

ENERGY AUDIT - 2020



DON BOSCO COLLEGE

Mannuthy, Thrissur

Kerala

EXECUTED BY



ATHUL ENERGY CONSULTANTS PVT LTD

4th FLOOR, CAPITAL LEGEND BUILDING,

KORAPPATH LANE, ROUND NORTH, THRISSUR, KERALA-680020

Ph: +91 735611199/0-6 Web: www.athulenergy.com E-Mail: info@athulenergy.com



[Signature]
MANAGER
DON BOSCO COLLEGE
MANNUTHY,
THRISSUR - 680651.
KERALA

BRIEF CONTENTS

ACKNOWLEDGEMENTS	5
ENERGY AUDIT	9
ABOUT DON BOSCO COLLEGE	10
ELECTRICITY CONSUMPTION ANALYSIS	12
ELECTRICITY SYSTEM AND EQUIPMENT ANALYSIS	14
ANNEXURE-1	16
ANNEXURE-2	24



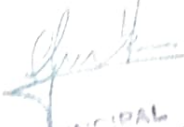

PRINCIPAL
DON BOSCO COLLEGE
MANGALURU
THRISOOR DISTRICT
KERALA

TABLE OF CONTENTS

ACKNOWLEDGEMENTS	5
1. GENERAL DETAILS	6
2. ENERGY CONSUMPTION & COST ANALYSIS	7
3. ENERGY SAVING PROPOSALS	7
4. AUDIT SUMMARY - ACTIONS	8
5. ENERGY AUDIT SUMMARY & RECOMMENDATIONS	8
ENERGY AUDIT	9
ABOUT DON BOSCO COLLEGE	10
ELECTRICITY CONSUMPTION ANALYSIS	12
1. ELECTRICITY BILLS ANALYSIS	12
2. CONNECTED LOAD DETAILS	13
ELECTRICITY SYSTEM AND EQUIPMENT ANALYSIS	14
SUMMARY OF LOADS	15
ANNEXURE-1	16
ENERGY SAVING PROPOSAL - 1	16
ENERGY SAVING PROPOSAL - 2	17
ENERGY SAVING PROPOSAL-3	19
ENERGY SAVING PROPOSAL-4	20
ANNEXURE-2	24
1. LED SPECIFICATION	24
2. BLDC SPECIFICATION	25
ABBREVIATIONS	26
INSTRUMENTS USED	27
REFERENCES	27
BEE CERTIFICATE	28



PRINCIPAL
DON BOSCO COLLEGE
MANNUTHY,
THIRISSUR-630651,
KERALA

LIST OF TABLES

TABLE 1: GENERAL DETAILS.....	6
TABLE 2: ENERGY CONSUMPTION & COST ANALYSIS.....	7
TABLE 3: ENERGY SAVING PROPOSALS.....	7
TABLE 4: ENERGY AUDIT SUMMARY - ACTIONS.....	8
TABLE 5: EB BILLS - COLLEGE.....	12
TABLE 6: LIGHT AND FAN LOADS.....	13
TABLE 7: COMPUTER AND ACCESSORIES.....	13
TABLE 8: MISCELLANEOUS EQUIPMENT.....	14
TABLE 9: MAIN LOGGING.....	14
TABLE 10: CONNECTED LOAD.....	15
TABLE 11: EC PROPOSAL 1.....	16
TABLE 12: EC PROPOSAL 2.....	17
TABLE 13: LIFECYCLE DATA OF LIGHT TYPES.....	18
TABLE 14: LED SPECIFICATION.....	24
TABLE 15: BLDC SPECIFICATION.....	25
TABLE 16: INSTRUMENTS USED.....	27

LIST OF FIGURES

FIGURE 1: COLLEGE - GOOGLE LAYOUT.....	11
FIGURE 2: CONNECTED ELECTRICAL LOAD.....	15




PRINCIPAL
DON BOSCO COLLEGE
MANNUTHY,
THIRUVANANTHAPURAM - 690651,
KERALA

ACKNOWLEDGEMENTS

We express our sincere gratitude to the **Don Bosco College, Thrissur** for giving us an opportunity to carry out the project of Energy Audit. We are extremely thankful to all the staffs for their support to carry out the studies and for input data, and measurements related to the project of Energy audit.

College Team Members

- | | | |
|---|---------------------------------|---------------------|
| 1 | Fr. Raju Chakkanattu SDB | Principal |
| 2 | Mr. Antony P James | IQAC coordinator |
| 3 | Fr Sumon Jose SDB | Administration head |

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

ENERGY AUDIT TEAM

1. **Mr. Santhosh A**
Registered Energy Auditor of Bureau of Energy Efficiency (BEE - Govt. of India)
Accredited Energy Auditor No - EA 7597
2. **Mr. Ashok KMP**
Registered Energy Manager of Bureau of Energy Efficiency (BEE - Govt. of India)
Energy Manager No - EA 25612

Yours faithfully



Managing Director
Athul Energy Consultants Pvt Ltd



PRINCIPAL
DON BOSCO COLLEGE
MANNUTHY,
THRISSUR - 680651,
KERALA

1. GENERAL DETAILS

The general details of the Don Bosco College are given below in table.

SL. NO	PARTICULARS	DETAILS
1	Name & Address of college	Don Bosco College Mannuthy, Thrissur Kerala-680651
2	Contact person	Mr. Antony P James , IQAC coordinator Ph: 9496349308 Mail: dbcqacmty@gmail.com
3	Location: Latitude & Longitude	10.52895N, 76.25698E
4	No. of Teaching staff	38
6	No. of Non-Teaching staff	15
7	No of students	712
8	Building area	4259.7 m ²
9	Land area	3.72 acres
10	Department nos	05
11	Under graduate program	06
12	Post graduate program	02
13	Hostel numbers	NIL
14	Number of electricity connection	03 nos
15	Total connected load (As per KSEBL)	75.812 kW
16	Average electricity consumption	1684 kWh/ month
17	Average annual working days	245 days
18	DG Set	100 kVA - 1 no
19	Solar power plant installation	20 kW inverter
20	Average annual exported power to the grid	22,464 kWh

Table 1: GENERAL DETAILS



[Signature]
 PRINCIPAL
 DON BOSCO COLLEGE
 MANNUTHY,
 THRISSUR - 680651,
 KERALA

2. ENERGY CONSUMPTION & COST ANALYSIS

The average annual electricity consumption and cost incurred for the college campus is listed below

Location	Units	Value	Average Cost
			Rs
Auditorium	kWh	8712	1,80,000.00
Arts block	kWh	5988	50,616.00
Science block	kWh	5508	65,964.00
Total	kWh	20208	2,96,580.00

Table 2: ENERGY CONSUMPTION & COST ANALYSIS

3. 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 25 nos of T8 tubes and 10 nos of CFL with LED	575.00	4,485.00	8,000.00	21
2	Replacement of 25 ceiling fan with BLDC fans	1875.00	14625.00	77,500.00	64
3	Use of excess electricity generated from renewable sources in another premise		89,799.84	20,000.00	3
	Total	2,450.00	1,08,909.84	1,05,500.00	
4	Installation of 20 kW Grid Tied Solar PV system	14,220.00	1,59,146.00	14,00,000.00	106

TABLE 3: ENERGY SAVING PROPOSALS



[Signature]
 PRINCIPAL
 DON BOSCO COLLEGE
 MANNUTHY
 THRISSUR - 689051
 KERALA

4. 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	Staff rooms, Office areas	Change the existing old ceiling fans with BLDC fans	Energy consumption will come down
2	Replacement of old window AC with New 5 star rated ones	Prayer hall	Change the old existing ACs with 5 star ACs.	Energy consumption will come down
3	Replacement of Fluorescent lights with LED	Class rooms, Staff rooms, office rooms	Replace with LED tubes	Energy consumption will come down
4	Use of excess electricity generated from renewable sources in another premise	Con no - 23824 integrating with 9736 and 7023	Consult with KSEBL officials and solar installer	Energy charges will reduce for other consumers

TABLE 4: ENERGY AUDIT SUMMARY - ACTIONS

5. ENERGY AUDIT SUMMARY & RECOMMENDATIONS

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

- **At present three LT connections provided in the college to cater the load.**
- College is benefitted with space in its roof top hence they can go for more solar installations in their facility and go for zero billing and claimed as solar powered college or Green college.
- **Air conditioners:** Replace one window AC with new five-star split AC.
- **Light loads:** Majority of the lighting fixtures are fluorescent type (T 8). 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.



[Signature]
 PRINCIPAL
 DON BOSCO COLLEGE
 MANNATHY,
 THRISSUR - 680001
 KERALA

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 energy consumption."**

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 Don bosco, 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.




PRINCIPAL
DON BOSCO COLLEGE
MANMATHY
THIRUVIR - 680 661,
KERALA

ABOUT DON BOSCO COLLEGE

Don Bosco College, Mannuthy is a self-financed Arts and Science College affiliated to the university of Calicut. It is a Minority Educational Institution, approved by the National Commission for Minority Educational Institutions, Government of India, and forms part of the world-wide Don Bosco Educational Services.

With the approval of the Government of Kerala (GO(MS) No 10/2005/ Higher Education, Thiruvananthapuram, 1404/2005) Don Bosco College, Mannuthy, began its mission of moulding the young through a holistic educational process from 2005.

Vision statement of the college

To form globally integrated persons who champion the cause of justice, truth, peace and respect. To groom intellectually competent, morally upright, psychologically, integrated, physically able, and socially responsible persons through holistic and innovative education.

The students should be capable of championing the cause of justice, love, truth and peace in order to develop our nation. They equip themselves to be in the forefront to create a just and human society that respects human dignity and promotes religious harmony. They are prepared to shoulder the responsibility of fostering national integration, and the cultural heritage of the country. They are empowered to stand on their own feet, facing bravely and successfully, this world of acute competition.

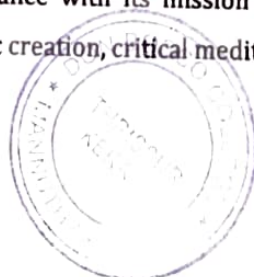
Our mission

Don Bosco College, Mannuthy, believe that education should help people to lead better lives, earn better income, and take their position in the higher echelons of society. It should give them the strength to understand and cope with the hard realities of life, thus paving the way for fulfilment in life. With this end in view, Don Bosco College leads the students, regardless of the programme selected, through an integrated programme of scientific formation and personality development.

Department details

1. Department of languages

The department of Languages officially commenced during the academic year 2019-2020. It was inaugurated with the vision to achieve Excellence in academics, Harmony in curricular and co-curricular activities, Commitment to the self and the community and Service to the society. The department of English in consonance with its mission statement is committed to promote an intellectual climate through artistic creation, critical meditation and innovative ideation.



2. Department of commerce

The department started functioning from the year 2005 with the course of B COM Computer Application. Available seats were 30 which were raised to 60 later on. Ms Mary Hormise was the first Head of Department. BCOM Finance was introduced in the year 2014. M COM Finance was introduced in 2017. At present we have M COM Finance with 24 seats, B COM Computer Application with 60 seats and BCOM Finance with 60 seats. They have 10 qualified and dedicated faculty members headed by Ms Joby Jacob. They are offering five add on courses to students namely ACCA, Certificate in Logistics & Warehousing, Tally, Both UG and PG students are doing individual project under the guidance of our faculty members. All the final year students are getting a chance to learn MS OFFICE at free of cost under the guidance of Mr. José A I.

3. Department of electronics

The Department of Electronics aims at providing quality, academic and technical education in the field of electronics. The department is committed to impart right kind of skills to the students to excel in this highly technical, competitive era of globalization. The Department offered degree programmes in Electronics at the under graduate level from 2005 to 2016. It also offers post graduate Programme in Applied Electronics from 2015.

4. Department of management

The department offers BBA program which allows a student to specialise in the field of Marketing with the guidance and support of faculty members with a rich experience in academic excellence from 2005 to 2019.

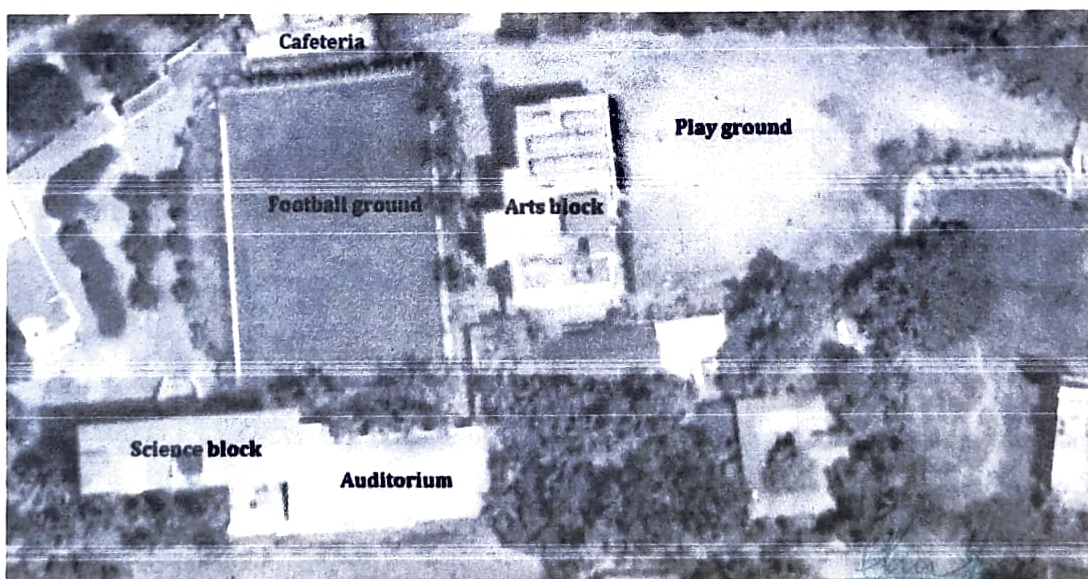
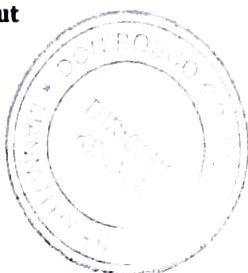


Figure 1: College – google layout



PRINCIPAL
 DON BOSCO COLLEGE,
 MANNUTHY,
 THIRISSUR - 680651,
 KERALA

ELECTRICITY CONSUMPTION ANALYSIS

1. ELECTRICITY BILLS ANALYSIS

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

College Building

Section	Consumer no-1 Mannuthy	Consumer no-2 Mannuthy	Consumer no-3 Mannuthy
Consumer number	1156751009736	1156753023824	1156751007023
Tariff/phase	LT-6F/Three	LT-6F/Three	LT-6F/Three
Connected load (kW)	35	29.812	11
Meter type	TOD	Net meter	TOD
Average fixed charge (Rs)	4900	4200	1540
Average kWh consumption	726	499	459
Average kWh export	NIL	1872	0
Average kWh charges (Rs)	9981	4218	3581.13
Average bill amount (Rs)	15897	4218	5497
Cost per unit (Rs/kWh)	13.75	NIL	7.80

TABLE 5: EB BILLS - COLLEGE

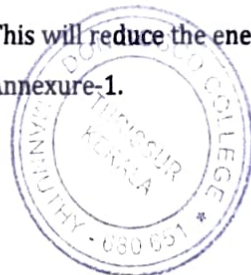
Inference

- As per the tariff structure LT 6F have Rs 7.8 per unit, if the consumption rovers around 0-500 units monthly. However, if the monthly units are above 500, the charge is Rs 9 per units.
- The average annual expenses for electricity consumption is around Rs. 3.07 lakhs.
- In that 70% of the consumption is by consumer numbers - 9736 and 7023.
- Average monthly export from the consumer number - 23824 is 1872 kWh, where 20 kW solar power plant installed in the terrace area.

Suggestions

- As the consumer number - 23824 generates 1872 kWh monthly, the Don Bosco can wheel this excess power that supplies to the grid to the other two consumers (9736 and 7023) as per the KSERC (Renewable energy & net metering) regulation 2020 - section 17.

- This will reduce the energy charges considerably which mentioned in the Annexure-1.



PRINCIPAL
DON BOSCO COLLEGE
MANNUTHY
THRISUR - 680651,
KERALA

2. CONNECTED LOAD DETAILS

LIGHT AND FAN LOADS

The total connected light and fan load in the college is given below in the table

Sl no	Particulars	Watts	Number	Total kW
1	Ceiling fan	60	78	4.68
2	Fluorescent tube	36	75	2.7
3	LED tube	20	25	0.5
4	CFL	11	36	0.396
5	LED bulb	5	43	0.215
6	Incandescent bulb	40	5	0.2
7	Spot light LED	100	3	0.3
Total				8.991

Table 6: Light and fan loads

Inference

- Considering the number of working hours, the fan loads would contribute 30% of the total consumption in the college.
- In that majority of the consumption by the office areas and staff rooms in the buildings as it will run approximately 8 hours per day.

Suggestion

- Suggesting to replace the continuous run ceiling fans with BLDC 1200 mm fans which reduce the power consumption to 50%.
- The details calculation is given in the Annexure-1.
- Replace the fluorescent light fittings with LED tube in stage wise (as an when the existing light fittings need replacement), which will reduce the power consumption in long run.
- Retrofit LED tubes are also available which will works on the existing tube fittings, which can replace with damaged fluorescent ones.

COMPUTERS, PRINTERS AND PROJECTORS

The list of computer and related accessories in the college is given in the table below.

Equipment	Watts	Count	Total kW
Computer System	120	99	11.88
Printer	250	10	2.5
Photo stat machine	550	2	1.1
Projector	350	5	1.75
Total in kW			17.23

Table 7: Computer and accessories



PRINCIPAL
DON BOSCO COLLEGE
MANNUTHY,
THRISSUR - 680657
Page 13 of 28

MISCLANEOUS EQUIPMENTS

The other equipment that exists in the buildings are given in the table below

Equipment	Watts	Count	Total kW
Air conditioners	1500	3	4.5
Water cooler	250	3	0.75
Induction Cooker	1000	1	1
Fridge	250	1	0.25
Lab load			3.5
Total			10

Table 8: Miscellaneous equipment

ELECTRICITY SYSTEM AND EQUIPMENT ANALYSIS

This section analyze the electricity performance in the building. The electricity consumption was analyzed in the main incomer at the secondary of the KSEBL transformer, which includes all the three consumers. The Secondary side of the transformer was logged using power quality analyser Krykard ALM 35 for 4 hours and measured data is given in following table. The measurement-averaging period was 01 minute.

Measurement values - Secondary side				
Actual Energy for 04 Hrs	kWh		12.8	
Apparent Energy for 04 Hrs	kVAh		43.2	
Exported units	kWh		10.5	
Power Factor			0.75	
Particulars	Units	Minimum	Maximum	Average
Active Power	kW	-8.57	14.50	2.72
Apparent Power	kVA	8.72	16.53	9.20
Reactive Power	kVAr	0	8.35	3.84
Voltage Line	Volts	404	429	414
Current	Amps	7.5	31.5	12.75
THD V	%	0.9	1.8	1.3
THD A	%	3.6	41.7	35.5
Voltage Imbalance	%	0	0.7	0.3
Current Imbalance	%	0.7	35.6	22.2

Table 9: Main logging



DON BOSCO COLLEGE
 MANNUTHY,
 THRISSUR - 680011
 KERALA

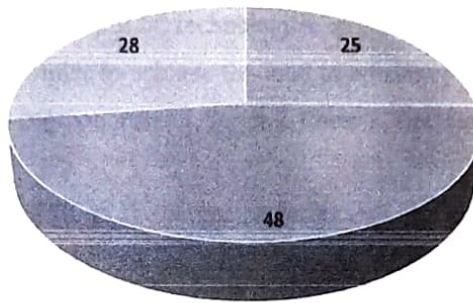
SUMMARY OF LOADS

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

Sl.No:	Particulars	Total Load
1	Light and Fan Loads	8.991 kW
2	Computers & accessories	17.23
3	Miscellaneous equipment's	10
	Total	36.221

TABLE 10: CONNECTED LOAD

Connected Load



■ Light and Fan Loads ■ Computers & accessories ■ Miscellaneous equipment's

FIGURE 2: CONNECTED ELECTRICAL LOAD



[Signature]
 PRINCIPAL
 DON BOSCO COLLEGE
 MANJERI,
 THIRUVANANTHAPURAM - 680601,
 KERALA

ANNEXURE - I

ENERGY SAVING PROPOSAL - I

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

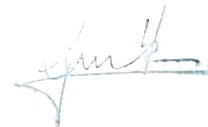
Proposal

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	Unit	With BLDC
Power of existing ceiling fans at full speed	Watts	60
Power of replacing fan	Watts	30
Difference in Wattage	Watts	30
Avg No: of working hours/day	Hrs	10
No: of working days per year (Average)	Nos	250
No: of working hours per annum	Hrs	2500
Number of Ceiling Fans operating	Nos	25
kWh Saving per Annum	kWh	1875
Cost per kWh (Average)	Rs	7.8
Annual Financial Savings	Rs	14625.00
Cost of replacing Fan per piece	Rs	3100
Investment for replacing Fan	Rs	77500
Simple Payback period	Months	64

TABLE 11: EC PROPOSAL 1




 PRINCIPAL
 DON BOSCO COLLEGE
 MANNUTHY,
 THRISSUR - 680001
 KERALA

ENERGY SAVING PROPOSAL - 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	Units	Fluorescent tube with LED	CFL with LED
Power of Fluorescent lights	Watts	36	11
Proposed LED light	Watts	20	5
Difference in Wattage	Watts	16	6
Avg No: of working hours/tube/day	Hrs	5	5
No: of working days per year (Average)	Nos	250	250
No: of working hours per annum	Hrs	1250	1250
Number of Lights operating	Nos	25	10
kWh Saving per Annum	kWh	500.00	75.00
Cost per kWh (Average)	Rs	7.8	7.8
Annual Financial Savings	Rs	3,900.00	585.00
Cost of LED tube	Rs	300	50
Investment for LED lights	Rs	7,500	500
Simple Payback period	Months	23	10

Summary

Annual Energy Savings	kWh	575.00
Total Financial Savings	Rs	4,485.00
Total investment	Rs	8,000.00
Payback period	Months	21

TABLE 12: EC PROPOSAL 2



PRINCIPAL
DON BOSCO COLLEGE
MANNUTHY,
THRISUR - 690651,
KERALA



DON BOSCO COLLEGE

(Affiliated to the University of Calicut)

Mannuthy, Thrissur 680 651, Tel: 0487 - 2373730, 2371337, 2370447

www.dbcollegemannuthy.edu.in, E-mail: dbciqacmty@gmail.com , dbtrichur@gmail.com

DECLARATION BY HEAD OF THE INSTITUTION

This is to certify that Quality audits on environment and energy regularly undertaken by the Institution.

Principal



PRINCIPAL
DON BOSCO COLLEGE
MANNUTHY,
THRISSUR - 680651.
KERALA

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 4500k
- 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 13: Lifecycle data of light types



[Signature]
 PRINCIPAL
 DON BOSCO COLLEGE
 MANNUTHY,
 THRISUR - 680651,
 KERALA

ENERGY SAVING PROPOSAL-3

USE OF EXCESS ELECTRICITY GENERATED FROM RENEWABLE SOURCES IN ANOTHER PREMISE

Background

As the consumer number - 23824 generates 1872 kWh monthly, the Don Bosco can wheel this excess power that supplies to the grid to the other two consumers (9736 and 7023). The present export unit charges are Rs 3 per unit. However, the wheeling charges are: Rs 0.55/unit and transmission charges are Rs 0.39 per unit.

Proposal

By wheeling the excess power from the consumer number 23824 to other two, the college can have sufficiency cost savings without any further expense. The calculation for the same is given in the table below.

Particulars	Units	Values
Wheeling charges for renewable energy	Rs/kWh	0.55
Transmission charges	Rs/kWh	0.39
Present export charges	Rs/kWh	3
Present tariff for import	Rs/kWh	7.8
Present export units - Annual	kWh	22464
Present export benefits	Rs	67,392.00
Net annual wheeling charges	Rs	21,116.16
Present annual consumption by other consumers	kWh	14220
Present annual charges by other consumers	Rs	1,10,916.00
Reduction of amount in other consumers by wheeling	Rs	89,799.84
Implementation cost	Rs	20,000.00
Payback period	Months	2.67



PRINCIPAL
DON BOSCO COLLEGE
MANNUTHY,
THRISUR - 680651,
KERALA

ENERGY SAVING PROPOSAL-1

INSTALLATION OF 20 kW SOLAR ON GRID SYSTEM

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. The advantages of solar power are:

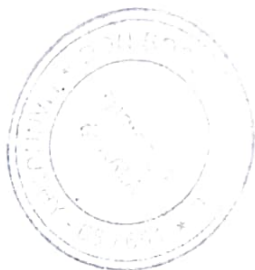
- The solar energy is more evenly distributed in the world than wind or biomass.
- It is well proven and demonstrated technology
- It promises to be most cost-effective renewable power at high volumes.


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.

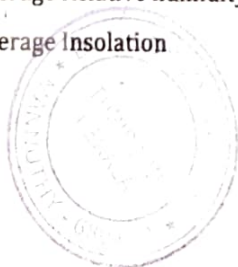



PRINCIPAL
DON BOSCO COLLEGE
MANNUTHY,
THRISUR - 680651,
KERALA



LOCATION OF DON BOSCO COLLEGE

	Unit	Climate data location
Latitude	°N	10.52895N
Longitude	°E	76.25698E
Elevation	m	08
Average Relative humidity	%	72
Average Insolation	kWh/m ² /d	5.1



Mannuthy
 PRINCIPAL
 DON BOSCO COLLEGE
 MANNUTHY,
 THRISSUR - 680681

Climate parameters of last 22 years average

Month	Air temperature (Average) °C	Relative humidity %	Daily solar radiation horizontal kWh/m ² /d	Atmospheric pressure kPa	Wind speed m/s	Earth temperature °C
January	24.9	55.5	5.49	96.6	4.23	26.3
February	25.8	56.2	6.07	96.6	3.54	28.4
March	26.9	59.5	6.52	96.5	3.94	30.5
April	26.4	71	6.39	96.4	4	29.8
May	25.8	77.2	5.6	96.3	4.71	28.5
June	24.6	83.9	3.75	96.2	7.04	25.9
July	24	85.1	3.55	96.3	6.84	24.8
August	23.8	84.8	4.07	96.4	6.56	24.8
September	23.9	82.4	4.93	96.4	4.83	25.5
October	24.4	78.6	4.74	96.5	3.59	25.8
November	24.9	65.6	5.01	96.6	3.96	25.9
December	24.9	56.6	5.27	96.7	5.01	25.8
Annual	25	72	5.1	96.4	4.86	26.8

Design Space Requirement for Panel Mounting:

A minimum shadow free space of 8 to 10m² is required for the solar panel mounting for the capacity of 1KW. The panel must be mounted facing south with appropriate inclination for obtaining maximum output from installation. Suitable structure according to wind speed and roof structure must be used without shading the panel surface.

Space availability in college at roof top: 200 m²

Approximate possible installation of solar power plant: 20 kW

Solar PV modules and Inverter:

Solar PV panels of 300 W or above must be selected for the rooftop installation above 10KW. The efficiency of individual panel must not be less than 15%. String inverter with MPPT charge controllers is more suitable for the solar power plant installation in roof top. Equipment and installation must be complied with CEA grid regulations-2013



[Handwritten Signature]
 DON BOSCO COLLEGE
 MANNUTHY,
 THRISUR Page 22 of 28
 KERALA

SAMPLE SYSTEM ARCHITECTURE

Electrical

Component	Production (kWh/yr.)	Fraction %
PV array	28,000	100
Grid purchases	0	0
Approx. Total consumption	28,000	

As the present annual unit consumption through grid is only 22,000 units, by the installation of 20 kW system, the college can be entirely supplied from the solar power plant.

Details of Solar PV system and its possible production rate is given below in table

Quantity	Units	Value
Rated capacity	kW	20
Mean output	kWh/d	80
Capacity factor	%	17.1
Total production	kWh/yr	28,000
Maximum output	kW	18
Present annual average consumption through grid in consumer 9736 and 7023 (through wheeling to nearby consumer)	kWh	14220
PV penetration	%	100

Summary:

Description	Value
Approximate unit savings per year (kWh)	14,220
Cost per unit of electricity (Rs)	7.8
Export energy (kWh)	13,780
Cost for export energy (Rs)	3.5
Approximate annual financial savings (Rs)	1,59,146.00
Approximate investment for installation of 20 kW SPV system (Rs)	14,00,000.00
Payback period (years)	8.80



[Signature]
 PRINCIPAL
 DON BOSCO COLLEGE
 MANNUTHY,
 THRISSUR - 680651,
 KERALA

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 14: LED SPECIFICATION



[Signature]
 PRINCIPAL
 DON BOSCO COLLEGE
 MANNUTHY,
 THRISSUR - 680651,
 KERALA

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	Hour	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

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 15: BLDC SPECIFICATION



[Signature]
 PRINCIPAL
 DON BOSCO COLLEGE
 MANNUTHY,
 THRISSUR - 680651,
 KERALA

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

[Handwritten Signature]
 DON BOSCO COLLEGE
 TRISSUR
 KERALA


INSTRUMENTS USED

SLNO	EQUIPMENT DESCRIPTION	MAKE & MODEL
1	Power energy & harmonic Analyser	Krykard ALM 35
2	Thermal Imager	FLIR E50

TABLE 16: 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


PRINCIPAL
DON BOSCO COLLEGE
MANNUTHY,
THRISSUR - 680651,
KERALA

BEE CERTIFICATE



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


PRINCIPAL
DON BOSCO COLLEGE
MANNUTHY,
THRISSUR - 680651,
KERALA