ENERGY AUDIT – 2021

CHRIST COLLEGE, IRINJALAKUDA
(AUTONOMOUS)
THRISSUR, KERALA

EXECUTED BY

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Also congratulating our Energy audit team members for successfully completing the assignment in time and making their best efforts to add value.

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Yours faithfully

Managing Director
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1. ENERGY SAVING PROPOSALS

The following table shows the energy saving proposals

Sl No:	Particulars	Annual energy Savings (kWh)	Annual Financial Savings (Rs.)	Investment (Rs)	Simple payback Period (Months)
1	Replacement of ceiling fans with BLDC /BEE star rated fans -100 No each	7500 or 3750	48750 or 24375	270000 or 160000	66 or 79
2	Replacement of existing Tube fitting with LED. T-12 – 100, T-8 – 200 and T-5 as 25 Nos	10800	70200	97500	17
3	Replacement of CFL 50 s with LED Lights	800	5200	6250	14

TABLE 1: ENERGY SAVING PROPOSALS

2. AUDIT SUMMARY - ACTIONS

The actionable summary of the audit report is given in the table below.

Sl No:	Particulars	Location	Action to be taken	Remarks
1	Replacement of ceiling fans with BLDC fans	Classrooms, Staff rooms	Change the existing old ceiling fans with BLDC fans	Energy consumption will come down
2	Replacement of Fluorescent lights with LED	Class rooms, Staff rooms	Replace with LED lights.	Energy consumption will come down

TABLE 2: ENERGY AUDIT SUMMARY – ACTIONS

3. ENERGY AUDIT SUMMARY & RECOMMENDATIONS

The summary of the report with respect to each section is as follows.

1. **Electricity consumption analysis:**

- College is installed 160kWp solar power system and gone for zero billing and thus self-sustainable in electricity.
- **Air conditioners:** Replacement of old AC's with new energy efficient star rated AC's required.
- **Light loads:** Majority of the lighting fixtures are fluorescent type (T8). By replacing these loads with LED light fittings will reduce the overall power consumption.
- **Ceiling fan loads:** Ceiling fans are installed in majority of the areas by replacing it with Brushless DC fans which consumes in the range of 25 to 30W at full speed, instead of 70W in normal fans, will reduce the power consumption considerably. Also while purchasing new fans priority should be given for BLDC

ENERGY AUDIT

OBJECTIVES

An energy audit is a key to assessing the energy performance of facility and for developing an energy management program. The typical steps of an energy audit are:

- Preparation and planning
- Data collection and review
- Plant surveys and system measurements
- Observation and review of operating practices
- Data documentation and analysis
- Reporting of the results and recommendations

1.1. Definition of energy auditing

In the Indian Energy Conservation Act of 2001 **(BEE 2008)**, an energy audit is defined as:

"The verification, monitoring and analysis of the use of energy and submission of technical report containing recommendations for improving energy efficiency with cost-benefit analysis and an action plan to reduce energyconsumption."

1.2. Objectives of Energy Auditing

The objectives of an energy audit can vary from one plant to another. However, an energy audit is usually conducted to understand how energy issued within the plant and to find opportunities for improvement and energy saving. Sometimes, energy audits are conducted to evaluate the effectiveness of an energy efficiency project or program. In Christ College Irinjalakuda as per the request, we have assessed the energy consumption and saving opportunities at present scenario.

Methodology for the study

The methodology adopted for energy audit starts from historical energy data analysis, power quality analysis, monitoring of operational practices, system evaluation, cost benefit analysis of the energy conservation opportunities, and prepare plan for implementation. The proposals given in the report includes economical energy efficiency measures to reduce facilities unnecessary energy consumption and cost. The energy conservation options, recommendations and cost benefit ratio, indicating payback period are included in this report.

Details Work

The Scope of Work includes:

1. Historical energy data analysis.
2. Electrical, Mechanical and Thermal energy analysis.
3. Power Quality Analysis.
4. Identification of Energy saving opportunities.
5. Cost Benefit Analysis.

FIGURE 1 FRONT VIEW OF COLLEGE

1. CONSTRUCTED AREA OF COLLEGE

The campus building is located in a center of lush greenery with ample free space. The main building and other buildings have ample lighting and ventilation. The construction of all buildings of Christ College Irinjalakuda have ample ventilation and air flow and keeping a silent atmosphere to the students.

Christ College Irinjalakuda constructed the building to optimum utilisation of land and classrooms and with abundant light and natural ventilation. Maximum day light ingression and natural ventilation increases the indoor air quality and avoid the sick building syndrome. The whole facility and buildings are designed to maximum and optimum utilisation of land is done.

Sl.No:	Floor	No Of Floors	Total Built Up Area(M^2)
1	New Block 1 and 2 Phase	G+6	3360.00
2	Zoology , Library, and Commerce	G+2	3185.00
3	Zoology New	G+2	550.00
4	Guest Room	G+2	486.00
5	Auditorium	G+1	1063
6	Ladies Retiring Rooms	G=1	282
7	Administrative Block	G+2	5437
8	Chavara Seminar Hall	G+2	128
9	Chemistry Block	G+2	2616
10	Chemistry Block (New)	G+2	885
11	Carpentry Shed	G	128
12	Hotel Management	G+2	259
13	Physics Workshop	G+1	82
14	Main Block	G+2	1852
15	New Main Block	G+2	3612
16	Central Block	G+2	945
17	Main Hostel	G+2	4377
18	Mess Hall	G+1	1078
19	BPE Building	G+1	2196
20	New Physical Education	G+1	1586
21	Mary Rani Girls Hostel	G+2	2078
22	Boys Hostel Play Hall	G	185
23	Boys Hostel	G+3	820
	Grand Total		37190

'Table 3 BUILT UP AREA OF COLLEGE

ELECTRICITY CONSUMPTION ANALYSIS

2. BASELINE DATA & CONSUMPTION

Base Line Data	College Building
Connection	KSEB
Voltage	415
Tariff	HT -II (B) General
Consumer No:	1356440054821
KSEB Section	Irinjalakuda
Billing Period	Monthly
Connected Load (kW)	272
Contract Demand	100
Billing Demand Maximum billed	75
Annual maximum Demand	51
Average monthly electricity consumption (kWh)	18000
Average fixed charges (Rs/month)	33000
Average monthly electricity cost (Rs)	12,000

TABLE 4 : BASELINE DATA

3. ELECTRICITY BILLS ANALYSIS

The Electricity bills analysis of the college and other buildings are given below:

Note: We are not taken other bills due to Covid pandemic the electricity is not being consumed in many buildings. Hence, we will not able to conduct proper bill analysis and get a conclusion of the same. The main reason college is not functioning in its regular mode for the last one year.

CONNECTED LOAD DETAILS

LIGHTING AND FAN

Effective lighting is essential for process and utility areas to carry out their work properly, yet it is possible to achieve significant savings in this area and improve the quality of the lit environment. Good lighting design can reduce costs and have the added benefit of decreasing internal heat gains, thus reducing the need for air conditioning too. The lighting details of the Christ College Irinjalakuda at various buildings are given below:

MAIN BLOCK

Area	LED	LED Tube	LED	T12	T8	T5	CFL
Power in Watts	9	20	40	40	36	28	18
Ground Floor							
Physics Lab		12					
Physics Msc lab		11					
Class room 8 to 16		8		3	4		4
First Floor							
Principal	12				1		
Bursar	4						
Office		1			12		
Toilet	1						
Class rooms	9	6	2		10	2	
Second Floor							
21 Class rooms	2	9		14	1	3	
2 Toilet	4				3		
Library	1	8		26	41		
Total in No:	33	55	2	43	72	5	4
Total In W	297	1100	80	1720	2592	140	72
Grand Total kW	**6.001**						

COMMERCE BLOCK

Area	LED	LED Tube	T12	T8	CFL	Incandescent Bulb
Power in Watts	9	20	40	36	9	60
Ground Floor						
Class Rooms	1	7	3	11		2
First Floor						
Class rooms		1		5	1	
Second Floor						
Class rooms			6			
Total in No:	1	8	9	16	1	2
Total In W	9	160	240	576	9	120
Grand Total kW	**1.114**					

NEW BUILDING (Commerce Self)

Area	LED	LED Tube	T12	T8	T5	CFL	CFL	CFL	Incandescent Bulb
Power in Watts	9	20	40	36	28	6	18	40	60
Ground Floor									
Class Rooms		3	2				1	1	
Toilet		2							
First Floor									
Class rooms		12	6	16		1			2
Toilet	3								
Veranda	1		1	9	1				
Second Floor									
Class rooms		3		6					
Total in No:	4	20		31	1	1	1	1	2
Total In W	36	400	0	1116	28	6	18	40	120
Grand Total kW	**1.764**								

NEW BUILDING

Area	LED	LED Tube
Power in Watts	20	36
Ground Floor		
Class Rooms		
Toilet		
First Floor		
Class rooms	6	6
Second Floor	2	
Class rooms	11	2
Veranda	2	
Third Floor		
Class Room	9	
Veranda	2	
Fourth Floor		
Class room	8	
Total in No:	40	8
Total In W	800	288
Grand Total in kW	**1.088**	

ZOOLOGY BLOCK

Area	LED	LED Tube	T12	T8
Power in Watts	9	20	40	36
Ground Floor				
Class Rooms	36			6
First Floor				
Class rooms	1	28	11	2
Second Floor				
Class rooms		2	6	12
Total in No:	37	30	17	20
Total In kW	333	600	680	720
Grand Total in kW	**2.333**			

CANTEEN, AUDITORIUM, TENNIS AND SEMINAR BLOCK

Area	LED	LED	LED Tube	LED	LED	T12	T8	Incandescent Bulb
Power in Watts	6	9	20	30	50	40	36	60
Ground Floor								
Canteen		1	12				1	
Auditorium								
First Floor								
Class Rooms		12	8	38		2	14	1
Second Floor		5				5		
Tennis court					12			
Seminar Complex								
Studio	2	7						
Seminar Hall		22					2	
Class Rooms		1	1			1	9	
Total in No:	4	48	21	38	12	8	26	1
Total In W	24	432	420	1140	600	320	936	60
Grand Total in kW	**3.932**							

CHEMISTRY BLOCK

Area	LED	LED Tube	T12	T8	T5
Power in Watts	9	20	40	36	28
Ground Floor					
Class Rooms	7	9	10	5	9
First Floor					
Class rooms		2	16	16	7
Second Floor					
Class rooms	6	5	2	5	1
Hotel Management					
Class Rooms		4	7	2	

Veranda		1	3		
Total in No:	13	21	38	28	17
Total In W	117	420	1520	1008	476
Grand Total in kW	**3.541**				

LADIES HOSTEL

Area	LED	LED Tube	LED	T8	T5	CFL	CFL
Power in Watts	9	20	40	36	28	9	18
Rooms	16	30	0	2			24
Veranda	5	1		4		3	5
Washroom	1			1		16	
Mess	2	1	3	1			
Kitchen	1		2				
Terrace	2			4			
Warden						2	1
Prayer room			1		1		24
Open area	2		0	6		2	5
Total in No:	29	32	6	18	1	23	59
Total In kW	261	640	240	648	28	207	1062
Grand Total in kW	**3.086**						

BOYS HOSTEL

Area	LED	LED Tube	T8	T5
Power in Watts	9	20	36	28
Rooms		19	10	
Varanda		6		
Washroom	4	1	1	1
Mess	1	7	7	
Kitchen		4	1	
Terrace				
Warden			10	
Prayer room				
Open area			1	
Total in No:	5	37	30	1
Total In kW	45	740	1080	28
Grand Total in kW	**1.893**			

Table 5 LIGHTING LOAD IN COLLEGE

TOTAL FAN LOADS

Area	Ceiling fan	Pedestal Fan	Wall fan	Exhaust Fan	Exhaust Fan
Power in Watts	60	60	60	40	60
Main Block	124	12	4	3	1
Commerce Block	28	2	1	0	0
New Building (Commerce Self)	85	0	0	0	0
New Building	40	0	0	0	0
Zoology Block	34	3	3	0	5
Canteen, Auditorium, Seminar Hall	37	1	3	1	1
Chemistry Block	61	6	0	7	8
Ladies Hostel	52	0	0	0	1
Boys Hostel	34	0	0	0	2
Total in No:	495	24	11	11	18
Total In kW	29.7	1.44	0.66	0.44	1.08
Grand Total in kW	**33.32**				

Table 6 FAN LOADS IN COLLEGE

TOTAL COMPUTER & PRINTER LOADS

Area	PC	Printer	Printer	Printer
Power in Watts	60	200	350	500
Main Block	79	7	8	3
Commerce Block	4	1	2	
New Building (Commerce Self)	26	0	6	
New Building	7	3	1	
Zoology Block	6	3	3	
Canteen, Auditorium, Seminar Hall	2	0	0	
Chemistry Block	44	0	5	
Ladies Hostel	3	1	0	
Boys Hostel	0	0	0	
Total in No:	171	15	25	3
Total In kW	10.26	3	8.75	1.5
Grand Total in kW	**23.51**			

TABLE 7 COMPUTER AND OFFICE LOADS

AIR CONDITIONERS

Rated Capacity(TR)	Quantity	Power consumption(kW)	Total Power consumption (kW)
3	3	3.5	10.5
2	8	2.1	16.8
1.5	1	152	152
1	16	1	16
Grand Total in kW	**33.82**		

TABLE 8 AC LOADS

OTHER MISCELLANEOUS LOADS

Particulars	No	Rated Load in watts	Total Load in kW
Projector	17	150	2.55
TV	13	80	1.04
TV Large	01	1118	1.118
Fridge	7	250	1.75
Grinder	2	1400	2.8
Mixer	2	800	1.6
Oven	01	800	0.8
Freezer	01	200	0.2
Camera	8	10	0.08
Grand Total in kW	**11.938**		

TABLE 9 MISCELLANEOUS LOADS

SUMMARY OF LOADS

The details of the loads installed in the college are given below:

Sl.No:	Particulars	Total Load	In %
		kW	
1	Light Loads	24.752	19
2	Fan Loads	33.32	26
3	Computers & Printers, Projector	23.51	18
4	Air conditioners	33.82	27
5	Miscellaneous loads	11.938	9
	Total in kW	**127.34**	

TABLE 10: CONNECTED LOAD AS EQUIPMENT

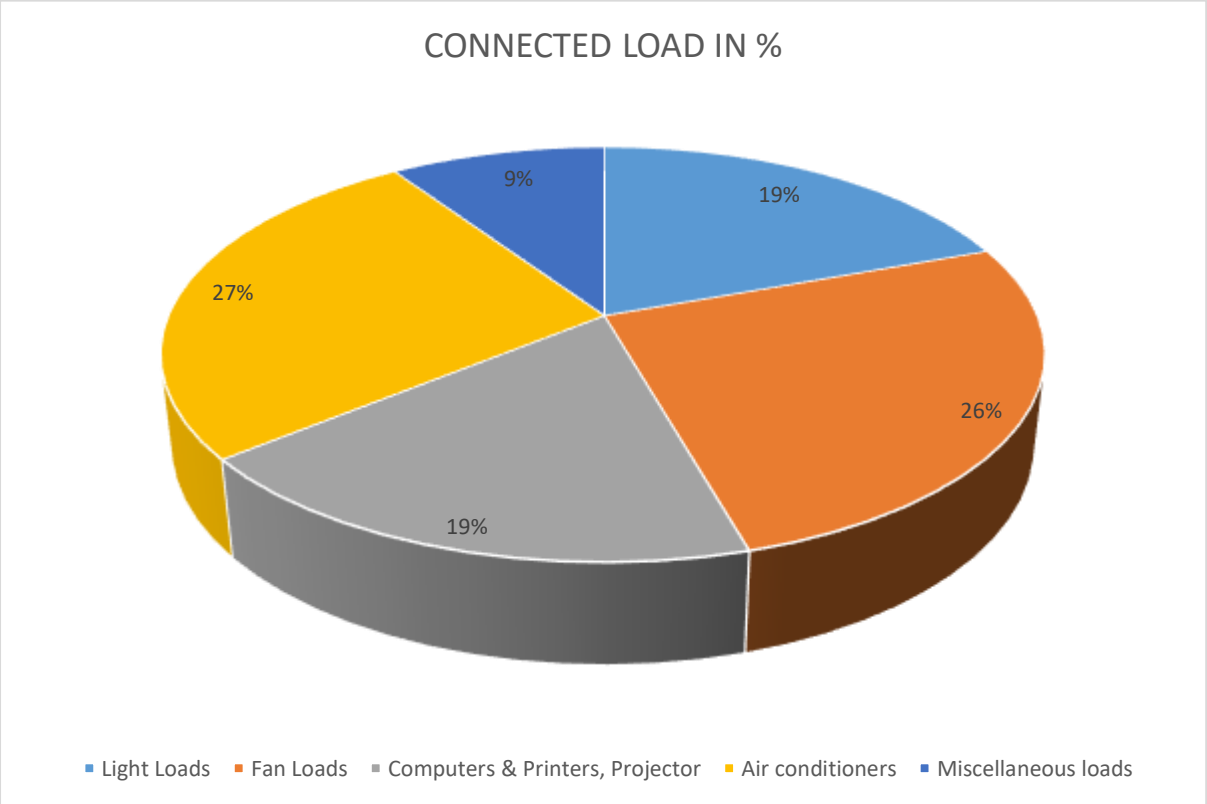


FIGURE 2 CONNECTED LOADS

LUX MEASUREMENTS

According to National Lighting code-2010 BIS 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. Details are given in the section. Lux levels of some areas are given in the Table. The lux levels mentioned as satisfactory need to be improved.

Sl. No.	AREA	Measured Lux	Required Lux	Remarks
1	Class room in Main block	150	150	Good
2	Class room in E block	165	150	Good
3	Hostel	170	150	Good
4	Computer lab	180	150	Good
5	Office	180	150	Good
6	Library	180	150	Good
7	Staff room	140	150	Satisfactory
8	**Principal Office**	**145**	**150**	Satisfactory

TABLE 11: LUX MEASUREMENT

RENEWABLE ENERGY

Christ College installed 170 kWp of solar power system in three phases in the college. In the first phase college installed 20kW above the college roof. As on the second phase additional 50kW solar system is installed. On third phase additional 100kw solar installed above the main building. Walk ways are also done around solar panels for ensure the proper cleaning of solar panels in time to time. In the first and second phase 335Wp modules of 209 No: installed and in the third phase is of 325 Wp 308 No: There is 25Kva invertors of 6No: of Froneous make and 20Kw 1No: invertor of ON GRID is installed for conversion of solar DC power to grid system.

Now Christ College is self-sufficient in terms of electrical energy. College is not taking but exporting electrical energy to KSEB for the last 1year during day time.

Figure 3 Renewable energy solar system

ANNEXURE-1

ENERGY SAVING PROPOSALS - 1

REPLACEMENT OF CEILING FANS IN THE OFFICE WITH ENERGY EFFICIENT BLDC FANS

Background

A BLDC fan takes in AC voltage and internally converts it into DC using SMPS. The main difference between BLDC and ordinary DC fans is the commutation method. A commutation is basically the technique of changing the direction of current in the motor for the rotational movement. In a BLDC motor, as there are no brushes, so the commutation is done by the driving algorithm in the Electronics. The main advantage is that over a period, due to mechanical contact in a brushed motor the commutators can undergo wear and tear, this thing is eliminated in BLDC Motor making the motor more rugged for long-term use. To explain, BLDC technology in simpler terms, BLDC uses a combination of Permanent Magnets and Electronics to achieve the kind of efficiency and performance, it delivers. A BLDC fan composes of 3 main components: - 1. Stator 2. Rotor 3. Electronics

Proposal

Replace the ceiling fans with BLDC in the as per preference of operating hours as office areas. Staff rooms and in security cabin and in hostels the calculation for the savings is given in the table.

Particulars	Units	BLDC fan	With BEE star rated
Existing Ceiling Fans	Watts	60	60
Proposed BLDC or EE Fans	Watts	30	45
Difference in Wattage	Watts	30	15
Avg No: of working hours/day	Hrs	10	10
No: of working days per year (Average)	Days	250	250
No: of working hours per annum	Hrs	2500	2500
Number of Fans operating	Nos	100	100
Energy Saving per Annum	kWh	7500	3750
Cost per kWh	Rs	6.5	6.5
Annual Financial Savings	Rs	48750	24375
Cost of BLDC Fans	Rs	3000	1900
Salvage value of fan	Rs	300	300
Investment for Fans	Rs	270000	160000
Simple Payback period	Months	66	79

TABLE 12: EC PROPOSAL 1

ENERGY SAVING PROPOSALS – 2

REPLACEMENT OF FLUORESCENT TUBES WITH ENERGY EFFICIENT LED LIGHTS

At present LED lights are used in very few areas. Replacement of Fluorescent lights to be done in phase manner with LED lights.

Particulars		T12	T8	T5
Existing Fluorescent lights	Watts	40	36	28
Proposed LED light	Watts	20	20	20
Difference in Wattage	Watts	20	16	8
Avg No: of working hours/day	Hrs	8	8	8
No: of working days per year (Average)	Nos	250	250	250
No: of working hours per annum	Hrs	2000	2000	2000
Number of Lights operating for change	Nos	100	200	25
Energy Saving per Annum	**kWh**	**4000**	**6400**	**400**
Cost per kWh (Average)	Rs	6.5	6.5	6.5
Annual Financial Savings	**Rs**	**26000**	**41600**	**2600**
Cost of LED light	Rs	300	300	300
Investment for LED lights	Rs	30000	60000	7500
Simple Payback period	Months	14	17	35

TABLE 13: EC PROPOSAL 2

Particulars	Unit	Details
Total Annual energy savings	kWh	10800
Total Annual Financial savings	Rs	70200
Total Investment	Rs	97500
Simple payback period	Months	17

Reason for change in the lighting system

- Lighting quality can have a dramatic influence on the attitude and performance of working persons, if they have an environment that with proper uniform lighting.
- In addition to the lumens per watt which is a lighting quantity calculation lighting quality and life of lighting system is also to be considered.
- Lighting quality can be divided into Uniformity, Glare, Colour rendering Index, coordinated colour temperature.
- In case of consistency and in uniformity, the life time of LED is far better than CFL s and FTLs.
- Deterioration of lumens or lux level in FTLs and CFL are more as compared with LED which is consistent during in its life time.
- Considering VCP (Visual Comfort Probability) LED is better option than FTLs and CFL because the glare value is lesser.
- The LED are whitish in colour than FTLs which is giving a better feeling of brightness to the persons occupied or working
- CCT of LED is 5000k which is white as compared with lesser CCT for FTLS of 4500 k
- There is no mercury content in the LED as compared with CFL and FTL s hence it is environmentally supportive.
- The life cycle data of tube lights with LED is given in the table below.

Type of lamp	Typical life in Hours	Cost per lamp	No: of lamps required during LED lifetime (led 60,000 Hours)	Replacement cost per lamp	Approximate maintenance expense for replacement	Total cost per lamp
T12	5000	45	12	540	500	1040
T8	5000	45	12	540	500	1040
T5	5000	100	12	1200	500	1700
LED	60000	800	1	800	0	800

Table 14: LIFECYCLE DATA OF LIGHT TYPES

ENERGY SAVING PROPOSALS – 3

REPLACEMENT OF CFLs WITH ENERGY EFFICIENT LED LIGHTS

At present in few areas CFLs are using which we can replace with LED lights.

Particulars		CFL
Existing Fluorescent lights	Watts	18
Proposed LED light	Watts	9
Difference in Wattage	Watts	9
Avg No: of working hours/day	Hrs	8
No: of working days per year (Average)	Nos	250
No: of working hours per annum	Hrs	2000
Number of Lights operating for change	Nos	50
Energy Saving per Annum	**kWh**	**800**
Cost per kWh (Average)	Rs	6.5
Annual Financial Savings	**Rs**	**5200**
Cost of LED light	Rs	125
Investment for LED lights	Rs	6250
Simple Payback period	Months	14

ANNEXURE-2

1. LED specification

The Department of Electronics and information technology issued "Electronics and information Technology goods order 2012" on 3rd October 2012 the following standards for LED lamps are covered.

1. IS 15885 (Part -2/section 13)
2. IS 16102 (Part-1): 2012

As per this order LED manufactures to get their product tested from BIS recognised labs.

Thus, the following electrical parameters and standards should ensure while purchasing LED in future based on the BIS standards. These are the minimum technical requirements for the acceptance of LED. Also, the LED test certificates as per the various standards mentioned below should be examined while purchasing.

Sl no	Parameters	Requirements	Applicable IS
1	Light source	SMD LED chip	LM 80/IS 16106
2	System Efficacy	>= 110 lumen /watt	IS 16106:2012
3	LED Driver Efficiency	Minimum 85%	
4	**Harmonics**	**Maximum 10%**	**IS 16102-2-2012**
5	**Power factor**	**Minimum 0.95**	**IS 16102-2**
6	Frequency	50 Hz ±3%	LM-79 report
7	Operating voltage	110V – 320V	LM 79 report
8	Surge voltage	>4 kV	LM 79 report
9	Ambient temp	-10 to 50 deg C	LM 79 report
10	Degree of protection	IP 66	IS 10322
11	CRI	Minimum 70	IS 16102 - 2

TABLE 15: LED SPECIFICATION

2. BLDC SPECIFICATION

Normal trend of one ceiling fan working hours with present cost while replacing with BLDC fan and the payback period is given in below table.

Number of working hours/day for a single ceiling fan	**Hours**	9	10	11	12	13	14	15	16	17	18	19	More than 20
Simple payback period after replacement with BLDC	**Years**	5	5	4	4	4	3	3	3	3	3	3	2

The BLDC fan test certificates as per the various standards mentioned below should be examined while purchasing.

Sl no	Parameters	Requirements	Applicable IS
1	Air delivery	215 CMM	IS 374 - 2019
2	Harmonics	Maximum 10%	IS 374 - 2019
3	Power factor	Minimum 0.95	IS 374 - 2019
4	Frequency	50 Hz ±3%	IS 374 - 2019
5	Insulation resistance	>2 MΩ	IS 374 - 2019
6	Speed	350 rpm	IS 374 - 2019
7	Maximum temperature rise	70 deg C	IS 374 - 2019
8	Degree of protection	IP 65	IS 10322

Table 16: BLDC SPECIFICATION

ABBREVIATIONS

APFC	:	Automatic Power Factor controller
AVG	:	Average
BDV	:	Breakdown voltage
BEE	:	Bureau of energy efficiency
CEA	:	Central electrical authority
CFL	:	Compact fluorescent lamp
CFM	:	Feet cube per minute
DB	:	Distribution Board
DG Set	:	Diesel Generator Set
EC	:	Energy Conservation
FD	:	Forced draft
HPSV	:	High-pressure sodium vapour
HT	:	High Tension
ID	:	Induced draft
IEC	:	International electro technical commission
IEEE	:	The Institute of electrical and electronics engineers
IS	:	Indian Standard
KG	:	Kilogram
KVA	:	Kilo Volt Ampere
KVAH	:	Kilo volt Ampere Hour
KVAR	:	Kilo volt-ampere
KW	:	Kilo Watts
KWH	:	Kilowatt-hour
LED	:	Light emitting diode
MAX	:	Maximum
MH	:	Metal halide
NEMA	:	National Electrical Manufacturers Association
OLTC	:	On load tap changer
ONAN	:	Oil natural air natural
PCC	:	Point of common coupling
PSI	:	Pound square inch
RMD	:	Registered Maximum demand
SEC	:	Specific electricity consumption
SFU	:	Switch Fuse Unit
SLD	:	Single Line Diagram
TDD	:	Total demand distortion
THD	:	Total harmonics distortion
TOE	:	Tonne of oil equivalent
UPS	:	Uninterruptible power supply
VFD	:	Variable frequency drive

INSTRUMENTS USED

SL.NO	EQUIPMENT DESCRIPTION	MAKE & MODEL
1	Power energy & harmonic Analyser	Krykard ALM 35
2	Thermal Imager	FLIR E50

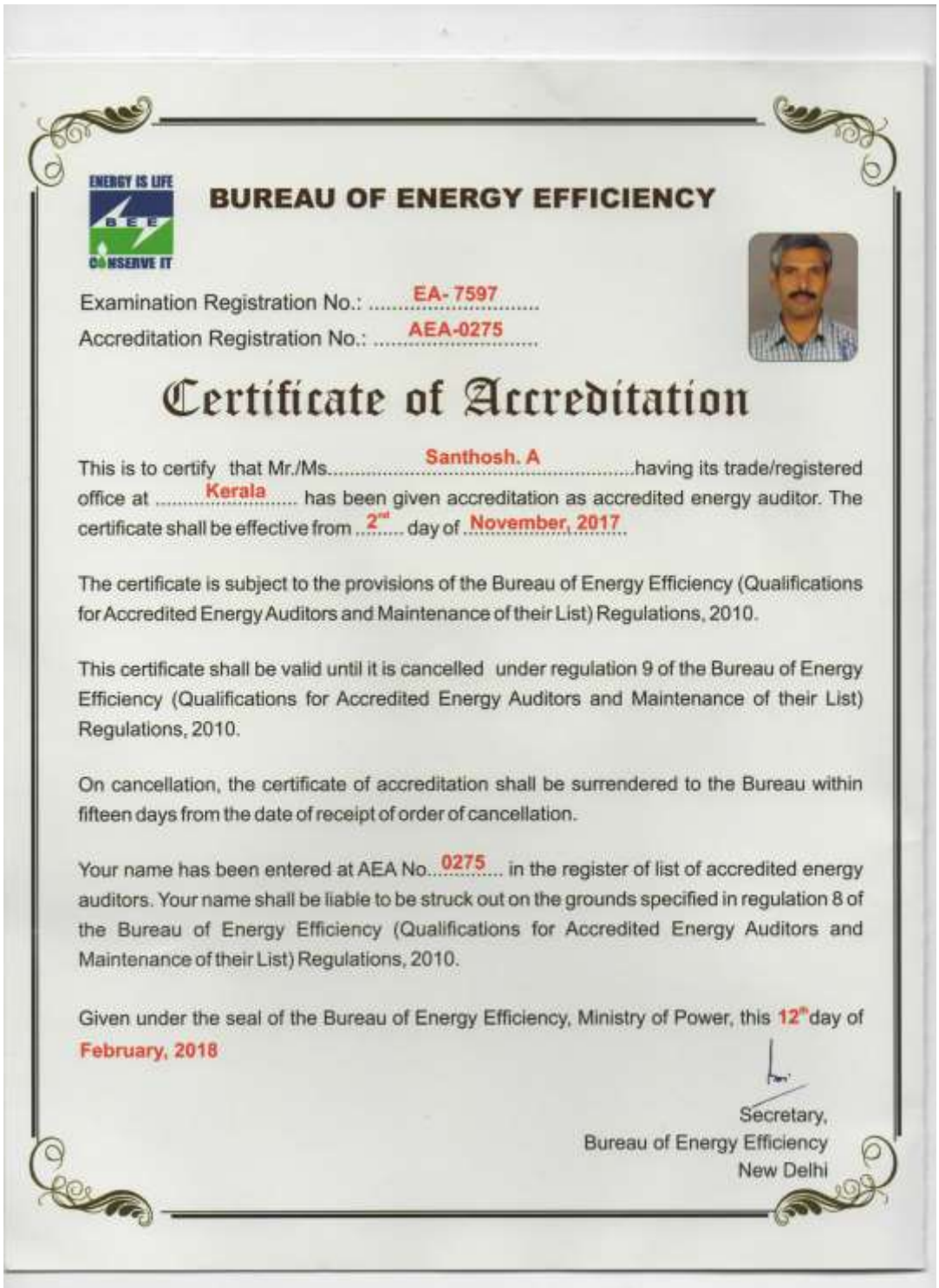
TABLE 17: INSTRUMENTS USED

REFERENCES

1. BEE energy audit books
2. CEA regulations of grid connectivity-2007
3. IEEE Std. 519-1992.
4. National lighting code – 2010

CERTIFICATES

I. BEE Accreditation Certificate



ENERGY IS LIFE
BEE
CONSERVE IT

BUREAU OF ENERGY EFFICIENCY

Examination Registration No.: EA- 7597
Accreditation Registration No.: AEA-0275

Certificate of Accreditation

This is to certify that Mr./Ms. Santhosh. A having its trade/registered office at Kerala has been given accreditation as accredited energy auditor. The certificate shall be effective from 2nd day of November, 2017

The certificate is subject to the provisions of the Bureau of Energy Efficiency (Qualifications for Accredited Energy Auditors and Maintenance of their List) Regulations, 2010.

This certificate shall be valid until it is cancelled under regulation 9 of the Bureau of Energy Efficiency (Qualifications for Accredited Energy Auditors and Maintenance of their List) Regulations, 2010.

On cancellation, the certificate of accreditation shall be surrendered to the Bureau within fifteen days from the date of receipt of order of cancellation.

Your name has been entered at AEA No. 0275 in the register of list of accredited energy auditors. Your name shall be liable to be struck out on the grounds specified in regulation 8 of the Bureau of Energy Efficiency (Qualifications for Accredited Energy Auditors and Maintenance of their List) Regulations, 2010.

Given under the seal of the Bureau of Energy Efficiency, Ministry of Power, this 12th day of February, 2018

Secretary,
Bureau of Energy Efficiency
New Delhi

I. EMC Empanelment certificate

Energy Management Centre - Kerala
(Department of Power, Govt of Kerala)

CERTIFICATE OF EMPANELMENT

This is to certify that ***M/s.Athul Energy Consultants Pvt Ltd****(4/2, Capital Legend Building, Korapath Lane, Rouund North, Thrissur)is empanelled as Energy Audit firm in Energy Management Centre Kerala to conduct mandatory energy audit as per Government of Kerala G.O (Rt) No.2/2011/PD dated 01.01.2011.*

Empanelment No:
EMCEEA-0811F-3

Scope/Area	Building	Industry -Electrical	Industry Thermal
	Yes	Yes	Yes

This empanelment is valid up to 01/02/2024
Issuing Date: 02/02/2021
Place: Thiruvananthapuram

Director,
Energy Management Centre - Kerala