.20	184.42
Current	Amps	4.47	12.92	7.72
THD voltage	%	1.85	7.94	3.56
THD current	%	8.31	64.54	26.80

Standards:

- Permissible voltage limit as per CEA standards on grid connectivity is 230 plus or minus 10%, which means 254V is the maximum allowable.

Observations:

- At present maximum voltage exceeded the permissible limit which should be taken care of by reporting it to the supplier.
- Increase in the voltage increases the consumption of electricity and also the failure frequency of the equipment.

3. LIGHT & FAN LOAD CONSUMPTION PATTERN

Details	T12	CFL	BULB	CEILING FAN NEW	CEILING FAN OLD	EXHAUST FAN
Watts(W)	40	15	40	60	90	60
Total Nos.	125	-	1	-	92	2
Total KW	5	-	0.04	-	8.580	0.12
Net total Kw	13.74					

Observations & suggestions:

- All the T12 fluorescent tube lights and CFLs may be replaced with LED tubes and LED bulbs.
- All the old ceiling fans and their resistance type regulators may be replaced by energy efficient fans.

4. Lux Measurements

According to BEE there is a lighting code to determine the overall energy efficiency of lighting system using measurements and methods which is applicable to all commercial buildings. One of the methods is Illuminance method which is the most practicable one.

LOCATION	MEASURED	REQUIRED	REMARKS
Sarala Sharma's Cabin	223	150	Good
Zt Khan's Room	189	150	Good
S Sharma 'S Room	231	150	Good
Computer Lab	321	250	Good
Average Lux In Class Rooms	220	150	Good

Note:

- The entire measurement taken during the day time.
- Standard lux is based on the ECBC user guide.

5. Computer & Its Accessories:

DETAILS	WATTS	TOTAL NO	TOTAL KW
LCD Computer	200	38	7.6
CRT Computer	250	4	1
Laptop	100	1	0.1
Scanner	200	1	0.2
Xerox	350	1	0.35
Laser	200	9	1.8
3 In One Printer	300	1	0.3
TOTAL kW			11.35

6. Air conditioning:

The department have installed Split AC in office, class rooms, laboratories etc. and their efficiency calculations are given below in table.

LOCATION	TYPE	COOLING CAPACITY (TR)	MEASURED COOLING CAPACITY KW	RATED POWER ELECTRICAL (KW)	RATED EER	MEASURED EER
Sarala	Split	1.5	4.82	1.55	3.4	3.11
ZT Khan	Split	1.5	4.77	1.55	3.4	3.08
S Sharma	Split	2	5.94	2.36	2.8	2.52
Computer Lab	Split	1.5	4.75	1.55	3.4	3.07
	Split	1.5	4.92	1.55	3.4	3.18
	Split	1.5	4.97	1.55	3.4	3.21

7. WATER CONSUMPTION:

The department consumes water for various purposes like

- Drinking.
- Toilet flushing's
- Cleaning

Note:

- Water consumption is not monitored.
- Two stage flushing control may be used in toilets for reducing water wastage.

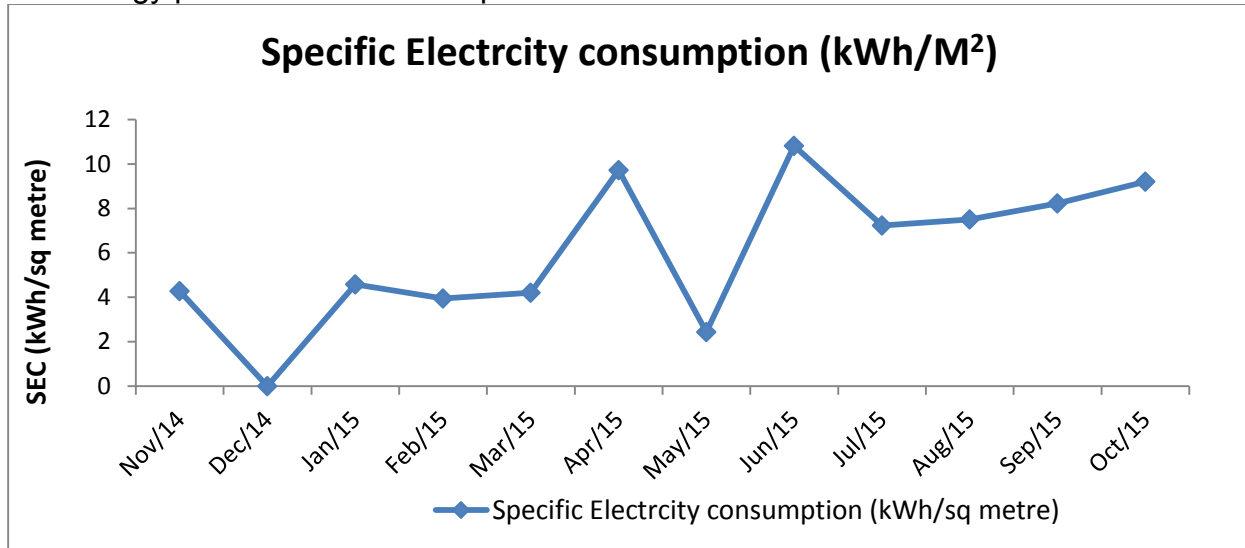
8. EFFICIENCY ANALYSIS:

Specific electricity consumption:

Specific electricity is calculated based on electricity consumed per building area in square meters. The details of specific electricity consumption for last few months are given below in table.

MONTH 2014-15	ELECTRICIY CONSUMPTION KSEB (kWh)	Area of the building (M ²)	SPECIFIC ELECTRICITY CONSUMPTION (kWh/M ²)
Nov-14	669	1751.3	4.28
Dec-14	740	1751.3	4.58
Jan-15	618	1751.3	3.95
Feb-15	678	1751.3	4.20
Mar-15	1954	1751.3	9.72
Apr-15	390	1751.3	2.44
May-15	2320	1751.3	10.82
Jun-15	1229	1751.3	7.23
Jul-15	1343	1751.3	7.50
Aug-15	1519	1751.3	8.23
Sep-15	1680	1751.3	9.21
Oct-15	904	1751.3	5.65

The energy performance index is plotted in the below chart.



Note:

- Specific electricity consumption found to be varying in all those months.
- Maximum SEC measured in the Jun-2015 and is 10.82 kWh/m².
- SEC is highly depended on the seasonal changes and the number of working days in a month. Variations are also possible in specific electricity consumption due to energy usage variation in different seasons of the year.

E. LIBRARY:

Building :LIBRARY
 Department :LIBRARY
Consumer No : 1000143738
 Service No :402164

1. Electrical Bill Analysis:

Base line data given below is based on the Electricity bill provided by the supplier of electricity CSPDCL. Details obtained from the Electricity bill is as follows.

Base Line Data (based on last 12 months)		
1	Electricity Provider	CSPDCL
2	Tariff	LV2ND3OT14
3	Connected Load (kW)	65
4	Average Monthly Energy Consumption (kWh)	4224.83
5	Monthly Total Electricity Cost (Avg. In Rs)	67402.5
6	Average Power Factor	-

Observations:

- PF is not provided in the bill

2. Electrical Load analysis:

Department	-	Library		
Consumer / meter No	-	402164		
Date & time of measurement		28/11/2015 15:06		
Actual Energy	kWh	6.84		
Apparent Energy	kVAh	7.97		
Power factor	-	0.85		
Particulars	Units	Minimum	Maximum	Average
Active power	kW	12.42	15.19	13.69
Apparent power	kVA	14.83	17.43	15.95
Voltage (VL)	Volts	232.8	237.1	235.3
Current	Amps	11.6	39	24.19
Voltage unbalance	%	0	0.6	0.25
Current unbalance	%	43.5	58.1	48.5
THD voltage	%	2	2.6	2.29
THD current	%	4.4	10.7	8.19

3. LIGHT & FAN LOAD CONSUMPTION PATTERN

Details	T5	T12	CFL	CEILING FAN NEW	CEILING FAN OLD
Watts(W)	28	40	15	60	90
Total Nos.	07	132	126	15	16
Total KW	0.19	5.28	1.89	0.9	1.44
Net total Kw	9.70				

Observations & suggestions:

- All the T12 fluorescent tube lights and CFLs may be replaced with LED tubes and LED bulbs.
- All the old ceiling fans and their resistance type regulators may be replaced by energy efficient fans.

4. Lux Measurements

According to BEE there is a lighting code to determine the overall energy efficiency of lighting system using measurements and methods which is applicable to all commercial buildings. One of the methods is Illuminance method which is the most practicable one.

LOCATION	MEASURED LUX	REQUIRED LUX	REMARKS
Average Lux In Library	321	250	Good
Librarians Room	289	150	Good

Note:

- The entire measurement taken during the day time.
- Standard lux is based on the ECBC user guide.

5. Computer & Its Accessories:

DETAILS	WATTS	TOTAL NO	TOTAL KW
LCD Computer	200	12	2.4
Scanner	200	02	0.4
Xerox	350	01	0.7
Laser	200	03	0.6
3 In One Printer	300	01	0.3
TOTAL kW			4.4

6. Air conditioning:

The department have installed a total of Split AC in the department including office, class rooms, laboratories etc. and their efficiency calculations are given below in table.

LOCATION	TYPE	COOLING CAPACITY (TR)	MEASURED COOLING CAPACITY KW	RATED POWER ELECTRICAL (KW)	RATED EER	MEASURED EER
Library	Split1	2	5.28	2.4	2.68	2.20
	SPLIT2	2	5.25	2.4	2.68	2.19
	SPLIT3	2	2.13	2.4	2.68	2.14
	SPLIT4	2	5.36	2.4	2.68	2.24
	SPLIT5	2	5.52	2.4	2.68	2.30
Librarians room	Split	1.5	4.40	1.6	3.29	2.75

7. WATER CONSUMPTION:

The department consumes water for various purposes like

- Drinking.
- Toilet flushing's
- Cleaning

Note:

- Water consumption is not monitored.
- Two stage flushing control may be used in toilets for reducing water wastage.
-

8. EFFICIENCY ANALYSIS:

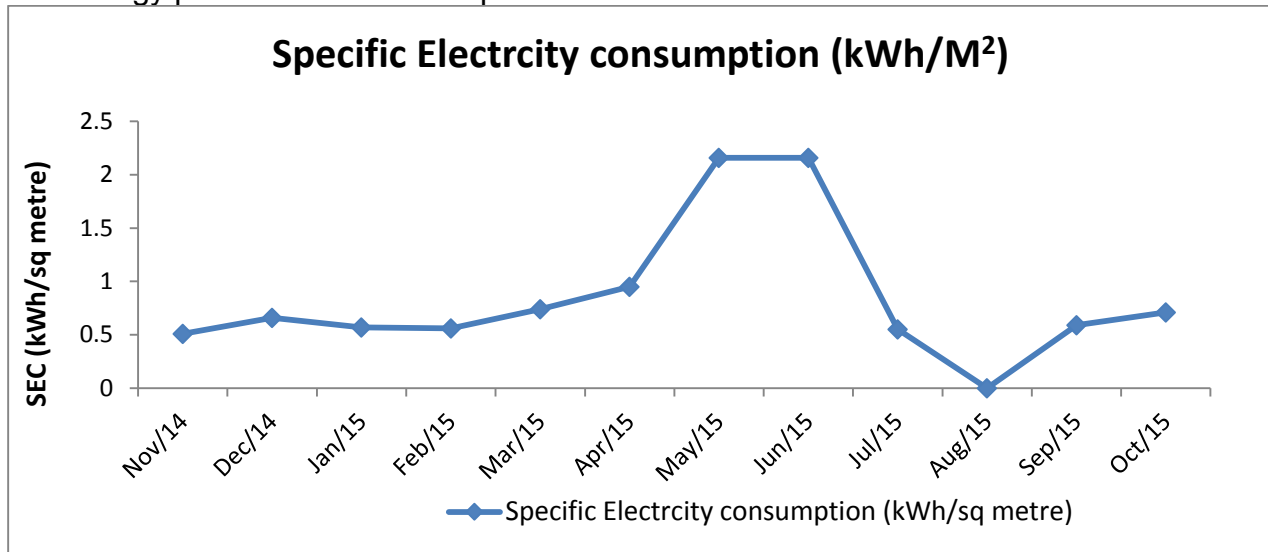
Specific electricity consumption:

Specific electricity is calculated based on electricity consumed per building area in square meters. The details of specific electricity consumption for last few months are given below in table.

MONTH 2014-15	ELECTRICITY CONSUMPTION KSEB (kWh)	Area of the building (M ²)	SPECIFIC ELECTRICITY CONSUMPTION (kWh/M ²)
Nov-14	2556	4950.7	0.52
Dec-14	3300	4950.7	0.67
Jan-15	2847	4950.7	0.58
Feb-15	2817	4950.7	0.57

Mar-15	3708	4950.7	0.75
Apr-15	4743	4950.7	0.96
May-15	10740	4950.7	2.17
Jun-15	10740	4950.7	2.17
Jul-15	2734	4950.7	0.55
Aug-15	0	4950.7	0.00
Sep-15	2961	4950.7	0.60
Oct-15	3543	4950.7	0.72

The energy performance index is plotted in the below chart.



Note:

- Specific electricity consumption found to be varying in all those months.
- Maximum SEC measured in the May & June-2015 and is 2.17 kWh/m².
- SEC is highly depended on the seasonal changes and the number of working days in a month. Variations are also possible in specific electricity consumption due to energy usage variation in different seasons of the year.

F. ANIMAL HOUSE :

Building : LIFE SCIENCE
 Department : LIFE SCIENCE
Consumer No : 1000145146
 Service No : 405706

1. Electrical Bill Analysis:

Base line data given below is based on the Electricity bill provided by the supplier of electricity CSPDCL. Details obtained from the Electricity bill is as follows.

Base Line Data (based on last 12 months)		
1	Electricity Provider	CSPDCL
2	Tariff	LV2ND1OT14
3	Connected Load (Kw)	3.36
4	Average Monthly Energy Consumption (Kwh)	373
5	Monthly Total Electricity Cost (Avg. In Rs)	1730.83
6	Average Power Factor	-

Observations:

- PF is not included in the bill.

2. Electrical Load analysis:

Department	-	Life science		
Consumer / meter No	-	405706		
Date & time of measurement		28/11/2015 15:55		
Actual Energy	kWh	0.06		
Apparent Energy	kVAh	0.01		
Power factor	-	0.6		
Particulars	Units	Minimum	Maximum	Average
Active power	kW	.58	1.67	.73
Apparent power	kVA	1.86	4.76	2.37
Voltage (VL)	Volts	232.7	253	244.99
Current	Amps	.04	7.93	1.35
THD voltage	%	2.95	3.52	3.18
THD current	%	5.10	13.43	6.58

Standards:

- Permissible voltage limit as per CEA standards on grid connectivity is 230 plus or minus 10%, which means 254V is the maximum allowable.

Observations:

- At present maximum voltage is at the brim of the permissible limit which should be taken care of by reporting it to the supplier.
- Increase in the voltage increases the consumption of electricity and also the failure frequency of the equipment.

3. LIGHT & FAN LOAD CONSUMPTION PATTERN

Details	T12	CFL
Watts(W)	40	15
Total Nos.	6	4
Total KW	0.24	0.06
Net total Kw	0.3	

Observations & suggestions:

- All the T12 fluorescent tube lights and CFLs may be replaced with LED tubes and LED bulbs.
- All the old ceiling fans and their resistance type regulators may be replaced by energy efficient fans.

4. Lux Measurements

According to BEE there is a lighting code to determine the overall energy efficiency of lighting system using measurements and methods which is applicable to all commercial buildings. One of the methods is Illuminance method which is the most practicable one.

LOCATION	MEASURED	REQUIRED	REMARKS
Average Lux In Animal House	226	150	Good

Notes:

- The entire measurement taken during the day time.
- Standard lux is based on the ECBC user guide.

5. Air conditioning:

The department have installed a total of 6 Split AC and a window AC In the department and their efficiency calculations are given below in table.

LOCATION	TYPE	COOLING CAPACITY (TR)	MEASURED COOLING CAPACITY KW	RATED POWER ELECTRICAL (KW)	RATED EER	MEASURED EER
ANIMAL HOUSE	WINDOW	1.5	NOT WORKING			
	SPLIT	1.5	NOT WORKING			
AQUARIUM	SPLIT	1.5	4.6	1.65	3.2	2.81
	SPLIT	1.5	4.49	1.85	2.8	2.43
	SPLIT	1.5	4.45	1.85	2.8	2.41
	SPLIT	1.5	4.42	1.85	2.8	2.39
	SPLIT	1.5	4.42	1.85	2.8	2.39

6. WATER CONSUMPTION:

The department consumes water for various purposes like

- Drinking.
- Toilet flushing's
- Cleaning

Note:

- Water consumption is not monitored.
- Two stage flushing control may be used in toilets for reducing water wastage.

7. EFFICIENCY ANALYSIS:

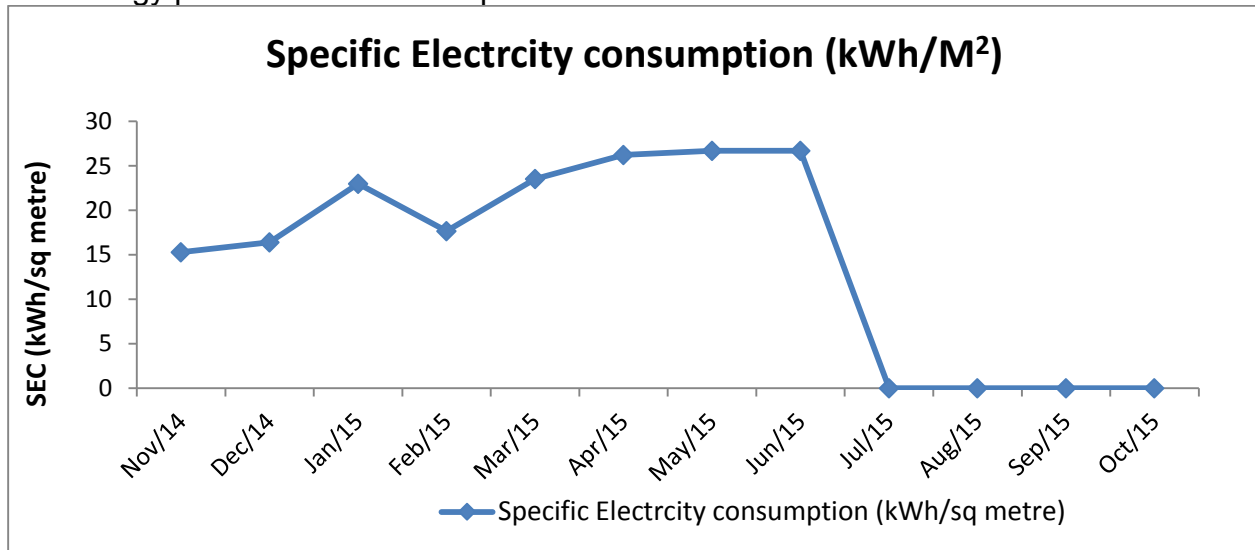
Specific electricity consumption:

Specific electricity is calculated based on electricity consumed per building area in square meters. The details of specific electricity consumption for last few months are given below in table.

MONT H 2014-15	ELECTRICITY CONSUMPTION KSEB (kWh)	Area of the building (M ²)	SPECIFIC ELECTRICITY CONSUMPTION (kWh/M ²)
Nov-14	260	17	15.29
Dec-14	279	17	16.41
Jan-15	391	17	23.00
Feb-15	300	17	17.65

Mar-15	400	17	23.53
Apr-15	446	17	26.24
May-15	454	17	26.71
Jun-15	454	17	26.71
Jul-15	0	17	0.00
Aug-15	0	17	0.00
Sep-15	0	17	0.00
Oct-15	0	17	0.00

The energy performance index is plotted in the below chart.



Note:

- Specific electricity consumption found to be varying in all those months.
- Maximum SEC measured in the Jun-2015 and is 26.7 kWh/m².
- SEC is highly depended on the seasonal changes and the number of working days in a month. Variations are also possible in specific electricity consumption due to energy usage variation in different seasons of the year.
- The kWh consumption was nil from the Jul-15 as the energy metre is not working for the same.

G. PUMP AD BLOCK:

Consumer No : 1000145478

Service No : 406185

1. Electrical Bill Analysis:

Base line data given below is based on the Electricity bill provided by the supplier of electricity CSPDCL. Details obtained from the Electricity bill is as follows.

Base Line Data (based on last 12 months)		
1	Electricity Provider	CSPDCL
2	Tariff	LV2ND1OT14
3	Connected Load (Kw)	
4	Average Monthly Energy Consumption (Kwh)	677.54
5	Monthly Total Electricity Cost (Avg. In Rs)	4850.90
6	Average Power Factor	-

Observations:

- Original EB bill was not available thus connected load and other details couldn't include in the above table.
- Capacitor is not in the premises. Thus PF would be less than the permissible limit.

2. Electrical Load analysis:

Department	-	Pump ad block		
Consumer / meter No	-	406185		
Date & time of measurement		28-11-2015, 16:12		
Actual Energy	kWh	0.36		
Apparent Energy	kVAh	0.60		
Power factor	-	0.6		
Particulars	Units	Minimum	Maximum	Average
Active power	kW	3.39	3.43	3.41
Apparent power	kVA	5.51	5.58	5.55
Voltage (V _L)	Volts	236.39	251.45	242.90
Current	Amps	7.26	8.11	7.60
THD voltage	%	2.85	2.96	3.13
THD current	%	4.07	4.67	4.44

Note:

- PF found to be low in the Pump. By installing the capacitor of required rating we can improve the PF.
- Capacitor of 1 kVAr is sufficient for the motor.

H. BOTANICAL GARDEN PUMP:

Consumer No : 1000297299

Service No : 406203

1. Electrical Bill Analysis:

Base line data given below is based on the Electricity bill provided by the supplier of electricity CSPDCL. Details obtained from the Electricity bill is as follows.

Base Line Data (based on last 12 months)		
1	Electricity Provider	CSPDCL
2	Tariff	LV2ND3OT14
3	Connected Load (Kw)	3.75
6	Average Monthly Energy Consumption (Kwh)	510.25
7	Monthly Total Electricity Cost (Avg. In Rs)	4847.5
9	Average Power Factor	-

Observations:

- **PF is not included in the bill.**

2. Electrical Load analysis:

Department	-	Pump Life science		
Consumer / meter No	-	406203		
Date & time of measurement		28/11/2015 11:01		
Actual Energy	kWh	1.25		
Apparent Energy	kVAh	1.47		
Power factor	-	0.85		
Particulars	Units	Minimum	Maximum	Average
Active power	kW	3.54	3.61	3.58
Apparent power	kVA	4.21	4.24	4.22
Voltage (VL)	Volts	230.5	238.5	235.5
Current	Amps	7.85	9.22	8.56

Note:

- **Average working hours of the pump found to be four**
- **Rated Power of the pump was 5 hp which is 3.62 kW**

I. PUMP NEAR LIBRARY

Building : PUMP NEAR LIBRARY
Consumer No : 100014550
 Service No : 406126

1. Electrical Bill Analysis:

Base line data given below is based on the Electricity bill provided by the supplier of electricity CSPDCL. Details obtained from the Electricity bill is as follows.

Base Line Data (based on last 12 months)		
1	Electricity Provider	CSPDCL
2	Tariff	LV2ND1OT14
3	Connected Load (Kw)	2.238
6	Average Monthly Energy Consumption (Kwh)	1041.6
7	Monthly Total Electricity Cost (Avg. In Rs)	8532
9	Average Power Factor	-

Observations:

2. Electrical Load analysis:

Department	-	Pump house near library		
Consumer / meter No	-	406126		
Date & time of measurement		28/11/2015 15:28		
Actual Energy	kWh	1.2		
Apparent Energy	kVAh	1.39		
Power factor	-	0.86		
Particulars	Units	Minimum	Maximum	Average
Active power	kW	3.56	3.62	3.58
Apparent power	kVA	4.09	4.16	4.11
Voltage (VL)	Volts	231.2	245.5	238.5
Current	Amps	8.38	9.19	8.98

Note:

- Average working hours of the pump found to be twelve
- Rated Power of the pump was 5 hp which is 3.62 kW

J. ARTS BHAVAN GROUND FLOOR

Building : ARTS BHAVAN
Department : ARTS BHAVAN
Consumer No : 1000143737
Service No : 402163

1. Electrical Bill Analysis:

Base line data given below is based on the Electricity bill provided by the supplier of electricity CSPDCL. Details obtained from the Electricity bill is as follows.

Base Line Data (based on last 12 months)		
1	Electricity Provider	CSPDCL
2	Tariff	LV2ND3OT14
3	Connected Load (Kw)	65
4	Average Monthly Energy Consumption (Kwh)	4141.83
5	Monthly Total Electricity Cost (Avg. In Rs)	93062.5
6	Average Power Factor	-

Observations:

- PF is not included in the bill.

2. Electrical Load analysis:

Department	-	Arts Bhavan Ground Floor		
Consumer / meter No	-	402163		
Date & time of measurement		28-11-2015, 11:53		
Actual Energy	kWh	4.33		
Apparent Energy	kVAh	5.64		
Power factor	-	0.76		
Particulars	Units	Minimum	Maximum	Average
Active power	kW	3.33	6.34	4.81
Apparent power	kVA	4.84	7.69	6.27
Voltage (VL)	Volts	232.5	243.2	240.0
Current	Amps	5.51	14.84	9.08
Voltage unbalance	%	1.1	2.3	1.61
Current unbalance	%	6.5	54.6	31.30
THD voltage	%	1.8	2.5	2.12
THD current	%	6.3	22.6	10.87

3. LIGHT & FAN LOAD CONSUMPTION PATTERN

Details	T12	CFL	CEILING FAN OLD
Watts(W)	40	15	90
Total Nos.	143	7	78
Total KW	1.72	0.105	7.02
Net total Kw	8.845		

Observations & suggestions:

- All the T12 fluorescent tube lights and CFLs may be replaced with LED tubes and LED bulbs.
- All the old ceiling fans and their resistance type regulators may be replaced by energy efficient fans.

4. Lux Measurements

According to BEE there is a lighting code to determine the overall energy efficiency of lighting system using measurements and methods which is applicable to all commercial buildings. One of the methods is Illuminance method which is the most practicable one.

LOCATION	MEASURED	REQUIRED	REMARKS
UGC Coaching Centre Hall A	231	150	Good
UGC Coaching Centre Hall B	254	150	Good
UGC Office	196	150	Good
Assistant Professor	167	150	Good
Women's Study Centre	229	150	Good
Psychology Office	198	150	Good
Psychology Office	217	150	Good
Mr. Shrivastava Cabin	238	150	Good
MPhil Room	177	150	Good
Yoga Office	202	150	Good
Room 4	199	150	Good
Room 3	231	150	Good
Room 2	241	150	Good

Notes:

- The entire measurement taken during the day time.
- Standard lux is based on the ECBC user guide.

5. Computer & Its Accessories:

DETAILS	WATTS	TOTAL NO	TOTAL KW
LCD Computer	200	25	5
Scanner	200	2	0.4
Xerox	350	1	0.35
Laser	200	7	1.4
3 In One Printer	300	1	0.3
TOTAL KW			7.45

6. WATER CONSUMPTION:

The department consumes water for various purposes like

- Drinking.
- Toilet flushing's
- Cleaning

Note:

- Water consumption is not monitored.
- Two stage flushing control may be used in toilets for reducing water wastage.

7. Air conditioning:

Arts bhavan have installed a total of 7 Split AC and a window in the department including office , class rooms, laboratories etc. and their efficiency calculations are given below in table.

LOCATION	TYPE	COOLING CAPACITY (TR)	MEASURED COOLING CAPACITY (KW)	RATED POWER ELECTRICAL (Kw)	RATED EER	MEASURED EER
Computer Lab	Split 1	1.5	4.82	1.55	3.40	3.11
	Split 2	1.5	4.78	1.55	3.40	3.09
	Split 3	1.5	4.72	1.55	3.40	3.05
Coordinators Room	Split	1.5	4.89	1.55	3.40	3.16
Promila Singh Cabin	Split	1.5	4.44	1.77	2.84	2.51
Vansh Gopal Singh Cabin	Split	1.5	4.28	1.77	2.84	2.42
Genomics Lab	Split	1.5	4.99	1.55	3.40	3.22

Faculty Room

Window

1.5

Not working

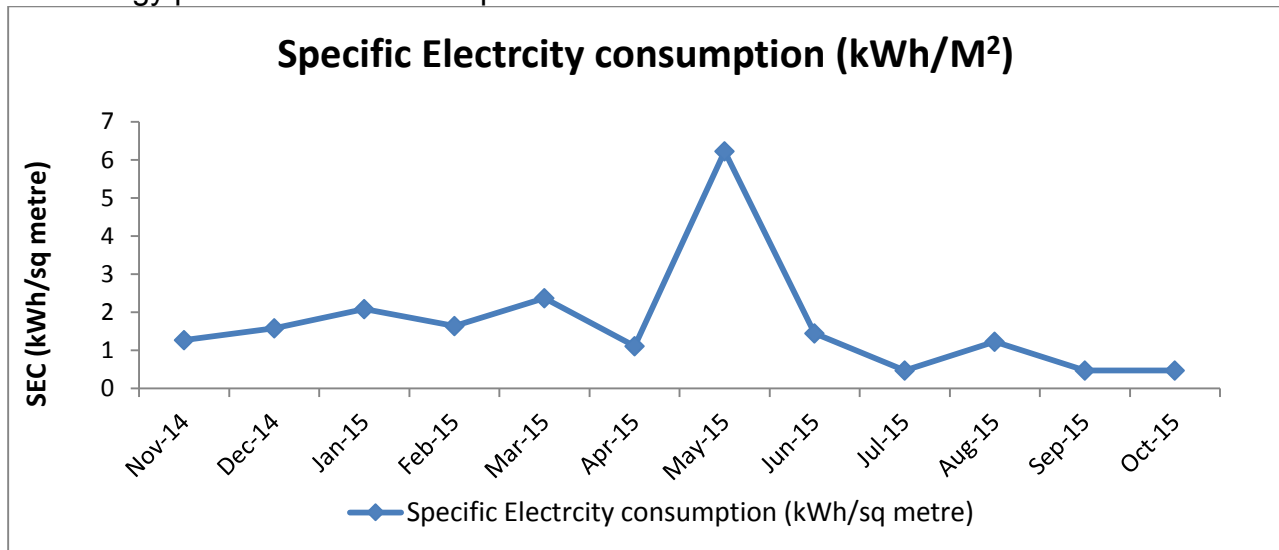
8. EFFICIENCY ANALYSIS:

Specific electricity consumption:

Specific electricity is calculated based on electricity consumed per building area in square meters. The details of specific electricity consumption for last few months are given below in table.

MONTH 2014-15	ELECTRICITY CONSUMPTION KSEB (kWh)	Area of the building (M ²)	SPECIFIC ELECTRICITY CONSUMPTION (kWh/M ²)
Nov-14	3100	2433.48	1.27
Dec-14	3858	2433.48	1.58
Jan-15	5091	2433.48	2.09
Feb-15	3993	2433.48	1.64
Mar-15	5778	2433.48	2.37
Apr-15	2718	2433.48	1.11
May-15	15168	2433.48	6.23
Jun-15	3537	2433.48	1.45
Jul-15	1150	2433.48	0.47
Aug-15	3007	2433.48	1.23
Sep-15	1150	2433.48	0.47
Oct-15	1152	2433.48	0.47

The energy performance index is plotted in the below chart.



Note:

- Specific electricity consumption found to be varying in all those months.
- Maximum SEC measured in the May-2015 and is 6.23 kWh/m².
- SEC is highly depended on the seasonal changes and the number of working days in a month. Variations are also possible in specific electricity consumption due to energy usage variation in different seasons of the year.
- High SEC due to building renovation

9. General mentions:

- Building was under renovation during the period of audit.
- AC is provided in some of the rooms. Most of them are old and not working due to the renovation in the area.

K. ARTS BHAVAN FIRST FLOOR :

Building : ARTS DEPARTMENT
 Department : ARTS DEPARTMENT
Consumer No : 10005394049
 Service No : 406354

1. Electrical Bill Analysis:

Base line data given below is based on the Electricity bill provided by the supplier of electricity CSPDCL. Details obtained from the Electricity bill is as follows.

Base Line Data (based on last 12 months)		
1	Electricity Provider	CSPDCL
2	Tariff	LV2ND3OT14
3	Connected Load (kW)	32
4	Average Monthly Energy Consumption (kWh)	576
5	Monthly Total Electricity Cost (Avg. In Rs)	5928.75
6	Average Power Factor	-

Observations:

- PF is not provided in the bill.

2. Electrical Load analysis:

Department	-	Arts dept. first floor		
Consumer / meter No	-	406354		
Date & time of measurement		25-11-2015, 12:49		
Actual Energy	kWh	0.74		
Apparent Energy	kVAh	0.96		
Power factor	-	0.77		
Particulars	Units	Minimum	Maximum	Average
Active power	kW	1.19	1.53	1.32
Apparent power	kVA	1.55	1.96	1.72
Voltage (VL)	Volts	240.2	246.6	243.8
Current	Amps	0	6.06	2.71
Voltage unbalance	%	0.4	0.9	0.6
Current unbalance	%	119.9	140.6	134.4
THD voltage	%	1.8	2.3	2.10
THD current	%	5.4	11.1	7.14

3. LIGHT & FAN LOAD CONSUMPTION PATTERN

Details	T12	CFL	BULB	CEILING FAN NEW	CEILING FAN OLD	EXHAUST FAN
Watts(W)	40	15	40	60	90	60
Total Nos.	108	5	-	4	58	2
Total KW	4.32	0.75	-	0.24	5.22	0.12
Net total Kw	10.65					

Observations & suggestions:

- All the T12 fluorescent tube lights and CFLs may be replaced with LED tubes and LED bulbs.
- All the old ceiling fans and their resistance type regulators may be replaced by energy efficient fans.

4. Lux Measurements

According to BEE there is a lighting code to determine the overall energy efficiency of lighting system using measurements and methods which is applicable to all commercial buildings. One of the methods is Illuminance method which is the most practicable one.

LOCATION	MEASURED LUX	REQUIRED LUX	REMARKS
Anthropology Office	201	150	Good
Seminar Office	225	150	Good
Human Genome Lab	288	250	Good
Staff Room	196	150	Good
HOD Cabin	159	150	Good
Forensic Lab	287	250	Good
Lecture Room	229	150	Good
Sahitya Academy Room	198	150	Good
Sociology Office	217	150	Good
Program Office	156	150	Good
Class Room	175	150	Good
Computer Lab	287	250	Good
Dr Tiwari Cabin	293	150	Good
Ancient Indian History Office	356	150	Good
SOS In Language And	187	150	Good
Dr Madhulatha Office	176	150	Good
HOD Cabin	264	150	Good
Scholar Room	281	150	Good
MPhil Class Room	241	150	Good
Staff Room	209	150	Good
Hall	226	150	Good

Notes:

- The entire measurement taken during the day time.
- Standard lux is based on the ECBC user guide.

5. Computer & Its Accessories:

DETAILS	WATTS	TOTAL NO	TOTAL KW
LCD Computer	200	28	5.6
CRT Computer	250	3	0.75
Scanner	200	4	0.8
Xerox	350	2	0.7
Laser	200	4	0.8
Total kW			8.65

6. WATER CONSUMPTION:

The department consumes water for various purposes like

- Drinking.
- Toilet flushing's
- Cleaning

Note:

- Water consumption is not monitored.
- Two stage flushing control may be used in toilets for reducing water wastage.

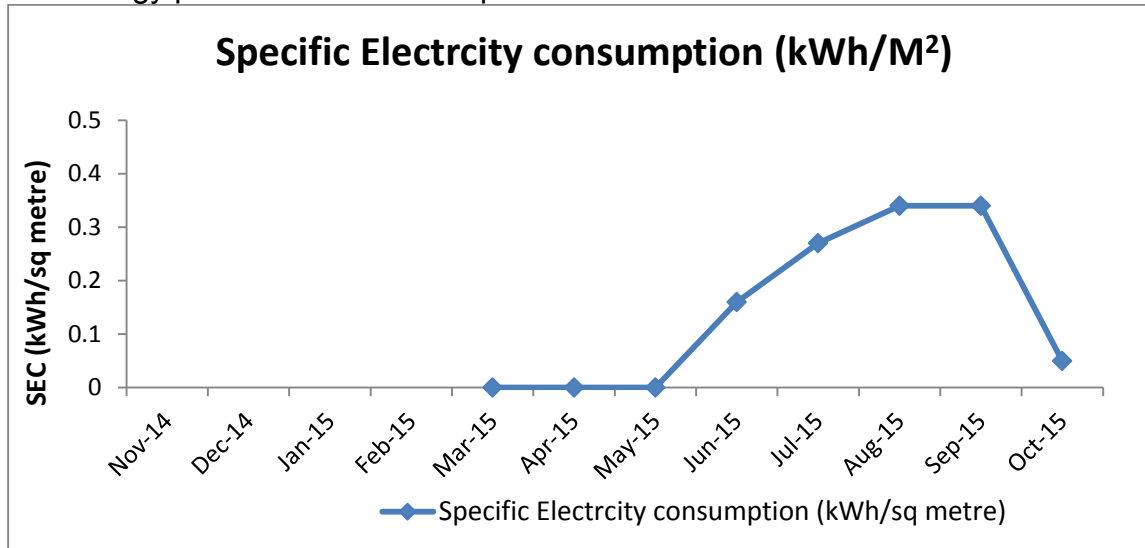
7. EFFICIENCY ANALYSIS:

Specific electricity consumption:

Specific electricity is calculated based on electricity consumed per building area in square meters. The details of specific electricity consumption for last few months are given below in table.

MONTH 2014-15	ELECTRICITY CONSUMPTION KSEB (kWh)	Area of the building (M ²)	SPECIFIC ELECTRICITY CONSUMPTION (kWh/M ²)
Mar-15	0	2433.48	0
Apr-15	0	2433.48	0
May-15	0	2433.48	0
Jun-15	400	2433.48	0.16
Jul-15	660	2433.48	0.27
Aug-15	840	2433.48	0.34
Sep-15	840	2433.48	0.34
Oct-15	140	2433.48	0.05

The energy performance index is plotted in the below chart.



Note:

- **Unit's consumption is not available for the first six months.**
- Specific electricity consumption found to be varying in all those months.
- Maximum SEC measured in the Aug-2015 and is 0.34 kWh/m².
- SEC is highly depended on the seasonal changes and the number of working days in a month. Variations are also possible in specific electricity consumption due to energy usage variation in different seasons of the year.

10. General mentions:

- Building was under renovation during the period of audit.
- AC is provided in some of the rooms. Most of them are old and not working due to the renovation in the area.

L. ARTS BHAVAN SECOND FLOOR:

Building : ATRS BHAVAN
 Department : ARTS BHAVAN
Consumer No : 1005394112
 Service No : 406355

1. Electrical Bill Analysis:

Base line data given below is based on the Electricity bill provided by the supplier of electricity CSPDCL. Details obtained from the Electricity bill is as follows.

Base Line Data (based on last 12 months)		
1	Electricity Provider	CSPDCL
2	Tariff	LV2ND1OT14
3	Connected Load (Kw)	32.14
4	Average Monthly Energy Consumption (Kwh)	672.5
5	Monthly Total Electricity Cost (Avg. In Rs)	11857.5
6	Average Power Factor	-

Note:

- PF is not provided in the bill.

2. Electrical Load analysis:

Department	-	Arts bhavan second floor		
Consumer / meter No	-	406355		
Date & time of measurement		28-11-2015, 13:25		
Actual Energy	kWh	3.53		
Apparent Energy	kVAh	4.92		
Power factor	-	0.71		
Particulars	Units	Minimum	Maximum	Average
Active power	kW	3.40	4.94	3.59
Apparent power	kVA	4.81	6.10	5.01
Voltage (VL)	Volts	241.4	247.9	245
Current	Amps	0	14.35	6.98
Voltage unbalance	%	0.3	0.8	0.6
Current unbalance	%	100	106	101.5
THD voltage	%	1.8	2.5	2.1
THD current	%	6.8	16.7	9.77

Note:

- PF found to be low in the logging period. This may due to the low load present under the meter.

3. LIGHT & FAN LOAD CONSUMPTION PATTERN

Details	T12	CFL	CEILING FAN OLD	EXHAUST FAN
Watts(W)	40	15	90	60
Total Nos.	87	2	48	2
Total KW	3.4	0.03	4.32	0.12
Net total Kw	7.87			

Observations & suggestions:

- All the T12 fluorescent tube lights and CFLs may be replaced with LED tubes and LED bulbs.
- All the old ceiling fans and their resistance type regulators may be replaced by energy efficient fans.

4. Lux Measurements

According to BEE there is a lighting code to determine the overall energy efficiency of lighting system using measurements and methods which is applicable to all commercial buildings. One of the methods is Illuminance method which is the most practicable one.

LOCATION	MEASURED	REQUIRED	REMARKS
SOS In History	302	150	Good
Average Lux In Class Rooms	254	150	Good
Staff Room	289	150	Good
HOD Cabin	264	150	Good
SOS In Economics	351	150	Good
Average Lux In Class Rooms	168	150	Good
Staff Room	225	150	Good
HOD Cabin	354	150	Good

Notes:

- The entire measurement taken during the day time.
- Standard lux is based on the ECBC user guide.

5. Computer & Its Accessories:

DETAILS	WATTS	TOTAL NO	TOTAL KW
LCD Computer	200	8	0.8
Scanner	200	2	0.4
Laser	200	6	1.2
TOTAL kW			1.4

6. WATER CONSUMPTION:

The department consumes water for various purposes like

- Drinking.
- Toilet flushing's
- Cleaning

Note:

- Water consumption is not monitored.
- Two stage flushing control may be used in toilets for reducing water wastage.

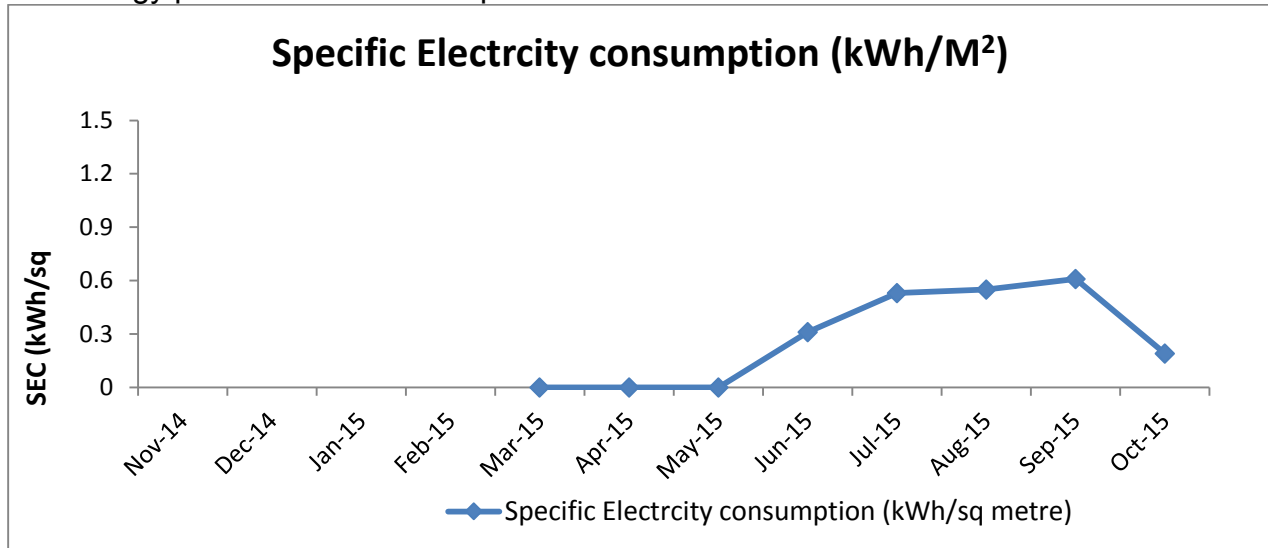
7. EFFICIENCY ANALYSIS:

Specific electricity consumption:

Specific electricity is calculated based on electricity consumed per building area in square meters. The details of specific electricity consumption for last few months are given below in table.

MONTH 2014-15	ELECTRICITY CONSUMPTION (kWh)	KSEB	Area of the building (M ²)	SPECIFIC ELECTRICITY CONSUMPTION (kWh/M ²)
Mar-15	0		2433.48	0
Apr-15	0		2433.48	0
May-15	0		2433.48	0
Jun-15	760		2433.48	0.31
Jul-15	1300		2433.48	0.53
Aug-15	1340		2433.48	0.55
Sep-15	1500		2433.48	0.61
Oct-15	480		2433.48	0.19

The energy performance index is plotted in the below chart.



Note:

- **Unit's consumption is not available for the first six months.**
- Specific electricity consumption found to be varying in all those months.
- Maximum SEC measured in the Sep-2015 and is 0.61 kWh/m².
- SEC is highly depended on the seasonal changes and the number of working days in a month. Variations are also possible in specific electricity consumption due to energy usage variation in different seasons of the year.

11. General mentions:

- Building was under renovation during the period of audit.
- AC is provided in some of the rooms. Most of them are old and not working due to the renovation in the area.

M. HEALTH CENTRE :

Building : Health centre
Department : Health centre
Consumer No : 1000143732
Service No :402158

1. Electrical Bill Analysis:

Base line data given below is based on the Electricity bill provided by the supplier of electricity CSPDCL. Details obtained from the Electricity bill is as follows.

Base Line Data (based on last 12 months)		
1	Electricity Provider	CSPDCL
2	Tariff	LV2ND1OT14
3	Connected Load (Kw)	4.95
4	Average Monthly Energy Consumption (Kwh)	317.83
5	Monthly Total Electricity Cost (Avg. In Rs)	2573
6	AVERAGE POWER FACTOR	-

Notes:

- PF is not available in the bill.

2. Electrical Load analysis:

Department	-	Health centre		
Consumer / meter No	-	402158		
Date & time of measurement		28-11-2015, 11:24		
Actual Energy	kWh	0.42		
Apparent Energy	kVAh	0.74		
Power factor	-	0.56		
Particulars	Units	Minimum	Maximum	Average
Active power	kW	0.56	2.16	0s.87
Apparent power	kVA	0.99	4.68	1.54
Voltage (VL)	Volts	230.85	240.22	236.40
Current	Amps	0.62	7.98	1.67
THD voltage	%	2.15	3.14	2.51
THD current	%	4.76	6.67	6.12

3. LIGHT & FAN LOAD CONSUMPTION PATTERN

Details	T5	T12	CFL	BULB	CEILING FAN NEW	CEILING FAN OLD
Watts(W)	28	40	15	60	60	90
Total Nos.	2	10	1	1	5	2
Total KW	.056	0.4	.015	0.06	0.3	0.18
Net total		1.011				

Observations & suggestions:

- All the T12 fluorescent tube lights and CFLs may be replaced with LED tubes and LED bulbs.
- All the old ceiling fans and their resistance type regulators may be replaced by energy efficient fans.

4. LUX MEASUREMENTS

According to BEE there is a lighting code to determine the overall energy efficiency of lighting system using measurements and methods which is applicable to all commercial buildings. One of the methods is Illuminance method which is the most practicable one.

LOCATION	MEASURED	REQUIRED	REMARKS
Doctor	233	150	Good
Madame's Room	196	150	Good
Pathology	251	150	Good

Notes:

- The entire measurement taken during the day time.
- Standard lux is based on the ECBC user guide.

5. Computer & Its Accessories:

DETAILS	WATTS	TOTAL NO	TOTAL KW
LCD Computer	200	2	0.4
CRT Computer	250	-	
Total kW			0.4

6. Air conditioning:

Health centre have installed 2 window AC and a split AC, and their efficiency calculations are given below in table.

LOCATION	TYPE	COOLING CAPACITY (TR)	MEASURED COOLING CAPACITY KW	RATED POWER ELECTRICAL (KW)	RATED EER	MEASURED EER
Doctor's Room	Window	1.5	3.75	2.5	2.1	1.5
Room	Split	1	3.399	1.1	3.2	3.09
Pathology	Window	1.5	3.55	2.5	2.1	1.42

Table

7. Water consumption:

Health centre consumes water for various purposes like

- Drinking.
- Toilets
- Cleaning

Note:

- Water consumption is not monitored.
- Two stage flushing control may be used in toilets for reducing water wastage.

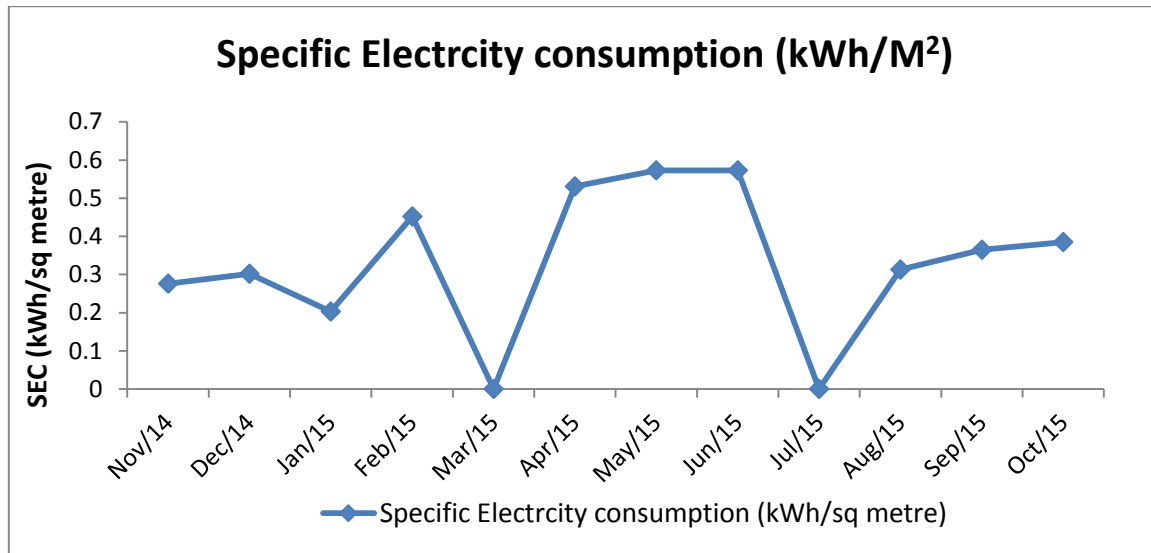
8. EFFICIENCY ANALYSIS:

Specific electricity consumption:

Specific electricity is calculated based on electricity consumed per building area in square meters. The details of specific electricity consumption for last few months are given below in table.

MONTH 2014-15	ELECTRICITY CONSUMPTION KSEB (kWh)	Area of the building (M²)	SPECIFIC ELECTRICITY CONSUMPTION (kWh/M²)
Nov-14	265	960	0.28
Dec-14	290	960	0.30
Jan-15	195	960	0.20
Feb-15	434	960	0.45
Mar-15	0	960	0.00
Apr-15	510	960	0.53
May-15	550	960	0.57
Jun-15	550	960	0.57
Jul-15	0	960	0.00
Aug-15	300	960	0.31
Sep-15	350	960	0.36
Oct-15	370	960	0.39

The energy performance index is plotted in the below chart.



Chart

Note:

- Specific electricity consumption found to be varying in all those months.
- SEC is highly depended on electricity consumption. Variations are observed in specific electricity consumption due to energy usage variation in different seasons of the year.

V. MEASUREMENTS TAKEN ON 30-11-2015:

A. ADMINSTRATIVE BUILDING:

- i. Building : ADMINSTRATIVE BUILDNG
 Consumer No : 1000297279
 Service No : 406135

1. Electrical Bill Analysis:

Base line data given below is based on the Electricity bill provided by the supplier of electricity CSPDCL. Details obtained from the Electricity bill is as follows.

Base Line Data (based on last 12 months)		
1	Electricity Provider	CSPDCL
2	Tariff	LV2ND3OT14
3	Connected Load (kW)	63.35
4	Average Monthly Energy Consumption (kWh)	4842.5
5	Monthly Total Electricity Cost (Avg. In Rs)	50725.83
6	Average power factor	-

Observations:

- PF is not included in the bill.

2. Electrical Load analysis:

Department	-	AD block Power meter		
Consumer / meter No	-	406135		
Date & time of measurement		30-11-2015, 11:41		
Actual Energy	kWh	8.27		
Apparent Energy	kVAh	9.53		
Power factor	-	0.86		
Particulars	Units	Minimum	Maximum	Average
Active power	kW	11.89	17.18	14.74
Apparent power	kVA	14.30	19.34	16.99
Voltage (VL)	Volts	231.6	242.1	235.9
Current	Amps	1.9	44.38	26.62
Voltage unbalance	%	1.6	2.1	1.9
Current unbalance	%	90.5	92.7	91.75
THD voltage	%	2.1	2.8	2.46
THD current	%	9.8	19.1	14.16

i. Building: ADMINSTRATIVE BUILDING

Consumer No : 1000143837

Service No : 404298

1. Electrical Bill Analysis:

Base line data given below is based on the Electricity bill provided by the supplier of electricity CSPDCL. Details obtained from the Electricity bill is as follows.

Base Line Data (based on last 12 months)		
1	Electricity Provider	CSPDCL
2	Tariff	LV2ND3OT14
3	Connected Load (kW)	69.95
6	Average Monthly Energy Consumption (kWh)	2471.27
7	Monthly Total Electricity Cost (Avg. In Rs)	19725.44
9	Average Power Factor	-

Observations:

- PF is not included in the bill

2. Electrical Load analysis:

Department	-	Ad block		
Consumer / meter No	-	404298		
Date & time of measurement		30-11-2015, 11:09		
Actual Energy	kWh	1.71		
Apparent Energy	kVAh	2.10		
Power factor	-	0.81		
Particulars	Units	Minimum	Maximum	Average
Active power	kW	3.54	4.04	3.68
Apparent power	kVA	4.37	4.80	4.50
Voltage (VL)	Volts	233	240.3	235.74
Current	Amps	0	13.78	5.55
Voltage unbalance	%	1.4	1.8	1.6
Current unbalance	%	100	102.7	100
THD voltage	%	2.2	2.7	2.4
THD current	%	7.3	18	11.86

ii. PAREEKSHA BHAVAN:

Building : ADMINSTRATIVE BUILDING
Consumer No : 1000297353
Service No : 406267

1. Electrical Bill Analysis:

Base line data given below is based on the Electricity bill provided by the supplier of electricity CSPDCL. Details obtained from the Electricity bill is as follows.

Base Line Data (based on last 12 months)		
1	Electricity Provider	CSPDCL
2	Tariff	LV2ND1OT14
3	Connected Load (kW)	----
4	Average Monthly Energy Consumption (kWh)	3992.75
5	Monthly Total Electricity Cost (Avg. In Rs)	34413
6	Average Power Factor	-

2. Electrical Load analysis:

Department	-	Exam. centre		
Consumer / meter No	-	406267		
Date & time of measurement		30-11-2015, 12:30		
Actual Energy	kWh	8.90		
Apparent Energy	kVAh	11.17		
Power factor	-	0.79		
Particulars	Units	Minimum	Maximum	Average
Active power	kW	8.81	11.09	97.71
Apparent power	kVA	11.38	12.26	13.32
Voltage (VL)	Volts	238.2	249.4	243.9
Current	Amps	6.88	31.69	15.70
Voltage unbalance	%	1.41	1.7	1.5
Current unbalance	%	48.6	76.4	63.2
THD voltage	%	2.7	3.4	3.04
THD current	%	4.7	13.3	8.96

iii. VC CHAMBER AC:

Building : ADMINSTRATIVE BUILDING
Department : ADMINSTRATIVE BUILDING
Consumer No : 1000145477
Service No : 406184

1. Electrical Bill Analysis:

Base line data given below is based on the Electricity bill provided by the supplier of electricity CSPDCL. Details obtained from the Electricity bill is as follows.

Base Line Data (based on last 12 months)		
1	Electricity PROVIDER	CSPDCL
2	Tariff	LV2ND1OT14
3	Connected Load (kW)	3.375
4	Average Monthly Energy Consumption (kWh)	345.83
5	Monthly Total Electricity Cost (Avg. In Rs)	2686.36
6	Average Power Factor	-

Observations:

2. Electrical Load analysis:

Department	-	VC chamber AC		
Consumer / meter No	-	406184		
Date & time of measurement		30/11/2015 12:19		
Actual Energy	kWh	0.8		
Apparent Energy	kVAh	0.9		
Power factor	-	0.88		
Particulars	Units	Minimum	Maximum	Average
Active power	kW	2.04	2.23	2.11
Apparent power	kVA	2.24	2.55	2.32
Voltage (VL)	Volts	236.7	249.5	244.5
Current	Amps	2.5	9.52	3.55
Voltage unbalance	%	2.5	3.1	2.87
Current unbalance	%	42.6	176.5	107.06
THD voltage	%	2.4	2.7	2.54
THD current	%	15.9	53.1	34.3

3. LIGHT & FAN LOAD CONSUMPTION PATTERN- GROUND FLOOR

Details	T8	T12	CFL	CFL	CEILING FAN NEW	CEILING FAN OLD	EXHAUST FAN
Watts(W)	36	40	15	36	60	90	60
Total Nos.	26	157	110	28	38	59	10
Total KW	0.94	6.28	1.65	1.008	2.28	5.31	0.6
Net total kW	18.068						

Observations & suggestions:

- All the T12 fluorescent tube lights and CFLs may be replaced with LED tubes and LED bulbs.
- All the old ceiling fans and their resistance type regulators may be replaced by energy efficient fans.

4. LIGHT & FAN LOAD CONSUMPTION PATTERN- FIRST AND SECOND FLOOR

Details	T8	T 12	CFL	CFL	CEILING FAN NEW	CEILING FAN OLD	EXHAUST FAN
Watts(W)	36	40	15	36	60	90	60
Total Nos.	16	257	15	52	107	56	28
Total KW	0.576	10.28	0.225	1.87	6.42	5.04	1.68
Net total Kw	26.091						

5. Lux Measurements

According to BEE there is a lighting code to determine the overall energy efficiency of lighting system using measurements and methods which is applicable to all commercial buildings. One of the methods is Illuminance method which is the most practicable one.

LOCATION	MEASURED	REQUIRED	REMARKS
VC Office Waiting Room	164	150	Good
VC Chamber	201	150	Good
Finance Manager	198	150	Good
Deputy Registrar	166	150	Good
RP Das Office	171	150	Good
Registrar Office	163	150	Good
Registrar Chamber	184	150	Good
Pareeksha Bhawan	192	150	Good
Computer Room First Floor	187	150	Good
UGC Grant Sell	174	150	Good
Confidential Room	155	150	Good
Deputy Registrar Confidential	159	150	Good
Manohar Dathey	162	150	Good
Computer Room	159	150	Good

Note:

- The entire measurement taken during the day time.
- Standard lux is based on the ECBC user guide.

6. Computer & Its Accessories:

DETAILS	WATTS	TOTAL NO	TOTAL KW
LCD Computer	200	75	15
CRT Computer	250	3	0.75
Scanner	200	7	1.4
Xerox	350	10	3.5
Laser	200	32	6.4
3 In One Printer	300	15	4.5
Total kW			31.55

7. Air conditioning:

The department have installed a total of 27 Split AC in the AD Block and their efficiency calculations are given below in table.

LOCATION	TYPE	COOLING CAPACITY (TR)	MEASURED COOLING CAPACITY KW	RATED POWER ELECTRIC AL (Kw)	RATED EER	MEASURE D EER
VC Office	Split	1.5	4.23	1.8	2.92	2.35
VC Office	Split	1.5	4.35	1.8	2.92	2.42
VC Office Waiting Room	Split	1.5	4.78	1.55	3.4	3.09
VC Office Waiting Room	Split	1.5	4.82	1.55	3.4	3.11
VC Chamber	Split	1.5	4.86	1.55	3.4	3.14
VC Chamber	Split	1.5	4.82	1.55	3.4	3.11
VC Chamber	Split	1.5	4.88	1.55	3.4	3.15
Registrar Office	Split	1.5	4.77	1.55	3.4	3.08
Registrar Chamber	Split	1.5	3.99	1.8	2.92	2.22
	Split	1.5	3.94	1.8	2.92	2.19
RP Das Office	Split	1.5	4.01	1.8	2.92	2.23
	Split	1.5	4.12	1.8	2.92	2.29
Deputy Registrar	Split	1.5	5.49	1.695	3.4	3.24
Server Room	Split	1.5	5.54	1.695	3.4	3.27
Finance Manager	Split	1.5	5.53	1.74	3.4	3.18
Pareeksha Bhawan	Split	2	6.14	2.55	2.67	2.41

Computer Room First Floor	Window	1.5	NOT WORKING			
	Split	1.5	4.46	1.55	3.4	2.88
UGC Grant Sell	Split	1.5	5.00	1.55	3.4	3.23
Confidential Room	Split	2	6.17	2.55	2.69	2.42
	Split	2	6.40	2.55	2.69	2.51
Manohar Dathey Room	Split	1.5	5.97	2.4	2.69	2.49
Computer Room	Split	1.5	5.88	2.4	2.69	2.45
Strong Room	Split	1.5	5.71	1.55	3.83	3.69
Strong Room	Split	1.5	4.97	1.55	3.4	3.21
Deputy Registrar Confidential	Spkit	1.5	5.78	2.4	2.69	2.41
Deputy Registrar Confidential	Window	Connection problem				

8. WATER CONSUMPTION:

The AD block consumes water for various purposes like

- Drinking.
- Toilets
- Cleaning

Note:

- Water consumption is not monitored.
- Two stage flushing control may be used in toilets for reducing water wastage.

9. EFFICIENCY ANALYSIS:

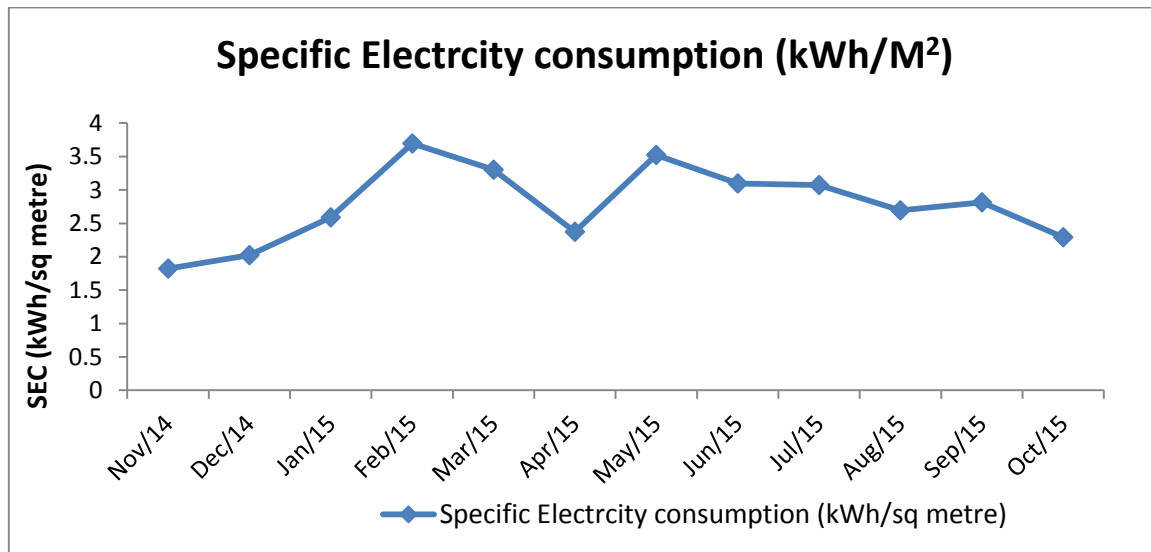
Specific electricity consumption:

Specific electricity is calculated based on electricity consumed per building area in square meters. The details of specific electricity consumption for last few months are given below in table.

MONTH 2014-15	ELECTRICIY CONSUMPTION KSEB (kWh)	Area of the building (M ²)	SPECIFIC ELECTRICITY CONSUMPTION (kWh/M ²)
Nov-14	7142	3916.35	1.82
Dec-14	7927	3916.35	2.02

Jan-15	10133	3916.35	2.59
Feb-15	14470	3916.35	3.69
Mar-15	12938	3916.35	3.30
Apr-15	9302	3916.35	2.38
May-15	13805	3916.35	3.52
Jun-15	12121	3916.35	3.09
Jul-15	12042	3916.35	3.07
Aug-15	10554	3916.35	2.69
Sep-15	11019	3916.35	2.81
Oct-15	8968	3916.35	2.29

The energy performance index is plotted in the below chart.



Chart

Note:

- Specific electricity consumption found to be varying in all those months.
- Maximum SEC measured in the Feb-2015 and is 3.69 kWh/m².
- SEC is highly depended on the seasonal changes and the number of working days in a month. Variations are also possible in specific electricity consumption due to energy usage variation in different seasons of the year.

B. VICE CHANCELLORS BUNGALOW POWER METER

Building : VICE CHANCELLORS BUNGALOW
Consumer No : 1000143833
Service No : 403290

1. Electrical Bill Analysis:

Base line data given below is based on the Electricity bill provided by the supplier of electricity CSPDCL. Details obtained from the Electricity bill is as follows.

Base Line Data (based on last 12 months)		
1	Electricity provider	CSPDCL
2	Tariff	LV1DL1GN14
3	Connected load (kW)	2.25
4	Average monthly energy consumption (kWh)	670.16
5	Monthly total electricity cost (avg. In Rs)	4033.63
6	Average power factor	-

Observations:

- PF is not included in the bill.

2. Electrical Load analysis:

- Load was very low to measure in our metre.

C. VICE CHANCELLORS BUNGALOW LIGHT METER:

Building : VICE CHANCELLORS BUNGALOW
Consumer No : 1000145444
Service No : 406098

1. Electrical Bill Analysis:

Base line data given below is based on the Electricity bill provided by the supplier of electricity CSPDCL. Details obtained from the Electricity bill is as follows.

Base Line Data (based on last 12 months)		
1	Electricity Provider	CSPDCL
2	Tariff	LV2ND1OT14
3	Connected Load (Kw)	2.518
4	Average Monthly Energy Consumption (Kwh)	1031.6
5	Monthly Total Electricity Cost (Avg. In Rs)	5882
6	Average Power Factor	-

Observations:

- PF is not included in the bill

2. Electrical Load analysis:

Department	-	VC BUNGALOW light meter		
Consumer / meter No	-	406098		
Date & time of measurement		30/11/2015 12:16		
Actual Energy	kWh	0.20		
Apparent Energy	kVAh	0.35		
Power factor	-	0.57		
Particulars	Units	Minimum	Maximum	Average
Active power	kW	1.49	1.68	1.60
Apparent power	kVA	2.71	2.85	3.06
Voltage (VL)	Volts	246.8	259.76	252.5
Current	Amps	.65	5.45	2.65
THD voltage	%	1.58	2.10	1.83

Standards:

- Permissible voltage limit as per CEA standards on grid connectivity is 230 plus or minus 10%, which means 254V is the maximum allowable.

Observations:

- At present maximum voltage exceeded the permissible limit which should be taken care of by reporting it to the supplier.
- Increase in the voltage increases the consumption of electricity and also the failure frequency of the equipment.

3. LIGHT & FAN LOAD CONSUMPTION PATTERN

Details	T12	CFL	SVL	CEILING FAN NEW	CEILING FAN OLD	EXHAUST FAN
Watts(W)	40	15	150	60	90	60
Total Nos.	42	-	3	4	10	3
Total kW	1.68	-	0.45	0.24	0.9	0.18
Net total kW	3.45					

Observations & suggestions:

- All the old ceiling fans and their resistance type regulators may be replaced by energy efficient fans.

4. Lux Measurements

According to BEE there is a lighting code to determine the overall energy efficiency of lighting system using measurements and methods which is applicable to all commercial buildings. One of the methods is Illuminance method which is the most practicable one.

LOCATION	MEASURED	REQUIRED	REMARKS
Drawing room	198	150	Good
Dining room	289	150	Good
Average lux at entrance	346	150	Good

Note:

- The entire measurement taken during the day time.
- Standard lux is based on the ECBC user guide.

5. Computer & Its Accessories:

DETAILS	WATTS	TOTAL NO	TOTAL KW
LCD computer	200	3	0.6
Laser	200	1	0.2
Total kW			0.8

6. WATER CONSUMPTION:

The building consumes water for various purposes like

- Drinking.
- Cooking.
- Toilet flushing's
- Cleaning

Note:

- Water consumption is not monitored.
- Two stage flushing control may be used in toilets for reducing water wastage.

7. EFFICIENCY ANALYSIS:

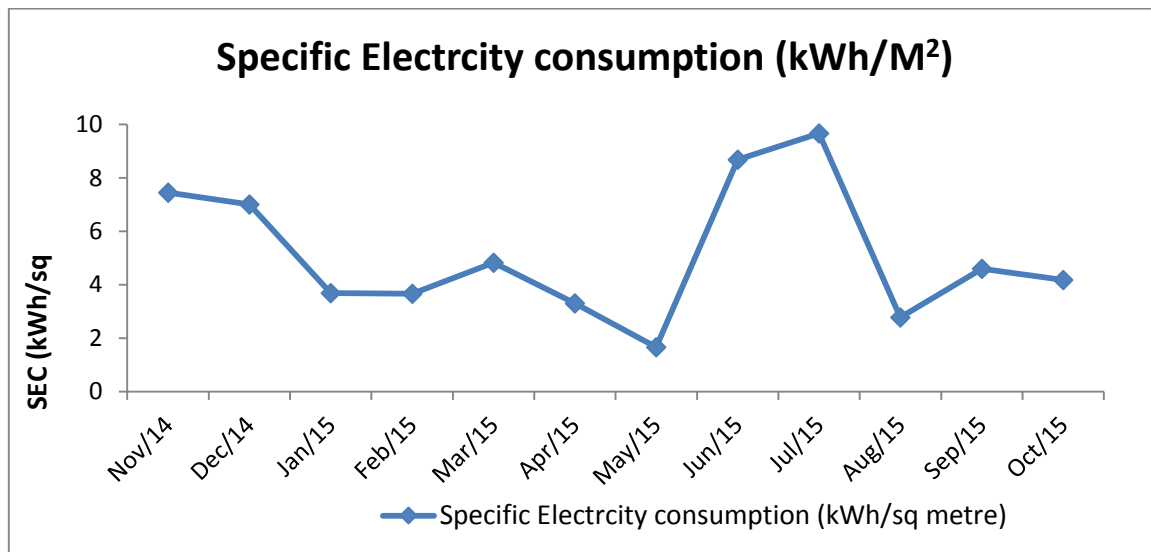
Specific electricity consumption:

Specific electricity is calculated based on electricity consumed per building area in square meters. The details of specific electricity consumption for last few months are given below in table.

MONTH 2014-15	ELECTRICITY CONSUMPTION KSEB (kWh)	Area of the building (M ²)	SPECIFIC ELECTRICITY CONSUMPTION (kWh/M ²)
Nov-14	3504	470.13	7.45
Dec-14	3300	470.13	7.01

Jan-15	1738	470.13	3.69
Feb-15	1721	470.13	3.66
Mar-15	2269	470.13	4.82
Apr-15	1556	470.13	3.30
May-15	785	470.13	1.66
Jun-15	4083	470.13	8.68
Jul-15	4543	470.13	9.66
Aug-15	1311	470.13	2.78
Sep-15	2163	470.13	4.60
Oct-15	1967	470.13	4.18

The energy performance index is plotted in the below chart.



Chart

Note:

- Specific electricity consumption found to be varying in all those months.
- Maximum SEC measured in the Jul-2015 and is 9.66 kWh/m².
- SEC is highly depended on the seasonal changes and the number of working days in a month. Variations are also possible in specific electricity consumption due to energy usage variation in different seasons of the year.

D. VICE CHANCELLORS BUNGALOW STREET LIGHT:

Consumer No : 1000143742
Service No : 402168

1. Electrical Bill Analysis:

Base line data given below is based on the Electricity bill provided by the supplier of electricity CSPDCL. Details obtained from the Electricity bill is as follows.

Base Line Data (based on last 12 months)		
1	Electricity Provider	CSPDCL
2	Tariff	LV2ND1OT14
3	Connected Load (kW)	0.36
4	Average Monthly Energy Consumption kWh)	317.83
5	Monthly Total Electricity Cost (Avg. In Rs)	2573
6	Average Power Factor	-

Observations:

- **PF is not included in the bill.**

2. Electrical Load analysis:

- **Load was very low and found to be insignificant to measure.**

E. VICE CHANCELLORS BUNGALOW PUMP HOUSE:

Consumer No : 1000145451
Service No : 406127

1. Electrical Bill Analysis:

Base line data given below is based on the Electricity bill provided by the supplier of electricity CSPDCL. Details obtained from the Electricity bill is as follows.

Base Line Data (based on last 12 months)		
1	Electricity Provider	CSPDCL
2	Tariff	LV2ND1OT14
3	Connected Load (kW)	2.238
4	Average monthly energy consumption (kWh)	943.63
5	Monthly Total Electricity Cost (Avg. In Rs)	42179
6	Average Power Factor	-

Observations:

- **PF is not included in the bill.**

2. Electrical Load analysis:

Department	-	VC pump house		
Consumer / meter No	-	406127		
Date & time of measurement		30/11/2015 11:08		
Actual Energy	kWh	1.25		
Apparent Energy	kVAh	1.50		
Power factor	-	0.83		
Particulars	Units	Minimum	Maximum	Average
Active power	kW	0	3.62	3.55
Apparent power	kVA	0	4.36	4.27
Voltage (VL)	Volts	0	245.2	238.5
Current	Amps	0	8.25	7.1

F. REGISTRARS BUNGALOW:

Consumer No : 1001992610
Service No : 775464

1. Electrical Bill Analysis:

Base line data given below is based on the Electricity bill provided by the supplier of electricity CSPDCL. Details obtained from the Electricity bill is as follows.

Base Line Data (based on last 12 months)		
1	Electricity provider	CSPDCL
2	Tariff	--
3	Connected load (kW)	---
6	Average monthly energy consumption (kWh)	570.63
7	Monthly total electricity cost (avg. In Rs)	2983.63
9	Average power factor	---

Observations:

- PF is not present in the bill.

2. Electrical Load analysis:

- Load was very low and found to be insignificant to measure.

3. LIGHT & FAN LOAD CONSUMPTION PATTERN

Details	T12	SVL	BULB	CEILING FAN NEW	CEILING FAN OLD	EXHAUST FAN
Watts(W)	40	150	40	60	90	60
Total Nos.	8	1	2	8	-	1
Total kW	0.32	0.15	0.08	0.48	-	0.06
Net total kW	1.09					

Observations & suggestions:

- All the T12 fluorescent tube lights and CFLs may be replaced with LED tubes and LED bulbs.
- All the old ceiling fans and their resistance type regulators may be replaced by energy efficient fans.

4. Lux Measurements

According to BEE there is a lighting code to determine the overall energy efficiency of lighting system using measurements and methods which is applicable to all commercial buildings. One of the methods is Illuminance method which is the most practicable one.

LOCATION	MEASURED LUX	REQUIRED LUX	REMARKS
Average lux in rooms	169	150	Good
Dining room	224	150	Good
Kitchen	177	150	Good

Notes:

- The entire measurement taken during the day time.
- Standard lux is based on the ECBC user guide.

5. WATER CONSUMPTION:

The Bungalow consumes water for various purposes like

- Drinking.
- Toilet flushing's
- Cooking
- Cleaning

Note:

- Water consumption is not monitored.

- Two stage flushing control may be used in toilets for reducing water wastage.

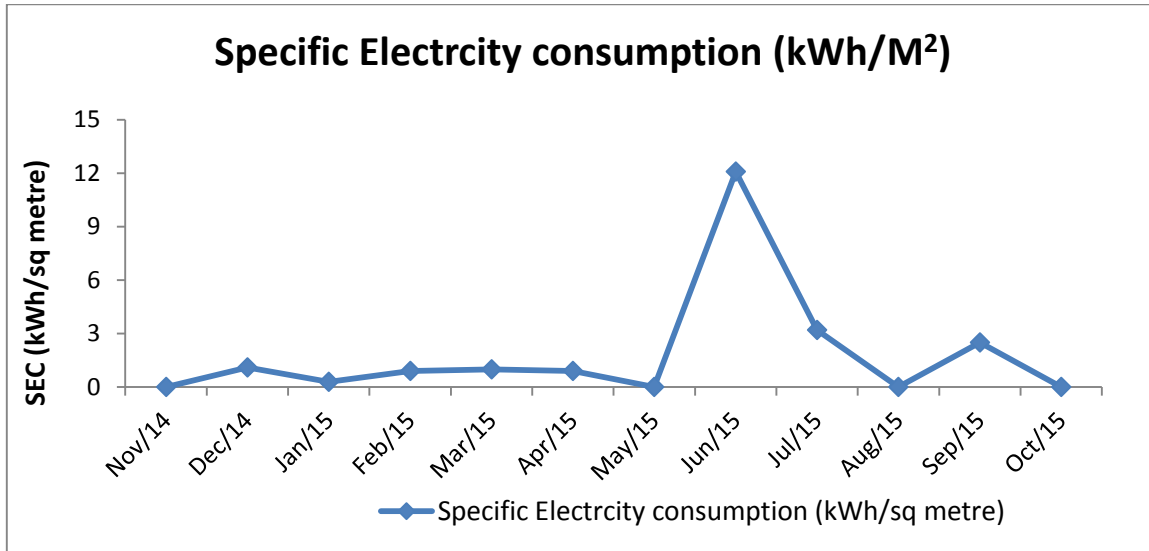
6. EFFICIENCY ANALYSIS:

Specific electricity consumption:

Specific electricity is calculated based on electricity consumed per building area in square meters. The details of specific electricity consumption for last few months are given below in table.

MONT H 2014- 15	ELECTRICIY CONSUMPTION KSEB (kWh)	Area of the building (M²)	SPECIFIC ELECTRICITY CONSUMPTION (kWh/M²)
Nov-14	0	285.51	0.0
Dec-14	310	285.51	1.1
Jan-15	90	285.51	0.3
Feb-15	250	285.51	0.9
Mar-15	290	285.51	1.0
Apr-15	260	285.51	0.9
May-15	0	285.51	0.0
Jun-15	3453	285.51	12.1
Jul-15	900	285.51	3.2
Aug-15	0	285.51	0.0
Sep-15	724	285.51	2.5
Oct-15	-	285.51	-

The energy performance index is plotted in the below chart.



Chart

Note:

- Specific electricity consumption found to be varying in all those months.
- Maximum SEC measured in the Jun-2015 and is 12.1 kWh/m².
- SEC is highly depended on the seasonal changes and the number of working days in a month. Variations are also possible in specific electricity consumption due to energy usage variation in different seasons of the year.

G. H TYPE PUMP:

Consumer No : 1000297290
Service No : 406188
Motor rated power : 5 HP

1. Electrical Bill Analysis:

Base line data given below is based on the Electricity bill provided by the supplier of electricity CSPDCL. Details obtained from the Electricity bill is as follows.

Base Line Data (based on last 12 months)		
1	Electricity Provider	CSPDCL
2	Tariff	LV2ND3OT14
3	Connected Load (kW)	3.62
4	Average Monthly Energy Consumption (kWh)	---
5	Monthly Total Electricity Cost (Avg. In Rs)	----
6	Average Power Factor	

Observations:

- PF is not present in the bill

2. Electrical Load analysis:

Department	-	H type pump		
Consumer / meter No	-	406188		
Date & time of measurement		30/11/2015 10:50		
Actual Energy	kWh	0.22		
Apparent Energy	kVAh	0.38		
Power factor	-	0.57		
Particulars	Units	Minimum	Maximum	Average
Active power	kW	2.99	3.68	3.36
Apparent power	kVA	5.60	5.88	5.74
Voltage (VL)	Volts	13.98	220.84	159.78
Current	Amps	9.81	11.47	10.70
THD voltage	%	2.29	5.94	3.08
THD current	%	4.18	4.60	4.43

6.0 DIESEL GENERATOR ANALYSIS:

Diesel generator is provided as standby power in most of the departments. Diesel generator efficiency is calculated from the rated values and the details are given below in table:

Sl no	Location	Capacity	Make	Date of Manufacture	Measured Load	% of loading	AMF condition	Rated SEGR	Actual SEGR	Remarks
		kVA			kVA	%				
1	Library	125	Kirloskar	2012	23.2	18.56	Not working	1.14	2.1	Poor
2	Electronics & Photonics	63	Kirloskar	2012	12.3	19.52	Not working	1.14	2.01	Poor
3	Physics & chemistry	125	Kirloskar	2012	30.79	24.63	Not working	1.5	1.85	Poor
4	MBA									
5	Computer science	125	Kirloskar	2012	17.41	13.93	Not working	1.14	1.95	Poor
6	Pharmacy	125	Kirloskar		27.29	21.83	Not provided	1.14	1.96	Poor
7	Statistics & mathematics	63	Kirloskar	2012	7.86	12.48	Working well	1.14	1.56	Poor
8	Geology	63	Kirloskar	2012	5.29	8.40	Working well	0.3	1.65	Poor
9	Life sciences	125	Kirloskar	2012	20.83	16.66	Not working	1.14	1.88	Poor
10	Administrative block	125	Kirloskar	2014	36.4	29.12	Not working	1.86	1.96	Satisfactory

Observations:

- **Most of the DG are under loaded during the period of audit.**
- DG maintenance records are not available at the respective departments.
- Diesel consumption is also not monitored by any of the departments.
- Only the AD block DG are having the SEGR (Specific energy generation ratio) in satisfactory.
- Diesel spillage found out near the location in most of the areas. Take almost care when handling the Diesel or during the filling time.
- Also most of the DG found to running even after the CSPDCL supply reinstated. (Example in Library). This is mainly due to the failure in operation of AMF (Auto mains failure).
- Manual operation of DG found out to be in most of the departments.

Suggestions:

- DG should be loaded for at least 50% during the working period. Even if loaded below 50% of the rated power, the DG consumed same diesel as of 50% loading.
- DG maintenance records should be properly maintained.
- Diesel consumption in litres should be monitored. Cost of the Diesel at the period also to be mention in the records.
- Use precautionary measures such as use of funnel, while filling the Diesel into it to avoid the spillage losses.
- All the AMF should be repaired and reinstate for the proper usage of DG. In some AMF panels, contactor problems are also found out (E.g. in library) which can be repaired easily.
- Always operate the DG in unload condition whether we are operating in manual.

7.0 PUMP LOADS AT VARIOUS LOCATIONS:

SI no	Location	Metre no	Pumping area	Rate d kW	No of working hours/day
1	LH pump	406187	Ladies hostel	5.62	6
2	Azad hostel pump	Azad hostel meter	Boys hostels	3.75	6
3	Pump room	406131	Girls hostel-1, Geography, Registrar bungalow, Guest house	3.75	6
4	Computer science	computer science server room metre	computer science, HRDC	3.75	2
5	Pharmacy	Pharmacy metre	Pharmacy,	3.75	2
6	Physical education	PE metre	Physical education	3.75	2
7	Regional studies & research	Regional studies metre	Regional studies	1.5	
8	Life science pump room	406203	Life science	2.2	4
9	Near library	406126	Library, Arts bhavan, Engineering dept,	3.75	12
10	Auditorium	Auditorium metre	Auditorium, garden,		
11	Administrative block	AD block metre	AD block,	3.75	6
12	Near quarters	406188	Quarters	3.75	6
13	VC bungalow pump	406127	VC bungalow	3.75	6

- Always keep a spare pump in your premises.
- Replace all the pumps which had more than 3 rewinding in their life period, with new one.
- Rated discharge and Rated head was not available neither at the pump location nor at the department.
- **There is no provision provided for the measurement of discharge head thus we couldn't measure the efficiency of the pump, as the discharge head is an important parameter to measure the hydraulic power of pump, which itself is the output power.**
- Efficiency also couldn't measure due to the high scaling in the pump

8.0 Power Quality in the University

Following Observations are made by auditors during the audit

- 90% of actual measurements shows heavy current unbalances in the electric distribution system
- Voltage level of some of the connections are higher than the specified limit which is indicated in the EC proposals
- Current harmonics levels are found high in the system
- Power factor found as low in most of the area especially hostels, SOS areas.

Recommendations

- Detailed study and urgent preparing of single line diagram of electrical distribution system. This will give clear cut indication about distribution of loads among each phase.
- Purchase the equipment's like UPS, Lighting, and Luminaries etc. as per IEEE 519 standards for harmonics. Thus we can ensure the harmonic level in the whole system within the limits.
- Separate earthing for each UPS, computer system, LED lights, air conditioner is as per earthing standards to be provided at the earliest.

Standards to follow:

- IEE standard for Harmonic limits are given in below table:

Sl. No.	Description	Allowable Limit (%)
1	Individual Voltage Harmonic Distortion (Max.)	3.0
2	Total Voltage Harmonic Distortion (Max.)	5.0
3	Total Current Harmonic Distortion (TDD) (MAX)	8.0

- The above Limits for Harmonic Distortions are specified by CEA Technical standards for connectivity of the Distribution resources regulations-2010, based on IEC 610000 – 4 – 30 & IEEE 519-1992.
- Earthing standards as per IS3043 /1987 should follow for the earthing

9.0 THERMAL STUDY OF PANELS:

Thermal study has been conducted in every panel in each department to analyse the insulation failure in cables and it's overheat. Most of the cables are found to be unbalanced state due to the variation in current in each phase. Due to this unbalance condition the respective neutral cables having higher current and the some of the cables are very critical in condition. Follows the thermal images of various DBs in the **Annexure-5**(Separately attached).

10.0 ENERGY CONSERVATION OPTIONS AND RECOMMENDATIONS:-

Sl.No	PARTICULARS	ANNUAL ENERGY SAVINGS(kWh)	ANNUAL FINANCIAL SAVINGS (Rs)	INVESTMENT (Rs)	SIMPLE PAY BACK PERIOD(M onths)
1	Replacing 400 Nos.T12(40 W) Fluorescent Lamps (fitted with Copper Chokes) with electronic choke and T-8 Tubes	14400	1,15,200	62500	07
2	Replacing 500 Nos.T12(40 W) Fluorescent Lamps (fitted with Electronic Chokes) with 28 W T-5 Fitting:	11520	92160	85000	13
3	Replacing 250 Nos.T12(40 W) Fluorescent Lamps with LED Lights	24000	1,92,000	3,00,000	19
4	Replacing 300 Nos. Of Ordinary resistance type regulators with electronic regulators	7200	57600	1,00,000	20
5	Replacement of existing 300 ceiling fans with BLDC fans	54000	432000	9,00,000	25
6	Replacement of old 1.5TR window a/c with 5 star Split A/c	60480	483840	12,60,000	32
7	Replacement of existing CRT computer screens with LCD screen	7500	60,000	2,50,000	50

11.0 ENERGY SAVING PROPOSALS

ENERGY SAVING PROPOSAL No: 1

Replacing 500 Nos.T12 (40 W) Fluorescent Lamps (fitted with Electronic Chokes) with 28 W T-5 Fitting:

The replacement of T-12 to T-5 to be done in a phase manner .We is calculated only for phase -01. In this replacement importance should be given to according to duration and importance of position. First phase of replacement to be given hostels, and class room in the arts block

Replacement of existing FTL with T-5 will give the following benefits

- State of art aesthetics
- Reduced power consumption
- Lesser space requirement
- Futuristic lighting system

Existing Tube Type	=	40W with Copper Ballast
Power Rating of 40 W Copper Ballast	=	52W
Total Numbers selected	=	500Nos
Working hours per day	=	8
Annual working days	=	300
Annual working Hours	=	2400
Energy consumption of T-5 tubes with Electronic ballast	=	28Wh
Annual Energy Savings with this Conversion	=	11520 kWh
Tariff rate	=	Rs.8
Annual Financial Savings	=	Rs .92160
Investment for T-5 Tubes	=	Rs: 85000
Simple Payback period	=	12Months

ENERGY SAVING PROPOSAL No: 2

Replacement of existing ceiling fans with BLDC fans :

Existing Condition

Presently old conventional ceiling fan are used in the building .After few years of service this will becomes an energy eaters

Proposed condition with ESP

We can replace these old ceiling fans with BLDC Fans. We can control the speed by remote also. The replacement of the old ceiling fans to be done I a phase manner. For first phase gave importance in the HOD rooms, hostels, and administrative building

Preferable locations:

Administrative building, Vice chancellors Bungalow. Institute of management, SOS Physics and Chemistry,

Particulars	Ceiling fan (Old)
Institute of Management	81
SOS Physics and Chemistry	99
Administrative building First Floor	59
Administrative building second Floor	56
VC bungalow	05
Registrars bungalow	
Total Nos	300

Rated power of existing ceiling fans	=	90w
Rated power of BLDC fans	=	30w
Power saving by replacement	=	60w
Number of ceiling fans	=	300
Annual hours of operation	=	3000
Tariff rate	=	Rs.8.00
Annual energy savings	=	54000 kWh
Annual financial savings	=	Rs.432000
Approximate rate per fan	=	Rs.3000
Investment	=	Rs.900000
Simple payback period	=	25Months

Note:

- No salvage value is taken for the replaced fans.

Merits:

- A brushless DC (BLDC) motor is a synchronous electric Motor powered by direct-current (DC) electricity and having an electronic commutation system, rather than a mechanical commutator and brushes. In BLDC motors, current to torque and voltage to rpm are linear relationships. BLDC Motors use the DC voltage as input which is converted using the Pulse Width Modulation Techniques to control the excitation of the coils to generate the motion in prescribed fashion.
- The power consumption is less than half at full speed and is about 20% at low speed for the BLDC motor compared to the conventional motor based ceiling fan

ENERGY SAVING PROPOSAL No: 3

Replacement of Window air conditioners with Split type in 1.5 TR 4 star rated Air conditioners Star rating system chart.

Presently air conditioners are selected according to the star rating of air conditioners And it is on the base of EER (Energy Efficiency ratio) means cooling capacity in Watts divided by power consumption in watts

Cooling capacity of 1 TR = 3514watts

Star 1- 2.7 to 2.89, Star 2=2.9 to 3.09. , Star 3= 3.1 to 3.29, Star 4= 3.3 to 3.49, Star 5=3.5 and above are the EER ratios as approved by BEE for standard labelling

Power consumption variation according to the star rating given below

AC Tonnage(TR)	Cooling capacity(Watts)	Power consumption(Watts)				
		Star 1	Star 2	Star 3	Star 4	Star 5
0.75	2635.5	976 to 912	909 to 853	850 to 801	799 to 755	753
1	3514	1301 to 1216	1212 to 1137	1134 to 1068	1065 to 1007	1004
1.5	5271	1952 to 1824	1818 to 1706	1700 to 1602	1597 to 1510	1506
2	7028	2603 to 2432	2423 to 2274	2267 to 2136	2130 to 2014	2008
2.5	8785	3254 to 3040	3029 to 2843	2834 to 2670	2662 to 2517	2510
3	10542	3904 to 3648	3635 to 3412	3401 to 3204	3195 to 3021	3012

Here we are to be changed the air conditioners according to their working hours.

Preferable Locations

Guest House,-SOS IN Physics and Chemistry, SOS in Science, SOS in pharmacy, SOS in Statistics and mathematics, Health Centre, Administrative building

All the window air conditioners are to be changed into star rated air conditioners and before installation following calculations and rectifications to be done in the rooms

Rated power of existing window air conditioner	=	2200w
Rated power of 4 star rated air conditioner	=	1500w
Power saving by replacement	=	700w
Number of window air conditioners	=	36
Tariff rate	=	Rs.8
Annual running hours	=	2400
Annual energy savings	=	60480 kWh
Annual financial savings	=	Rs.483840
Approximate rate per 4 Star rated air conditioner 1.5 TR	=	Rs.35000
Investment	=	Rs.1260000
Simple payback period	=	32Months

ENERGY SAVING PROPOSAL No: 4

Replacement of existing CRT computer screens with LCD screen

There is total of 142 CRT computers in the university which is to be replaced with LCD computers in a phased manner. First replace the computers in the maximum usage areas, like in the administrative building etc.

Rated power of existing CRT computers	=	250w
Rated power of LCD computers	=	200w
Power saving by replacement	=	50w
Number of CRT computers	=	50
Tariff rate	=	Rs.8.00
Annual running hours	=	3000
Annual energy savings	=	7500 kWh
Annual financial savings	=	Rs.60,000
Approximate rate per computers	=	Rs.5000
Investment	=	Rs.250000
Simple payback period	=	50Months

ENERGY SAVING PROPOSAL No: 5

Replacing 500 Nos.T12 (40 W) Fluorescent Lamps (fitted with Copper Chokes) with electronic choke and T-8 Tubes

Existing Tube Type	=	40W with Copper Ballast
Power Rating of 40 W Copper Ballast	=	52W
Power Rating of T-8 with electronic ballast	=	40w
Energy saving per tube	=	12W
Total Numbers selected	=	500Nos
Working hours per day	=	8
Annual working days	=	300
Annual working Hours	=	2400
Annual Energy Savings with this Conversion	=	14400 kWh
Tariff rate	=	Rs.8.00
Annual Financial Savings	=	Rs 1, 15,200.
Investment for T-8 with Electronic chock	=	Rs: 62500
Simple Payback period	=	07Months

ENERGY SAVING PROPOSAL No: 6

Replacing 300 nos. of ordinary resistance type regulators with electronic regulator

Particulars	Ceiling fan resistance regulators
Guest house	36
Gandhi hostel	56
PG girls hostel	66
Teachers hostel	25
Azad hostel	48
Research Hostel for Girls	26
Professional girls hostel	39
Research boys hostel	4
Total	300

Existing regulator Type	=	Resistance type 12 W
Power Rating of electronic regulator	=	02W
Energy saving per regulator	=	10W
Total Numbers selected	=	300Nos
Working hours per day	=	8
Annual working days	=	300
Annual working Hours	=	2400
Annual Energy Savings with this Conversion	=	7200 kWh
Tariff rate	=	Rs.8.00
Annual Financial Savings	=	Rs 57600.
Investment for electronic regulator	=	Rs: 1,00,000
Simple Payback period	=	20Months

ENERGY SAVING PROPOSAL No: 7

Replacing 250 Nos.T12 (40 W) Fluorescent Lamps with LED Lights

Replace the T-12 tube lights into LED lights in type administrative building. Vice chancellors, registrars room, and all Head of the departments room .and common areas. This will create awareness among students and public. Public relation, and other guests and VIP are visiting mainly in these areas, hence opt for LED lights, BLDC fans and star rated air conditioners are in these areas.

Rated power of existing Tube lights (T-12)	=	52w
Rated power of LED tube lights	=	12w
Power saving by replacement	=	40w
Number of led LIGHTS	=	250
Tariff rate	=	Rs.08
Annual running hours	=	2400
Annual energy savings	=	24000 kWh
Annual financial savings	=	Rs.192000
Approximate rate per computers	=	Rs.1200
Investment	=	Rs.3, 00,000
Simple payback period	=	19Months

ANNEXURE-A

POTENTIAL SAVING RECOMMENDATIONS:

Distribution of power

	Potential area for energy savings and safety issues	Identified issue	Recommendations	
8	No isolation switches for building or rooms	Short circuit and for energy saving by single isolation	MCB/ELCB or master switch for isolation for electric supply.	Details are given in annexure -2
9	Selection of cables	Due to harmonics and unbalance current neutral wire can burn	Avoid unbalance and provide 4 core wiring	
10	Over voltage in transformers	Over voltage increase energy consumption and safety and maintenance issues for luminaries and equipment's	Taken up issue with CSPDCL for lowering the tap setting in the corresponding transformer	Details are given in annexure-2
11	Connected loads	Connected Load is more than sanctioned Load which will invite penalty from CDPDCL	Increase the connected load from CSPDCL and change it is in the next bills	
12	Low Power factor	Power factor found as lower than 0.85 invite penalty from CSPDCL	Increase the power factor by installing LV capacitors with loads.	
13	Cable joint and termination burning	For safety cable termination and fuses are found red hot	Proper crimping and terminal joints and fuse proper fuses instead of wires as fuses.	Refer the Annexure2 and Thermal image Photos

Lighting

	Potential area for energy savings and safety issues	Identified issue	Recommendations
14	Street Light, garden lights	Operated by security persons	Provision for timers for operation
15	Common lights in toilets , corridor steps	Found as burn in normal time	Energy volunteers to be formed among students and responsibility , stickers and posters in the lighting switch boards, change these lights as in first phase of changing
16	For New buildings under construction	T-12 tubes are using	Change into LED tubes and Luminaries order to be issued
17	Cleaning of luminaries	Most of the tubes and Luminaries are dusty	Energy team to be made among students in collaboration with NSS volunteers foe scheduled cleaning

Ceiling Fans

	Potential area for energy savings and safety issues	Identified issue	Recommendations
18	Cleaning	Old fans are not cleaning leads to corrosion in side of blades and improper lubrication of bearings increase power consumption	Energy team to be made among students in collaboration with NSS volunteers for scheduled cleaning,

Air conditioners:

	Potential area for energy savings and safety issues	Identified issue	Recommendations
20	Engineering practice	Lengthy copper tube from compressor to condenser, installation of air conditioner evaporator and condenser locations against its installation manual	Installation of condenser as minimum as possible from the evaporator , minimum gap between top ceiling and top of evaporator should be 1 feet, and for condenser side and back gaps between are to be 1feet for proper circulation of air, avoid the blockage of air in front of condenser fan.
21	Cleaning	Condenser fins and evaporator suction filter are not cleaned	Cleaning schedule to be incorporated, AMC for repairing and cleaning, along with checking of power consumption periodically and record the same.
22	Ingress of heat into the room	The windows are plane glass and the gaps are found between doors and old windows are properly loosing	The old metal frame of windows are to be changed, proper ceiling on doors and windows, Cool film installation on windows
23	Set temperature	Set temperature are found as in 16 to 20 °C in many areas	Set temperature to be changed into 23°C to 26°C as per ASHRAE standard for HVAC

Diesel generators:

SL No	Potential area for energy savings and safety issues	Identified issue	Recommendations
25	AMF installed in many DG sets	AMF is not working and CSPDCL supply restored DG will work continuously without knowing about the same.	AMF to be repaired with Supplier, Indication with lights and alarm against failure and restoration of CSPDCL supply.
26	Log book	No log book is maintained regarding type diesel consumption, running hours, energy generation and for maintenance check-ups and issues	Log book to be maintained and thus it became health card of the DG.

PUMPS

SL no	Potential area for energy savings and safety issues	Identified issue	Recommendations
27	No record of re wined motors and repaired pumps	Most of the pumps bore well pumps , and motors are rewinded many times.	Monitoring of repairing will be required for alternate pumping solutions, and record for reason for replacement
28	Peak time running	Peak time charges are more and we observed pumps are running during peak hours,	Peak time pumping to be shifted and pumping should be at off peak time ,
29	Capacitors in pumping installations	LV Capacitors installed in pumps are not working	Change the LV capacitors for better operation and improving power factor.

DISTRIBUTION OF POWER:

ENERGY SAVING PROPOSAL No: 8

Provide Isolation Switches/ MCB/ELCB Present system

At present in most of the departments and buildings do not have isolation switches. When an accident or short circuit occurs isolation of power supply or tripping of power supply is not possible.

Proposed System

Circuit breakers shall preferably be air break horizontal type fully interlocked and meeting the requirements of IS: 2516 or BS: 3659. Breakers shall be rated for a medium voltage of 600 V and rated full load amperes as indicated on drawings. Breakers shall be capable of making and breaking system short circuits. Breakers shall be manually operated complete with panel operating handle, isolating plug with safety shutters, mechanical ON/OFF indicator, silver plated arcing and main contact arc chutes and trip free operation. Breakers shall be capable of being racked out into 'Testing', 'Isolated' and 'Maintenance' positions and kept locked in any of the positions.

Merits of the system

- Energy savings by avoid cable losses after Isolation switches
- Avoid safety hazard by short circuit during non-working hours.
- Safe operation and maintenance working of system made easy

Preferable locations and sizing

SL NO	PARTICULARS	Service No/Consumer no	Full load Ampere rating (A)	MCB or MCCB RATING			RCCB
				Ampere rating (In)	Short circuit breaking capacity (kA)	Type	
1	Guest house	405439	90.19	100	10.00	B	Class AC - 30 mA rating
2	Gandhi hostel	403267	17.32	20	10.00	B	Class AC - 30 mA rating
3	PG girls hostel	403268	22.05	25	10.00	B	Class AC - 30 mA rating
4	Teachers hostel	403288	8.85	10	10.00	B	Class AC - 30 mA rating
5	Azad hostel	404408	16.56	20	10.00	B	Class AC - 30 mA rating
6	Research Hostel for Girls	771284	12.75	16	10.00	B	Class AC - 30 mA rating

7	Professional girls hostel	774229	13.30	16	10.00	B	Class AC - 30 mA rating
8	Research boys hostel	606167	7.55	10	10.00	B	Class AC - 30 mA rating
9	Girls hostel pump house	406131	6.49	10	10.00	C	Class AC - 30 mA rating
10	Street light	1000145454	41.32	50	10.00	B	Class AC - 30 mA rating
11	SOS in electronics and photonics	771282	66.99	80	10.00	B	Class AC - 30 mA rating
12	SOS in computer science and IT	773349	45.93	50	10.00	B	Class AC - 30 mA rating
13	New Computer building	406284	69.56	80	10.00	B	Class AC - 30 mA rating
14	Computer server room	406285	17.39	20	10.00	B	Class AC - 30 mA rating
15	HRDC	1005795195	71.30	80	10.00	B	Class AC - 30 mA rating
16	Institute of Management	773578	89.91	100	10.00	B	Class AC - 30 mA rating
17	National Centre for Natural Resources	1005248369	53.22	63	10.00	B	Class AC - 30 mA rating
18	SOS Physics and Chemistry	404300	121.39	125	10.00	B	Class AC - 30 mA rating
19	SOS Physics and Chemistry	406134	125.04	125	10.00	B	Class AC - 30 mA rating
20	USIC	406148	20.00	20	10.00	D	Class AC - 30 mA rating
21	SOS geology and water resource management	406195	40.21	40	10.00	B	Class AC - 30 mA rating
22	SOS in life Science-1	406147	36.87	40	10.00	B	Class AC - 30 mA rating
23	SOS in life Science-2	404446	32.17	32	10.00	B	Class AC - 30 mA rating

24	Bio science Lab	771215	14.78	16	10.00	C	Class AC - 30 mA rating
25	Tissue culture	406200	28.17	32	10.00	D	Class AC - 30 mA rating
26	SOS in Pharmacy	773533	130.41	160	10.00	B	Class AC - 30 mA rating
27	SOS in statistics & mathematics	774228	43.81	50	10.00	B	Class AC - 30 mA rating
28	University press	403232	14.17	16	10.00	D	Class AC - 30 mA rating
29	SOS in regional study and research:	771283	15.24	20	10.00	B	Class AC - 30 mA rating
30	SOS in Physical education	606210	47.08	50	10.00	C	Class AC - 30 mA rating
31	SOS in Law	405438	29.91	32	10.00	B	Class AC - 30 mA rating
32	Auditorium:	405914	24.29	25	10.00	B	Class AC - 30 mA rating
33	Community hall	406296	13.91	16	10.00	B	Class AC - 30 mA rating
34	Engineering department :	405708	5.84	6	10.00	D	Class AC - 30 mA rating
35	SOS in Geography	606211	65.35	80	10.00	B	Class AC - 30 mA rating
36	Library	402164	113.04	125	10.00	B	Class AC - 30 mA rating
37	Animal house	405706	22.69	25	10.00	B	Class AC - 30 mA rating
38	Pump and block	406185	6.09	10	10.00	C	Class AC - 30 mA rating
39	Botanical garden pump	406203	6.52	10	10.00	C	Class AC - 30 mA rating
40	Pump near library	406126	6.30	10	10.00	C	Class AC - 30 mA rating
41	Arts bhavan ground floor	402163	113.04	125	10.00	B	Class AC - 30 mA rating
42	Arts Dept. In first Floor	406354	55.65	63	10.00	B	Class AC - 30 mA rating
43	Arts bhavan second floor	406355	55.89	63	10.00	B	Class AC - 30 mA rating

44	Health centre	402158	14.35	16	10.00	B	Class AC - 30 mA rating
45	Administrative building	406135	116.95	125	10.00	B	Class AC - 30 mA rating
46	Administrative building	404298	121.65	125	10.00	B	Class AC - 30 mA rating
47	Pareeksha Bhawan	406267	23.56	25	10.00	B	Class AC - 30 mA rating
48	VC chamber	406184	5.87	6	10.00	B	Class AC - 30 mA rating
49	VC bungalow	403290	7.39	10	10.00	B	Class AC - 30 mA rating
50	VC Bungalow Street light	402168	0.70	1	10.00	B	Class AC - 30 mA rating
51	Registrars bungalow	775464	10.87	16	10.00	B	Class AC - 30 mA rating
52	Bio technology	1005623708	116.52	125	10.00	D	Class AC - 30 mA rating

ENERGY SAVING PROPOSAL No: 9

Selection of cables

Present system

The connected load is increased above the sanctioned which is connected earlier is increased, but the cables and other accessories provided are the same, Due to the increase of load the cables and its joints are became chances of failure and short circuiting

Proposed system

The cables are to be changed into higher size according to the connected load +safety factor for future expected additional load, the neutral cable size is also in the same size of the cable All cables shall conform to I.S-692, IS-7098, IS-1554 (Part-I) 1964 and IS 694-1990 or latest. Conductors of all cables except for flexible cables, shall be of aluminium

Merits

- By increase size of cable energy saving by increase of cross-sectional area of cable.
- Avoidance of safety hazards by short circuiting
- Maintenance will be reduced

**ENERGY SAVING PROPOSAL No: 10
Overvoltage problem rectification**

Present system

Voltage level is very high in Teachers hostel, Girls hostel, girls hostel pump house, street light, SOS computer science and IT , computer room , Human resources development centre, Institute of management , national centre for natural resources, SOS In geography and water management, Bio science lab, Vice chancellors bungalow, In most the cases voltage level is 260V and allowable limit is 254V ,

Proposed

The issue to be taken up with CSPDCL authorities for changing the tapping of corresponding transformers to the lower

Problems due to overvoltage

Effects of High Voltage.

An assumption people often make is that since low voltage increases the amperage draw on motors, then high voltage must reduce the amperage draw and heating of the motor. This is not the case. High voltage on a motor tends to push the magnetic portion of the motor into saturation. This causes the motor to draw excessive current in an effort to magnetize the iron beyond the point where magnetizing is practical.

Motors will tolerate a certain change in voltage above the design voltage. However, extremes above the design voltage will cause the amperage to go up with a corresponding increase in heating and a shortening of motor life.

For example, manufacturers previously rated motors at 220/440V, with a tolerance band of 510%. Thus, the voltage range they can tolerate on the high-voltage connections is 396V to 484V. Even though this is the so-called tolerance band, the best performance would occur at the rated voltage. The extreme ends (either high or low) put unnecessary stress on the motor.

High voltage will always tend to reduce power factor, thus increasing the losses in the system. This results in higher operating costs for the equipment and the system.

Operation on a continuous basis at either the high or low extreme will shorten the life of the motor.

Such sensitivity to voltage is not unique to motors. In fact, voltage variations affect other magnetic devices in similar ways. The solenoids and coils you find in relays and starters tolerate low voltage better than they do high voltage. This is also true of ballasts in fluorescent, mercury, and high-pressure sodium light fixtures. And it's true of transformers of all types. Incandescent lights are

especially susceptible to high voltage. A 5% increase in voltage results in a 50% reduction in the life of the lamp. A 10% increase in voltage above the rating reduces incandescent lamp life by 70%.

Overall, it's definitely better for the equipment if you change the taps on incoming transformers to optimize the voltage on the plant floor to something close to the equipment ratings. The best life and most efficient operation usually occur when you operate motors at voltages very close to the nameplate ratings.

Merits

- The damage of equipment's will avoid
- Short circuiting will be avoid
- The energy consumption will be reduced for luminaries
- Maintenance cost will be reduced

ENERGY SAVING PROPOSAL No: 11

Enhancement of sanctioned load according to the actual connected load

Present system

In some of the buildings, connected load is more than the sanctioned load which will invite penalty from CSPDCL

SL NO	PARTICULARS	Service No/Consumer no	SANCTIONED LOAD (kW)	CONNECTED LOAD (Kw)	REMARKS
1	PG girls hostel	403268	3.7	12.68	Greater than the Sanctioned load
2	Teachers hostel	403288	3.7	5.09	Greater than the Sanctioned load
3	Azad hostel	404408	2.1	9.52	Greater than the Sanctioned load
4	Research Hostel for Girls	771284	2.25	7.33	Greater than the Sanctioned load
5	Professional girls hostel	774229	7.3	7.65	Greater than the Sanctioned load
6	Research boys hostel	606167	3.94	4.34	Greater than the Sanctioned load
7	SOS in electronics and photonics	771282	34.3	38.52	Greater than the Sanctioned load

8	SOS in computer science and IT	773349	20	26.41	Greater than the Sanctioned load
9	HRDC	1005795195	40	41	Greater than the Sanctioned load
10	USIC	406148	9	11.5	Greater than the Sanctioned load
11	SOS geology and water resource management	406195	22.5	23.12	Greater than the Sanctioned load
12	SOS in life Science-1	406147	10.444	21.2	Greater than the Sanctioned load
13	SOS in life Science-2	404446	9.04	18.5	Greater than the Sanctioned load
14	Bio science Lab	771215	4	8.5	Greater than the Sanctioned load
15	Tissue culture	406200	9	16.2	Greater than the Sanctioned load
16	SOS in statistics & mathematics	774228	12	25.194	Greater than the Sanctioned load
17	University press	403232	0.9	8.15	Greater than the Sanctioned load
18	SOS in regional study and research:	771283	2.25	8.765	Greater than the Sanctioned load
19	SOS in Law	405438	8.72	17.2	Greater than the Sanctioned load
20	SOS in Geography	606211	33.38	37.58	Greater than the Sanctioned load
21	Pump near library	406126	2.238	3.62	Greater than the Sanctioned load
22	Arts bhavan ground floor	402163	65	29.435	Maintenance work was going on during the period of audit.
23	Arts Dept In first Floor	406354	32	19.3	Maintenance work was going on during the period of audit.

24	Arts bhavan second floor	406355	32.14	9.27	Maintenance work was going on during the period of audit.
25	Administrative building	406135	63.35	67.25	Greater than the Sanctioned load
26	VC bungalow	403290	2.25	4.25	Greater than the Sanctioned load

Provisions of billing in case of Excess Supply

II. For Normal Tariff consumers

- c) In case the connected load of any LT consumer, except the domestic (LV-1) consumers, is found at any time in excess of contracted load, the consumer shall have to pay charges at tariff (fixed and energy charge) corresponding to the excess load at the rate of one and half times the normal tariff for the excess load to the extent of 20% of contracted load and at the rate of two times of the normal tariff if the excess load is found beyond 20% of contracted load for actual period of enhancement of load or 6 months whichever is less, including the month in which the existence of excess load is detected and shall be continued to be billed till excess load is removed or contract load is enhanced.

Proposed system

Regularise the system with CSPDCL at the earliest.

Merits

- Avoid the penalty from the CSPDCL
- Avoid the unnecessary query from financial auditors of University as if penalty charged by CSPDCL

ENERGY SAVING PROPOSAL No: 12

Improvement in power factor

Present system

In guest house, Gandhi hostel, P.G Girls hostel, Teachers Hostel, Azad Hostel, Research girls Hostel, Professional Girls Hostel, Research boys hostel, Institute of management, University Press, SOS in Regional studies and research, Community hall, SOS in Geography, Arts Bhavan ground floor, First Floor, Second floor, areas the power factor is found lower than the minimum specified of 0.85. This will invite penalty from CSPDCL

Proposed system

Improve the power factor by the installation of LV capacitors and its rating chart is given below, Power factor indicated in our analysis at the time of measurement it may vary according to the usage. Hence take while deciding the proper value of capacitors

CSPDCL Act.

All **LT non-domestic consumers** with contracted load/connected load of 15 kW or above shall arrange to install suitable low tension capacitors of appropriate capacity at their cost. The consumer

shall ensure that the capacitors installed by him properly match with the actual requirement of the load so as **to ensure average monthly power factor of 0.85 or above**. A consumer who fails to do so will be liable to pay power factor surcharge @ 35 paise per kWh on the entire consumption of the month

Existing Power FACTOR	DESIRED POWER FACTOR							
	0.85	0.90	0.95	0.96	0.97	0.98	0.99	1.00
0.40	1.668	1.805	1.959	1.998	2.037	2.085	2.146	2.288
0.50	1.112	1.248	1.403	1.441	1.481	1.528	1.590	1.732
0.60	0.714	0.849	1.005	1.043	1.083	1.131	1.192	1.334
0.65	0.549	0.685	0.840	0.878	0.918	0.966	1.027	1.169
0.67	0.488	0.624	0.779	0.817	0.857	0.905	0.966	1.108
0.68	0.459	0.595	0.750	0.788	0.828	0.876	0.937	1.079
0.69	0.429	0.565	0.720	0.758	0.798	0.840	0.907	1.049
0.70	0.400	0.536	0.691	0.729	0.769	0.811	0.878	1.020
0.71	0.372	0.508	0.663	0.701	0.741	0.783	0.850	0.992
0.72	0.343	0.479	0.634	0.672	0.712	0.754	0.821	0.963
0.73	0.316	0.452	0.607	0.645	0.685	0.727	0.794	0.936
0.74	0.289	0.425	0.580	0.618	0.658	0.700	0.767	0.909
0.75	0.262	0.398	0.553	0.591	0.631	0.673	0.740	0.882
0.76	0.235	0.371	0.526	0.564	0.604	0.652	0.713	0.855
0.77	0.209	0.345	0.500	0.538	0.578	0.620	0.687	0.829
0.78	0.183	0.319	0.474	0.512	0.552	0.594	0.661	0.808
0.79	0.156	0.292	0.447	0.485	0.525	0.567	0.635	0.776
0.80	0.130	0.266	0.421	0.459	0.499	0.541	0.608	0.750
0.81	0.104	0.240	0.395	0.433	0.473	0.515	0.582	0.724
0.82	0.078	0.214	0.369	0.407	0.447	0.489	0.556	0.698
0.83	0.052	0.118	0.343	0.381	0.421	0.463	0.530	0.672
0.84	0.026	0.162	0.317	0.355	0.395	0.437	0.504	0.645
0.85	-	0.136	0.291	0.329	0.367	0.417	0.478	0.620

ENERGY SAVING PROPOSAL No: 13

Proper termination of cable joints and proper insertion of fuses

Present system

In most of the areas cable joints are without any proper methods, terminal joints are not properly jointed, Wires are used in most of the fuses instead of proper rated fuses. Please refer thermal images in annexure-3

Proposed system

1. CABLES AND CONDUCTORS

All cables shall conform to I.S-692, IS-7098, IS-1554 (Part-I) 1964 and IS 694-1990 or latest.

Conductors of all cables except for flexible cables shall be of aluminium.

FLEXIBLE CABLES

Conductors of flexible cables shall be of copper. The minimum size of core acceptable is 1.50 sq.mm.

2. CABLE JOINTING

All cable joints shall be carried out by experienced and Licence jointers under strict supervision. Electro plated brass cable glands, aluminium/tinned copper cable sockets and approved jointing materials must be used. The cable armouring is to be properly terminated.

All cable accessories and other associated materials shall conform to Indian Standard Specification where applicable.

ENERGY SAVING PROPOSAL-14:-

Timers in the operation of Street Light, garden lights

Present System

Security persons are the deciding authority for switching on and off the street lights, this will vary according to the person to person.

Proposed system

Install the timers for the operation of street lights and garden lights. This automation will increase of services and energy savings and calculation on power consumption will, be easier prior to the bill.

ENERGY SAVING PROPOSAL-15

Switching off of Common lights in corridor and toilets

Present system

Lights are switched on in the morning and it may be switched off in the night by security, this will increase the power consumption affecting the life of luminaries and creating a misunderstanding to the students and public about energy saving attitudes.

Proposed

Energy team to be formed among students and responsibility given, stickers and posters to be provided in the lighting switch boards. These lights should be changed in first phase of changing

Merits

Reduction in energy consumption

Life of luminaries are increased and thus the maintenance cost will come down
Creating awareness about energy conservation in the university students and staff.

ENERGY SAVING PROPOSAL-16

Changing of luminaries in new buildings with LED lights

Present system

Purchasing of new conventional lighting systems will increase the energy consumption

Proposed

The new luminaries are be changed into LED lights , Rules and regulations to be changed accordingly , Decision for change to be taken at the planning and designing stage of the building for opting the new technological luminaries .

ENERGY SAVING PROPOSAL-17

Improvement of light by cleaning of Luminaries

Present system

Cleaning of luminaries is note done in any of the areas. There is no dedicated team for cleaning and thus improves the illumination levels and life of luminaries.

Proposed

Energy volunteers to be formed among students and responsibility with the help of NSS Volunteers.

ENERGY SAVING PROPOSAL-18

Cleaning of ceiling fans

Present system

Cleaning of ceiling fans and exhaust fans are not done in any of the areas. There is no dedicated team for cleaning and thus improve the air circulation levels and life of ceiling fans

Proposed

Energy team to be formed among students and responsibility with the help of NSS Volunteers

ENERGY SAVING PROPOSAL-19

Follow up on proper engineering practice while installation of air conditioner

Present system

Lengthy copper tube from compressor to condenser, installation of air conditioner evaporator and condenser locations against its installation manual

Proposed

Installation of condenser as minimum as possible from the evaporator , minimum gap between top ceiling and top of evaporator should be 1 feet, side and back gaps between are to be 1feet for proper circulation of air, avoid the blockage of air in front of condenser fan.

Installation of air conditioners is to be done as per the instruction manual on indoor and outdoor units and its refrigerant piping.

Merits

- Reduction in power consumption
- Proper air circulation in the air conditioned room
-

ENERGY SAVING PROPOSAL-20

Cleaning of indoor and outdoor units

Present system

Condenser fins and evaporator suction filter are not cleaned

- Fouled condenser tubes force compressor to work hard to attain the derived capacity. For 0.8mm scaling build up in the condenser coils can increase the power consumption by 35%.
- Similarly the fouled or choked suction filter in the evaporator increases the running time of compressor and reduces the circulation of cold in the room.
- For every 1°C increase in the condensing temperature increases the specific energy consumption by 1%.

Proposed

Cleaning schedule to be incorporated, AMC for repairing and cleaning, along with checking of power consumption periodically and record the same.

ENERGY SAVING PROPOSAL-21

Avoid ingress of heat into the AC room

Present system

The windows are plane glass and the gaps are found between doors and old windows are properly loosing

Proposed

The old metal frame of windows are to be changed, proper ceiling on doors and windows, Cool film installation on windows

ENERGY SAVING PROPOSAL-22

Increase of set temperature of Air conditioners Present system

Set temperature are found as in 16 to 20 °C in many areas

Proposed system

As per the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) has their recommended temperature range to be from 22°C-27°C (64.4°F-80.6°F) for human comfort level at 55% RH.

Merits

- Every 1°C increment in evaporator temperature or setting temperature in the air conditioners reduced power consumption by 3%
- Energy saving by increase of temperature.

ENERGY SAVING PROPOSAL-23

Repairing of ASMF panels of DG SET Present system

AMF is not working and CSPDCL supply restored DG will work continuously without knowing about the same.

Proposed

AMF to be repaired with Supplier, Indication with lights and alarm against failure and restoration of CSPDCL supply.

ENERGY SAVING PROPOSAL-23:-

PF improvement in Pumps:

Present system:

At present all the pumps are running without any LV capacitors and thus in low PF ranging from 0.75 to 0.8 (Please refer pumps houses power table).

Merits

Proposed system:

Provide LV capacitors to all the pumps with multiplication factor as given below in table: to improve the PF to 0.95 and above. At least improve the PF to 0.95 and above from the present system.

Existing Power FACTOR	DESIRED POWER FACTOR							
	0.85	0.90	0.95	0.96	0.97	0.98	0.99	1.00
0.40	1.668	1.805	1.959	1.998	2.037	2.085	2.146	2.288
0.50	1.112	1.248	1.403	1.441	1.481	1.528	1.590	1.732
0.60	0.714	0.849	1.005	1.043	1.083	1.131	1.192	1.334
0.65	0.549	0.685	0.840	0.878	0.918	0.966	1.027	1.169
0.67	0.488	0.624	0.779	0.817	0.857	0.905	0.966	1.108
0.68	0.459	0.595	0.750	0.788	0.828	0.876	0.937	1.079
0.69	0.429	0.565	0.720	0.758	0.798	0.840	0.907	1.049
0.70	0.400	0.536	0.691	0.729	0.769	0.811	0.878	1.020
0.71	0.372	0.508	0.663	0.701	0.741	0.783	0.850	0.992
0.72	0.343	0.479	0.634	0.672	0.712	0.754	0.821	0.963
0.73	0.316	0.452	0.607	0.645	0.685	0.727	0.794	0.936
0.74	0.289	0.425	0.580	0.618	0.658	0.700	0.767	0.909
0.75	0.262	0.398	0.553	0.591	0.631	0.673	0.740	0.882
0.76	0.235	0.371	0.526	0.564	0.604	0.652	0.713	0.855
0.77	0.209	0.345	0.500	0.538	0.578	0.620	0.687	0.829
0.78	0.183	0.319	0.474	0.512	0.552	0.594	0.661	0.808
0.79	0.156	0.292	0.447	0.485	0.525	0.567	0.635	0.776
0.80	0.130	0.266	0.421	0.459	0.499	0.541	0.608	0.750
0.81	0.104	0.240	0.395	0.433	0.473	0.515	0.582	0.724
0.82	0.078	0.214	0.369	0.407	0.447	0.489	0.556	0.698
0.83	0.052	0.118	0.343	0.381	0.421	0.463	0.530	0.672
0.84	0.026	0.162	0.317	0.355	0.395	0.437	0.504	0.645
0.85	-	0.136	0.291	0.329	0.367	0.417	0.478	0.620

Merits

Reduces the motor cable losses by reducing the current through it.

Required capacitors with locations

Sl no	Location	Metre no	Pumping area	Rated kW	Present PF	Required PF	Required Capacitor (kVAR)
1	LH pump	406187	Ladies hostel	5.62	0.85	0.94	1.57
2	Azad hostel pump	Azad hostel meter	Boys hostels	3.75	0.85	0.94	1.05
3	Pump room	406131	Girls hostel-1, Geography, Registrar bungalow, Guest house	3.75	0.85	0.94	1.05
4	Computer science	computer science server room metre	computer science, HRDC	3.75	0.85	0.94	1.05

5	Pharmacy	Pharmacy metre	Pharmacy,	3.75	0.85	0.94	1.05
6	Physical education	PE metre	Physical education	3.75	0.85	0.94	1.05
7	Regional studies & research	Regional studies metre	Regional studies	1.5	0.85	0.94	0.42
8	Life science pump room	406203	Life science	2.2	0.85	0.94	0.62
9	Near library	406126	Library, Arts bhavan, Engineering dept,	3.75	0.85	0.94	1.05
10	Auditorium	Auditorium metre	Auditorium, garden,		0.85	0.94	0.00
11	Administrative block	AD block metre	AD block,	3.75	0.85	0.94	1.05
12	Near quarters	406188	Quarters	3.75	0.85	0.94	1.05
13	VC bungalow pump	406127	VC bungalow	3.75	0.85	0.94	1.05

Note:

As each pump used to supply water to several areas, the actual power consumption varies and thus PF too. Maximum PF will arrive only during the Maximum load. In the above calculation we assume that maximum power takes all the time during the running hours.

GENERAL SUGGESTIONS:

ANNEXURE-1:-

Implications if all the Existing LT Connections are converted to a Single HT Connection. :-

Given below is a comparative study on the financial implications if all the existing LT Connections are converted to a single HT Connection.

Present situation:

At present Electricity Supply to all the Installations are given from about 64 LT connections.

Approximate Total kW of connected load	=	1200 kW
Average kWh consumption/ month by PRSU month electricity bill)	=	83,885kWh (From the last 12
Approximately	=	85,000 kWh
Average cost/ unit (including surcharge & Duties)	=	Rs 7.00
Approximate total cost/Month	=	Rs 5, 95,000/-

Proposed Situation:

As per the CSPDC tariff structure, HT tariff applicable to Universities is HV-2. HV-2 tariff is applicable to the following categories:

1. This tariff is applicable to the mines, coal mines, cement industries, and other industries not covered under categories HV-1 and HV-4 for power, lights, fans, cooling ventilation, etc., which shall mean and include all energy consumption in factory and consumption for residential and general use therein including offices, stores, canteen yard lighting, etc.
2. This tariff is also applicable for supply to establishment such as Railways (other than traction), hospitals, offices, hotels, shopping malls, power supplied to outside of State (border villages), educational institutions, mixture and/or stone crushers and other institutions, etc., having mixed load or non-industrial and/or non-residential load. This tariff is also applicable to all other HT consumers not covered specifically in any other HV tariff category.

HV-2 tariff Structure is given below:

Category of Consumers	Demand Charge (Rs./kVA/month)	Energy Charge (Rs. per kVAh)
HV-2 11 kV & 33 kV	365	4.50

Determination of Maximum Demand

The maximum demand in each month shall be four times the largest number of kilo Volt Ampere hours delivered at the point of supply during any consecutive 15 minutes during the month as per sliding window principle of measurement of demand.

Power Factor Incentive/Penalty is not applicable as the energy charges are billed on kVAh.

But if PF is improved, kVA as well as kVAh will come down resulting in reduction in Demand Charge as well as Energy Charge.

Calculation:

Contract Demand proposed	=	1200 kVA
Average Maximum Demand	=	1000 kVA
Total Demand Charges (1000*350)	=	Rs 3, 50,000/-
Total Energy Charges (82,500*4.5) (3% Reduction for Transformer Loss)	=	Rs 3, 71,250/-
Total Charges (438000+450000)	=	Rs 7, 21,250/- + surcharge, duties
Approximate Monthly Amount	=	Rs 8, 00,000/-

A. Merits:

1. As the Substation is in the University compound itself, the chance of Electricity failure is very less
2. Operation and Maintenance of Transformer and the whole LT Installation can be done by the University Staff.
3. Providing 64 nos. LT connections in the same premises are very untidy and chaotic. If HT supply is taken, it can be avoided.

B. Demerits:

- Initial investment will be very high. It has to be estimated by a competent Electrical Consultant.
- There will be approximately 35% hike in monthly Energy Charges.
- Exclusive space for Transformer and Switchgear has to be provided.
- Staff exclusively for Operation and Maintenance has to be posted.

ANNEXURE-2:

Review of Present Maintenance Practice:

Present practice:

University does the maintenance whenever there occurs any breakdowns. This is the case of all the equipment's present in the university like pumps, cables, MCB etc. Pumps maintenance records are present in the university which contains Rewinding details, number of breakdowns and occurred date. Most of the maintenance work are done by the external contractors which called upon whenever requires.

Proposal:

Maintain a preventive maintenance program to reduce the interruptions and breakdowns in the system and proper recording of the maintenance practice

Methods to follow:

1. Routine Inspections (Regularly Scheduled) – Daily Walk-Through / Checklists
2. Detailed Inspections / Testing (Programmed Scheduled)
3. Analysis of Testing Reports/inspections – Both Current and Past – Recommended Corrective Measures / Action Items
4. Implementation of Corrective Measures / Action Items
5. Record Keeping / Trending Both Hard & Soft Copies
6. Gather Support / Funding / Commitment From Management
7. Survey All Systems / Equipment
8. Perform Failure Mode Effects Analysis (FMEA) – Safety of Personnel / Technicians – Uniqueness of System / Equipment –Equipment Redundancy
9. Determine Maintenance Intervals Based On The Following – Importance / Critical Nature of Equipment –Age of Equipment –Environment
10. Determine Resources / Staffing Requirements – Management of Program Shall Always Be Performed Internally – Timeline to Perform Maintenance (1 Week or 3 Months) – In sourcing
 - Ownership / Calibration of Equipment
 - Size of System
 - Define Scope of Work / Testing Specification • Regularly Engaged In Electrical Testing (Minimal of 5 Yrs.

Benefits:

1. Improves Safety For Facility and Technicians
2. Provides Assurance That Protective Devices Will Function
3. Safely Clears Fault Conditions (Short Circuits, Overloading, Ground Faults, etc.)



TQ SERVICES

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4. Arc-Flash Calculations Assume Equipment is Maintained
5. Calculation Required for Inspection and Selection of Proper PPE
6. Provides Higher Level of Reliability / Dependability – Reduces Risk of Equipment / System Failure
7. Minimizes Property Loss Claims / Lowers Insurance Premiums –
8. Strengthens Operational Learning / Training of Electrical System – Observe Reactions of Electrical, Mechanical, and Control Systems
9. Enables Equipment / System To Operate At Peak Efficiency – 1% - 3% Energy Savings Over Non-Maintained Equipment

ANNEXURE-3:

Renewable Energy Option -

The Sun is an inexhaustible, reliable and non-polluting source of power. Since the inception of life on earth, the only energy that was available came from the sun. The time is now approaching when mankind will again depend upon the sun as dominant energy source. We are aware that fossil fuels are not going to last forever. A growing worldwide concern for conservation of energy has reignited our interest in ecologically sustainable materials, processes and sources of energy.

Of the numerous renewable sources of energy known to mankind, Solar Photo Voltaic or SPV is one that has the potential to supply power for our future needs:

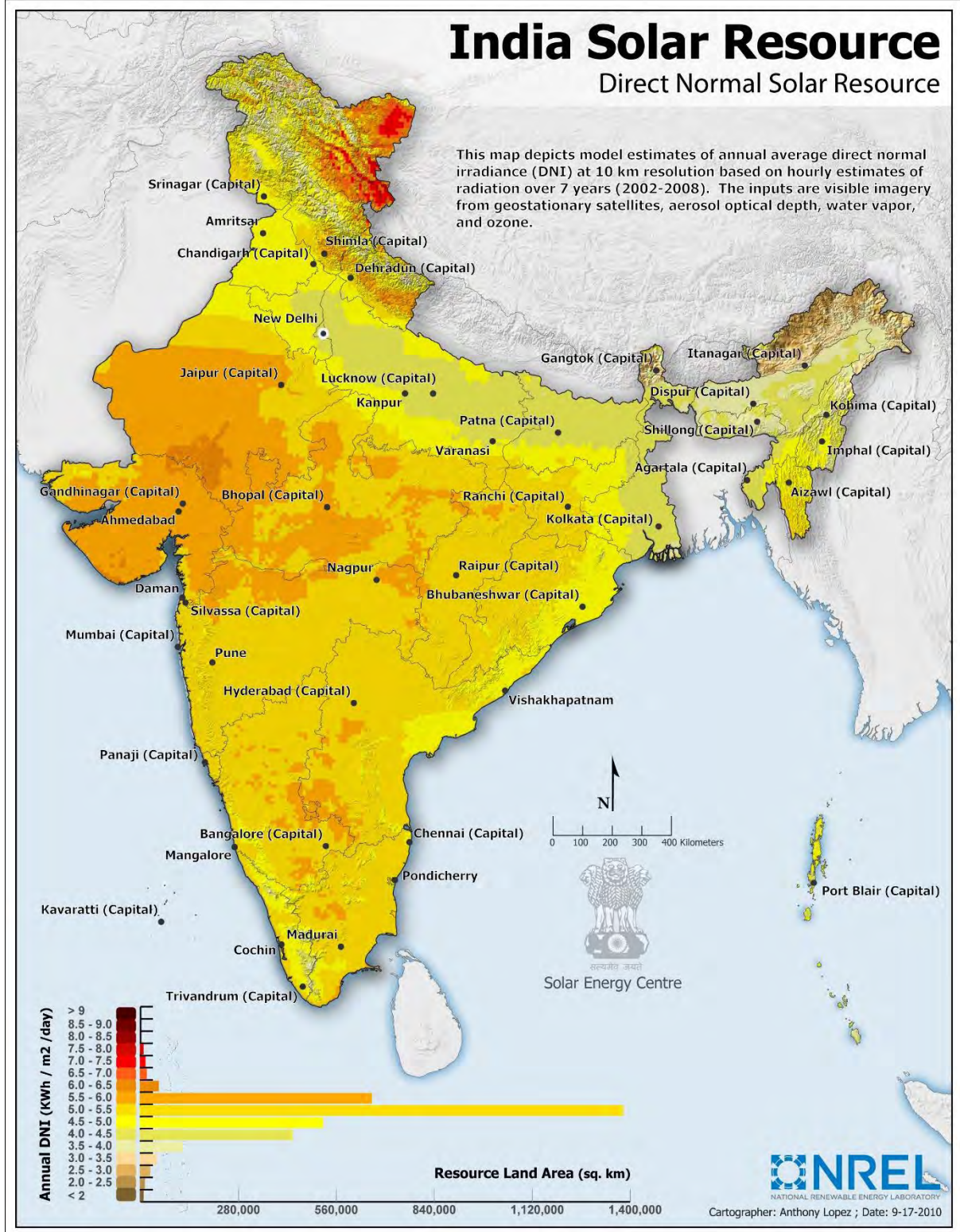
- Solar radiation is the largest renewable energy source
- The solar energy is more evenly distributed in the world than wind or bio-mass.
- It is well proven and demonstrated technology
- It promises to be most cost effective renewable power at high volumes.

In addition the solar photovoltaic technology offers following advantages:
No recurring fuel cost

- Clean, silent and no moving parts
- Modular, Reliable with Low Maintenance
- Environmentally sound, does not contribute to greenhouse gas emission.
- Can be installed at the point of use and prevents transmission line losses.
- Solar panels have life in excess to 25 years and can withstand high winds, severe hail impact, high humidity, ambient temperatures.

The solar energy potential in India is immense due to its convenient location near the Equator. India receives nearly 3000 hours of sunshine every year, which is equivalent to 5000 trillion kWh of energy. The following image shows the solar generation potential of India.

Solar Potential Analysis for Pandit Ravi Shankar Shukla University (PRSU) Campus,



Raipur, Chhattisgarh

Geographical Location:



Latitude: **21.24795**

Longitudes: **81.602142**

NASA Surface meteorology and Solar Energy: RET Screen Data

(Ref website: <https://eosweb.larc.nasa.gov/sse/RETScreen/>)

	Unit	Climate data location
Latitude	°N	21.248
Longitude	°E	81.602
Elevation	m	391
Heating design temperature	°C	13.70
Cooling design temperature	°C	36.78
Earth temperature amplitude	°C	18.07
Frost days at site	day	0

Month	Air temperature	Relative humidity	Daily solar radiation - horizontal	Atmospheric pressure	Wind speed	Earth temperature	Heating degree-days	Cooling degree-days
	°C	%	kWh/m ² /d	kPa	m/s	°C	°C-d	°C-d
January	19.8	46.5%	4.58	97.0	2.8	21.6	12	302
February	23.0	41.9%	5.44	96.8	3.0	25.8	0	363
March	27.6	34.8%	6.19	96.5	3.0	31.6	0	537
April	31.0	34.9%	6.71	96.2	3.0	34.9	0	620
May	32.9	38.9%	6.58	95.8	2.8	36.5	0	700
June	29.7	63.8%	4.89	95.7	2.8	31.6	0	585
July	26.6	79.3%	3.96	95.8	2.7	27.4	0	510
August	25.8	82.2%	3.79	95.9	2.6	26.1	0	484
September	25.6	76.8%	4.46	96.2	2.2	26.2	0	472
October	24.5	63.0%	5.07	96.6	2.3	25.2	0	451
November	22.1	47.8%	4.76	97.0	2.5	23.1	0	365
December	19.3	46.5%	4.49	97.2	2.5	20.5	7	292
Annual	25.7	54.7%	5.08	96.4	2.7	27.5	19	5681
Measured at (m)					10.0	0.0		

(Courtesy: eosweb.larc.nasa.gov)

General Requirement for Roof Top Solar PV plant Installation:-

Space Requirement for Panel Mounting:

A minimum shadow free space of 8m² is required for the solar panel mounting for the capacity of 1KW. The panel must be mounted facing south with appropriate inclination for maximum output from installation. Suitable structure according to wind speed and roof structure must be used without shading the panel surface.

Solar PV modules and Inverter:

Solar PV panels of 200W or above must be selected for the rooftop installation above 10KW. The efficiency of individual panel must not be less than 13%.

String invert with MPPT charge controllers is more suitable for the solar power plant installation in roof top. Equipment and installation must be complied with **CSERC Rooftop PV Regulation, 2013**.

Solar Air conditioning

Solar Air conditioning can be done in two ways

- 1, Solar powered air conditioning
- 2, Solar thermal power air conditioning (Vapour Absorption system)

Solar powered air conditioning

As in solar powered air conditioning uses photovoltaic system for generating power, then to inverter, battery and make whole thing is to use work with the air conditioner, In the existing systems in India have A/C power, which is to be switches to DC technology as of western countries. This takes time and not economical at the present situation and hence it is not recommended.

Solar Thermal power (VAM)

This is the greenest and latest technology and consumes least electricity for air conditioning and do not use CFC as refrigerant. Hence it is harmless to the environment. But the minimum of 25TR solar thermal power set up in India for Mamta ENERGY Pvt. Ltd. The cost of install VAM is very much higher than VAC

ANNEXURE-4:-

Innovative areas for energy conservation training-

- 'Start with campaign on energy conservation slogans, pictures, posters, and articles on notice boards, magazines, and tips on boards.
- Training programme for selected students and declare them as energy volunteers , train them for taking small group classes on energy conservation
- Promote cycling among the campus
- Train and mould the students to clean the luminaries fans, air conditioners and classes and public areas
- Celebrate energy conservation day, Science day, Technological days and other important scientist birth days
- Call industry specialists (Preferable old students) for took classes on energy related subjects but it should be in connection with their study areas.
- Promote home energy audits and building audit of university buildings (Equipments and specialists are available in CREDA)
- Conduct special training programs for engineering department with the support of CREDA
- Start energy conservation campaign on Raipur Nagar Palika with students. Arrange a procession from different parts of Raipur Town with energy slogans, street play, posters etc and joined at one place were public meeting to be arranged. Invite special guests who are working in the field of Energy conservation in rural areas.
- Energy quiz, posters , awards for best projects are one of the area for innovation



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Annexure-5:-

Thermal Images (Separate file attached).

ANNEXURE-6:-

LIST OF SUPPLIERS:

SL No:	Particulars	Brand	Address	Approx. Cost per piece
1	T-5	Bajaj	Bajaj Electricals, Bajaj Bhawan, Doongagi Colony, GE Road, Near Anupam Udyan, Raipur-492001	Rs.500
		Phillips	Regional Marketing Manager –Lighting, Philips India Ltd. Techno police Knowledge Park, Mahakali Caves Road, Chakkala Andheri (E)	Rs, 500
		GE	General Electricals	Rs.500
2	LED	Bajaj	Bajaj Electricals, Bajaj Bhavan, Doongagi Colony, GE Road, Near Anupam Udyan, Raipur-492001	8 W-Rs.626
		Phillips	Regional Marketing Mnager –Lighting, Philips India Ltd. Technopolice Knowledge Park , Mahakali Caves Road, Chakkala Andheri(E)	8W- Rs. 700
		GE	General Electricals, 361/362, Solitair Park, Mr. Vasanji Road, Chakkala ,Andheri (E) Mumbai -400093	8W Rs. 750
3	Air conditioners	Samsung	2 nd &3 rd Floor, Tower C, Vipul Tech Square, Golgi Course Road, Sector-43, Gurgaon - 122002	1TR, 5 star Rs33979 1.5TR, 5Star Rs 35058
		LG	L.G Electronics India Pvt. Ltd.A-Wing, 3 rd floor, D-3 District Centre Saket, New delhi	1TR, 5 star Rs34000 1.5TR, 5Star Rs 36000
		Carrier	Carrier Refrigewration and Air conditioning Ltd, 605A, Lokmat Building, Lokmat Square, Vardha Road, Ramdas Pet, Nagpur	1TR, 5 star Rs35000 1.5TR, 5 Star Rs 37058
4	BLDC Fans	Orient Eco	Orient Electricals Ltd., 82,1st floor, Okhala Industrial Estate, Phase -111, New delhi - 110020	4000
		Ruchi	Ruchi Electricals Ltd, F-81, Khanpur Extension , New Delhi-110620	3000

5	RCCB	Havel's	QRG Towers, 2D, SEC-16, Express High way, Noida UP-201304	Rs. 2600
		Bajaj	Bajaj Electricals, Bajaj Bhavan, Doongagi Colony. GE Road, Near Anupam Udyan, Raipur-492001	Rs. 2600
		GE	General Electricals 361/362, Solitair Park, Mr. Vasanji Road, Chakkala, Andheri (E) Mumbai -400093	Rs. 2750

ANNEXURE- 7:-

LIST OF INSTRUMENTS:-

SL.NO	EQUIPMENT DESCRIPTION	MAKE & MODEL
1	Power Energy & Harmonic Analyzer	Fluke 1735 With Flexi Probes (3000a) Krykard Alm 35
2	Infrared Thermometer	Fluke Mini 62
3	Non Contact Tachometer	Metravi Nctm – 1000
4	Lux Meter ,	Amprobe Lm 120
5	Clamp On Meter	Metravi Dt 2250
6	Vane Flow Meter	Metravi
7	Ultrasonic Flow Meter	Portlock 7s
8	Thermal Imager	Flir

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