ENERGY AUDIT REPORT

ST.BERCHMANS COLLEGE

CHANGANASSERY

Executed by

OTTOTRACTIONS
Energy-Engineering-Environment

2023

OTTOTRACTIONS
Energy - Engineering - Environment

DNRA 170, Valiyavila, Thirumala P O, Thiruvananthapuram 695006
Ph/Fax:0471 3966250,2368747 Helpline: +919447068747, 9447621674,
email:ottotractions@email.com, otenergy@gmail.com
www.ottotractions.com

Accredited Energy Auditor: AEA-33
Empanelled Accredited Energy Auditor: EmAEA-33
Bureau of Energy Efficiency,
Government of India.

Empanelled Energy Auditor: EMCEEA-0211F,
EMC (Energy Management Centre-Kerala)

ENERGY AUDIT REPORT

ST. BERCHMANS COLLEGE

CHANGANASSERY

OTTOTRACTIONS
Energy-Engineering-Environment

Energy Audit Report

St. Berchmans College, Changanassery

Report No: EA 985
2023

Empaneled Accredited Energy Auditor, AEA 33
Bureau of Energy Efficiency
Government of India

Empaneled Energy Auditor, EMCEEA-0211F,
Energy Management Centre
Government of Kerala.

Authorized Energy Auditor, GEDA/ENC/EAC: Autho/2014/8/103/2316,
Gujarat Energy Development Agency
Government of Gujarat

Empaneled Energy Auditor, India SME Technology Services Ltd
A joint Venture of SIDBI, SBI, Indian Bank, Oriental Bank of Commerce
& Indian Overseas Bank

About OTTOTRACTIONS

OTTOTRACTIONS established in 2005, is an organization with proven track record and knowledge in the field of energy, engineering, and environmental services. They are the first Accredited Energy Auditor from Kerala for conducting Mandatory Energy Audits in Designated Consumers as per Energy Conservation Act-2001. Government of Kerala recognized and appreciated OTTOTRACTIONS by presenting its prestigious “The Kerala State Energy Conservation Award” for the best performance as an Energy Auditor.

Acknowledgment

We were privileged to work together with the administration and staff of St. Berchmans College, Changanassery for their timely help extended to complete the audit and bringing out this report.

With gratitude, we acknowledge the diligent effort and commitments of all those who have helped to bring out this report.

We also take this opportunity to thank the bona-fide efforts of audit team for unstinted support in carrying out this audit.

We thank our consultants, engineers and backup staff for their dedication to bring this report.

Thank you.

B V Suresh Babu
Accredited Energy Auditor
AEA 33, Bureau of Energy Efficiency
For OTTOTRACTIONS

Contents

Certification

This is to certify that

The data collection has been carried out diligently and truthfully;

All data monitoring devices are in good working condition and have been calibrated or certified by approved agencies authorised and no tampering of such devices has occurred;

All reasonable professional skill, care and diligence had been taken in preparing the energy audit report and the contents thereof are a true representation of the facts;

Adequate training provided to personnel involved in daily operations after implementation of recommendations; and

The energy audit has been carried out in accordance with the Bureau of Energy Efficiency (Manner and Intervals of Time for the Conduct of Energy Audit) Regulations, 2010.

SURESH BABU B V
ACCREDITED ENERGY AUDITOR (AEA 33)

Executive Summary					
Consolidated Cost Benefit Analysis of Energy Efficiency Improvement Projects					
St Berchmans College (Autonomous)					
Sl No	Projects	Investment	Cost saving	SPB	Energy saved
		(Lakhs Rs)	(Rs)/Yr	Months	kWh/Yr
1	Energy Saving in Lighting by replacing existing 800 No's T8 (40W) Lamps to 18W LED Tube	2.40	1.369	21.04	16896
2	Energy Saving by replacing existing 300 No's in-efficient ceiling fans with Energy Efficient Five star fans	9.00	0.914	118.10	11290
3	Installation of 220kWp Solar Power Plant	121.00	37.38	38.84	281050
	Total	**11.40**	**2.28**	**139.15**	**28185.60**
(The saving are projected as per the assumed operation time observed based in the discussions with the plant officials. The data of saving percentages are taken from BEE guide books and field measurements.)					

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Introduction

A detailed energy audit has been carried out at St. Berchmans College, Changanassery by OTTOTRACTIONS in December 2022. During the energy audit energy saving opportunities has been identified to help improving energy efficiency of the facility. OTTOTRACTIONS is an Accredited Energy Auditor of Bureau of Energy Efficiency and Empaneled Energy Auditor of Energy Management Centre, Government of Kerala.

This energy audit report complies with the clauses in *Energy Conservation Act, 2001* on mandatory energy audit (**Form 4** [refer regulation 6(2)] guidelines for preparation of energy audit report) and complies with the G.O (Rt) No.2/2011/PD dated 01.01.2011 issued by Government of Kerala on mandatory energy audit.

1.1. General Building details and descriptions

St Berchmans College is the first higher education institution of the Archdiocese of Changanacherry. This institution was founded in 1922 by Venerable Mar Thomas Kurialacherry, Bishop of Changanassery diocese. It was started, with the noble aim of the Universal Catholic Church, to mould young men and women who will strive for excellence in every walks of life and human service. The College is recognized under sections 2 (f) and 12 (B) of the UGC Act 1956. The College was first accredited with 'Five Star' in 1999 and reaccredited with 'A+' in 2006. In the third cycle of accreditation in 2012, the college was again graded at A. In 2017, the college was again reaccredited with 'A' grade. The University Grants Commission (UGC) and the

Government of Kerala granted autonomy to this college in the year 2014. In 1996 and 1997, it won the coveted “R Shankar Award” for the Best College in the State, instituted by the Government of Kerala. In 2004, the UGC identified the College under its “College with Potential for Excellence” scheme. The National Commission for Minority Educational Institution, New Delhi has granted minority status to the college in 2010. All the Science Departments are supported by the FIST of DST, Government of India. It has been ranked among the top 100 Indian colleges by the National Institutional Ranking Framework (NIRF), MHRD, Government of India since 2018.

Occupancy Details	
Particulars	2021-22
Total Students	2994
Staffs	165
Total Occupancy of the college	3159

For calculating specific energy consumption, the total built-up area is taken into account.

Energy audit team

The Energy Audit team is listed below. Besides this list various domine experts also participated in this project.

1. Suresh Babu B V, Accredited Energy Auditor, AEA 33
2. B. Zachariah, Chief Technical Consultant
3. Abin Baby, Project Engineer
4. Devan J, Project Engineer
5. Jomon J S, Project Engineer

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Process description

The energy audit has been carried out at St Berchmans College. The following is the baseline data of this building.

BASELINE DATA SHEET FOR GREEN AUDIT											
1	Name of the Organisation	St Berchmans College (Autonomous)									
2	Address (include telephone, fax & e-mail)	ST. BERCHMANS COLLEGE, CHANGANASSERY, KOTTAYAM, 686101, KERALA Email: scas@saintgits.org									
2	Year of Establishment	1922									
3	Name of building and Total No. of Electrical Connections/building	HT II (A) GENERAL (1)									
4	Total Number of Students	Boys	1872	Girls	1122	Total	2994				
5	Total Number of Staff	165									
6	Total Occupancy	3159									
7	Total area of green cover (Acre)	20%									
8	Type of Electrical Connection	HT	1	LT	0						
9	Total Connected Load (kW)	363									
10	Average Maximum Demand (KVA)	140									
11	Total built up area of the building (M^2)	41294									
12	Number of Buildings	8									
13	Average system Power Factor	0.94									
14	Details of capacitors connected	NA									
15	Transformer Details (Nos., kVA, Voltage ratio)	TR 1									
		315									
15	DG Set Details (kVA,)	DG1	DG2	DG3	DG4	DG5	Remarks				
		125	100								
16	Details of motors	Rating		Nos.		Remarks					
		5 to 10		2							
		10 to 50									
		Above 50									

3

Energy and utility system description

3.1.1 Electricity

Electricity is purchased from KSEB under HT II (A) GENERAL 1, the details are given below. A 125 kVA and 100 kVA Diesel Generator are in operation at this campus

Base line Data (Electricity Bill)	
Code	EA 988
Facility	St Berchmans College (Autonomous)
Provider	KSEB
Contract Demand (kVA)	160
Connected Load (KW)	363
Tariff	HT II (B) GENERAL
Consumer Number	1346360002582
Energy Charge Rs/ kWh Z1	5.85
Energy Charge Rs/ kWh Z2	8.775
Energy Charge Rs/ kWh Z3	4.387
Demand Charge Rs/ kVA	420
Excess Demand Rs/kVA	210
Energy Bill Analysis interval	2021-22

3.2. Thermal Energy / Transportation

There are vehicles operated from college for transportation. LPG is used for cooking in the canteen and diesel is used to operate Diesel Generators.

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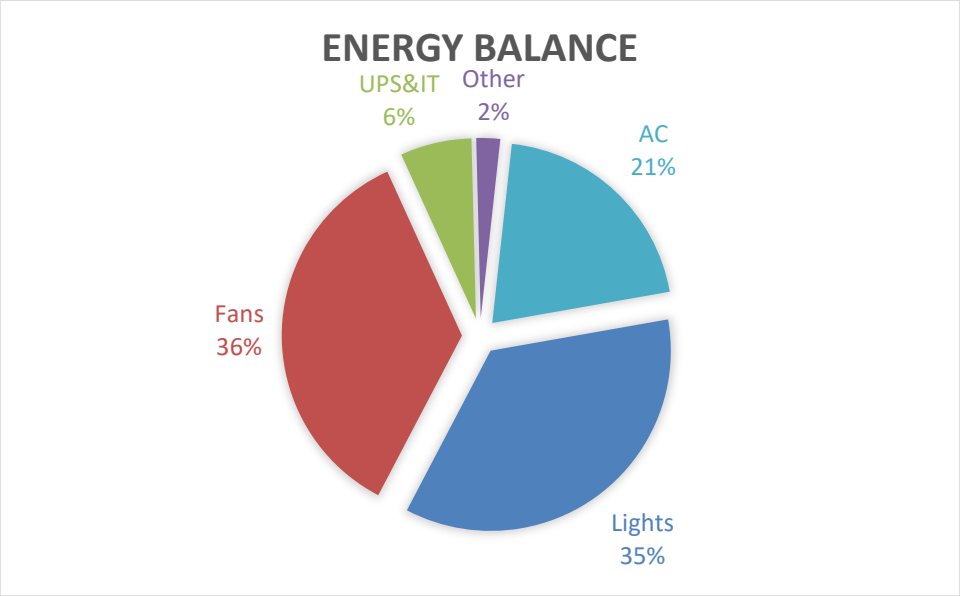
Energy Balance



36 % of the total energy consumed in this facility is used to operate Fans. Lights uses 35%, UPS uses 6% AC uses 21% and Others uses 2%

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Performance evaluation of major utilities and process equipment's /systems.

5.1. List of equipment and process where performance testing was done.

5.1.1. Electrical System

5.1.2. Lighting & Fans

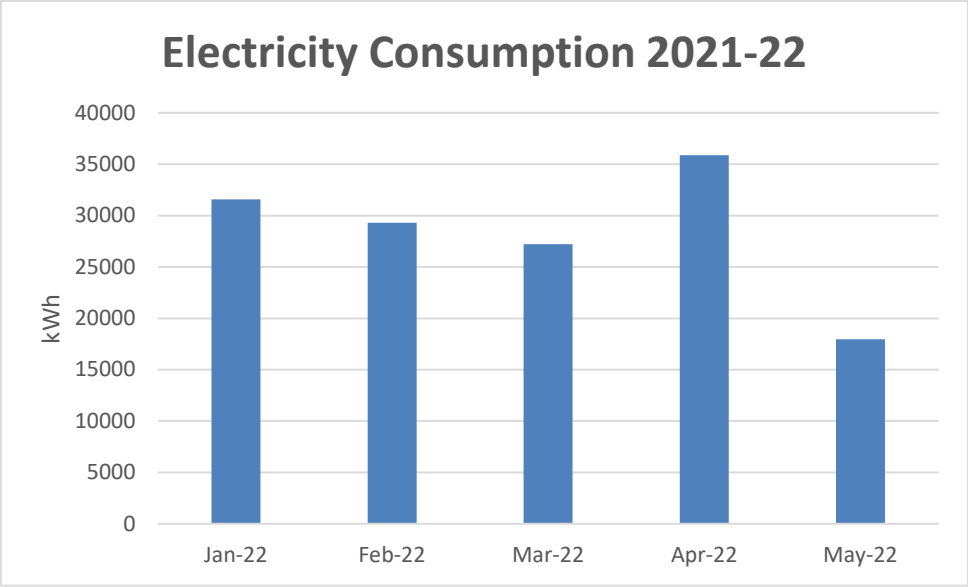
5.2. Results of performance testing

5.2.1. Electrical System

The average unit cost of electricity is **8.10 Rs/kWh**. This is taken as the basis for the financial analysis of electrical energy efficiency projects. The information on average energy consumption is taken from the historical electricity bill analysis.

Electricity Consumption

Electricity Bill Details (2021-22)												
Month	Name of the Consumer				St Berchmans College (Autonomous)							
	Contract		160		Consumer number & Section			1346360002582				
	Tariff		HT II (B)					Changanacherry				
	kWh				kVA			PF	PF Incentive	PF Penalty	Rs (Total)	Rs/kwh
	Z1	Z2	Z3	Total	Z1	Z2	Z3					
Dec-21	18776	4572	8242	31590	130	57	50	0.97	1781	0	243091	**7.70**
Jan-22	16420	4718	8174	29312	131	59	54	0.95	0	0	231720	**7.91**
Feb-22	14868	4482	7876	27226	100	61	55	0.96	769		213810	**7.85**
Mar-22	20864	5366	9638	35868	140	66	55	0.96	1011	0	274346	**7.65**
Apr-22	7920	3490	6542	17952	87	60	49	0.91		2022	158281	**8.82**
May-22	10154	3166	5722	19042	61	41	37	0.91		2149	165291	**8.68**



Diesel

The campus has Two Diesel Generators in operation. The details of Diesel consumption is given below.

Diesel Consumption Details				
	Transportation	Generator	Total	cost
	in L	in L	in L	in Rs
21-22	0	595	595	56542

Annual Electricity Consumption (kWh)		
Consumer No	**2021-22**	Connected Load (kW)
1346360002582	321980	363
Total	**321980**	**363**

St Berchmans College (Autonomous)		
		2021-22
1	Electricity KSEB (kWh)	321980
2	Electricity Solar - Off grid (kWh)	0.00
3	Electricity (KSEB + Off grid) kWh	321980
4	Electricity Grid Tied (kWh)	63875
5	Diesel (L)	595
6	LPG (kg)	600.00
7	Biogas (m3)	0.00

Energy Consumption Profile		
Sl No	Fuel	2021-22 (kCal)
1	Electricity	276902800
2	Diesel	6249379
3	LPG	7200000
4	Biogas	0
Total		290352179

Solar Power Plant

Solar Power Plant	
Capacity (kWp)	Annual Generation
50	63875

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Energy efficiency in utility and process system

The specific energy consumption is normally taken as the ratio of total energy consumed to the total are of building.

OTTOTRACTIONS- ENERGY AUDIT		
St Berchmans College (Autonomous)		
Energy Performance Index (EPI)		
Sl No	**Particulars**	2021-22
1	Total building area (m^2)	41294
2	Annual Energy Consumption (kCal)	290352179
3	Annual Energy Consumption (kWh)	337619
4	Total Energy in Toe	29.04
5	Specific Energy Consumption kWh/m^2	8.18

The Energy Performance Index (EPI) is

8.18 kWh/m^2

The EPI of 2021-22 may be taken as benchmark.

7

Evaluation of energy management system

Energy management policy

There is no written energy policy available, but environment policy is available which includes energy conservation also. A draft energy management policy is given below. The management may constitute an energy management policy and display the same in the plant to motivate the staff.

ST. BERCHMANS COLLEGE, CHANGANASSERY

ENERGY POLICY

(Draft)

We are committed to optimally utilize various forms of energy in a cost effective manner to effect conservation of energy resources. We are committed to conserve the energy which is a scarce resource with the requisite consistency in the efficiency, effectiveness in the cost involved in the operations and ensuring that production quality and quantity, environment, safety, health of people are maintained. We are also committed to increase the renewable energy share of the total energy we use.

We are also committed to monitor continuously the saving achieved and reduce its specific energy consumption by minimum of 2% every year.

Date ----------

Head of the Institution

7.1. Energy management monitoring system

- **Energy Management Cell** has to be constituted with an objective to revise action plan for energy conservation thereby reducing the production cost.
- Energy conservation tips/ posters are displayed in crucial points.
- Use of renewable energy has to be encouraged.

7.2. Training to staff responsible for operational and Documentation.

- The staff and students need to be made more aware of the importance of energy saving and management.
- Log books shall be maintained to record Electricity Consumption and Diesel consumption.
- Meter reading shall be taken and compared with KSEB regularly.
- Better operating practices regarding appliances and fixtures should be taught to the staff.

7.3. Best Practices

- Have solid waste management program
- Conducted Green Audit.
- Have different social and environmental clubs
- Installed LED bulbs
- Conducted Energy Conservation Training Programs
- Installed Solar Power Plant

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Energy Conservation Measures and Recommendations

Executive Summary					
Consolidated Cost Benefit Analysis of Energy Efficiency Improvement Projects					
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2	Energy Saving by replacing existing 300 No's in-efficent ceiling fans with Energy Efficient Five star fans	9.00	0.914	118.10	11290
3	Installation of 220kWp Solar Power Plant	121.00	37.38	38.84	281050
	Total	**11.40**	**2.28**	**139.15**	**28185.60**
(The saving are projected as per the assumed operation time observed based in the discussions with the plant officials. The data of saving percentages are taken from BEE guide books and field measurements.)					

OTTOTRACTIONS- ENERGY AUDIT	
Energy Saving Proposal Code	
Energy Saving in Lighting by replacing existing 800 No's T8 (40W) Lamps to 18W LED Tube	
Existing Scenario	
800 numbers of T8(40 W) lamps were identified during the energy audit field survey in the facility. During discussion with officers it is observed that the average utility of these fittings are of 30%.	
Proposed System	
The existing T8 may be replaced to LED Tube of 18W in phased manner and the savings will be of 55% (inclusive of improved light output and reduced energy consumption)	
Financial Analysis	
Annual working hours (hr)	2400
No of fittings	800
Total load (kW)	32.00
Annual Energy Consumption (kWh)	30720
Expected Annual Energy saving for replacing all fittings (kWh)	16896
Cost of Power	8.10
Annual saving in Lakhs Rs (1st year)	1.37
Investment required for complete replacements [@Rs 300 per fittings](Lakhs Rs)	2.40
Simple Pay Back (in Months)	21.04

OTTOTRACTIONS- ENERGY AUDIT	
Energy Saving Proposal	
Energy Saving by replacing existing 300 No's in-efficent ceiling fans with Energy Efficient Five star fans	
Existing Scenario	
There are 300 numbers of ceiling fans installed in the facilty with minimum 8 hrs a day operation. All are conventional type and most of them are very old.	
Proposed System	
There is an energy saving opportunity in replace the existing fans with new five star labelled fans.The five star labelled fans give a savings up to 30% with higher service value (air delivery/watt).	
Financial Analysis	
Annual working hours (hrs)	2400
Total numbers of ordinary fans	300
Total load (kW)	21.00
Annual Energy Consumption (kWh)	40320
Expected Annual Energy saving, for total replacement(kWh)	11290
Cost of Power (Rs)	8.10
Annual saving in Lakhs Rs (1st year)	0.91
Investment required for a total replacement (Lakhs Rs)[@3000 Rs per Fan with 50W at full speed]	9.00
Simple Pay Back (in Months)	118.10

Technical Supplements

Electricity Bill Details (2021-22)												
Month	Name of the Consumer				St Berchmans College (Autonomous)							
	Contract Demand(kVA)			160	Consumer number & Section			1346360002582				
	Tariff			HT II (B) GENERAL				Changanacherry				
	kWh				kVA			PF	PF Incentive	PF Penalty	Rs (Total)	Rs/kwh
	Z1	Z2	Z3	Total	Z1	Z2	Z3					
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May-22	10154	3166	5722	19042	61	41	37	0.91		2149	165291	**8.68**
				321980	140.13			0.9433			1E+06	**8.10**

KERALA STATE ELECTRICITY BOARD LIMITED

Office of the Special Officer(Revenue), Pattom,Thiruvananthapuram

DEMAND NOTICE FOR SEPTEMBER 2022

(As per CHAPTER VII OF KERALA ELETRICITY SUPPLY CODE -2014)

Con.	1346360002582	Bill Date	02-Sep-2022	Due Date	09-Sep-2022	Bill.No	21028111001991 Ver : 0
Tariff	HT II (A) GENERAL			Last Date	24-Sep-2022	CD	523940 BG 0

ST.BERCHMANS COLLEGE
SB College,VAZHAPALLY,
Changanassery,
Kottayam,,
Mobile no--9961004977

LCN :1/4952

SBI Virtual A/c No(IFS Code:SBIN0070493)-KSEBHT1C4952

KSEBL WISHES YOU A VERY HAPPY ONAM
Consumer GSTIN_ID- /KSEB (L)GST ID=32AAECK2277NBZ1

Arrears as on 31-Jul-2022			
Disputed	0	Undisputed	0

Contract Demand(kVA)	75% of CD (KVA)	130% of CD (KVA)	Connected Load (KW)
160.0	120.0	208.0	363.85

Date of Previous Reading	31-Jul-2022	Email: bursarsbc@gmail.com		
Date of Present Reading	31-Aug-2022	Supply Voltage	11 kV	HT

Average		
MD (kVA)	Consumption (kWh)	PF
97.09	22078	0.94

Billing Type	DPS
Section	Changanacherry
Circle	Kottayam

Reading Details of meter NET METER 4952-Working (KVA,KWh,KVAh & KVArh) for 08-2022

1. Energy Consumption(KWh)

Zone	FR	IR	MF	Units
1	304625.00	297564.00	2.000	14088
2	91948.00	89696.00	2.000	4504
3	163487.00	159521.00	2.000	7932
			Total	26524

2. Energy Consumption(KVAh)

Zone	FR	IR	MF	Units
1	319982.00	312446.00	2.000	15072
2	95304.00	92950.00	2.000	4708
3	173799.00	169556.00	2.000	8486
			Total	28266

Ave.PF=KWh/KVAh 0.94

3. Energy Consumption(KVArh) Lag and kVARh (Lead)

Zone	FR	IR	MF	Units	FR	IR	Units
1	83578.0	81222.0	2.000	4712	274.00	274.00	0
2	23186.0	22537.0	2.000	1298	66.00	66.00	0
3	55381.0	53895.0	2.000	2972	110.00	110.00	0
			Total kVArh(Lag)	8982	kVArh(Lead)		0

4. Demand (KVA)

	Readings	MF	Units
1	54.529	2.000	109.06
2	27.14	2.000	54.28
3	27.586	2.000	55.17

5.Factory Lighting	0.0
6.Colony Lighting	0.0
7.Generator	4125

INVOICE

	Unit	Rate	Amount (Rs)
1.Total Demand Charge			
a. Demand Charge - Normal	120.0	420.000	50400.00
b. Demand Charge - Peak	0.0	420.000	0.00
c. Demand Charge - Off peak	0.0	420.000	0.00
d. Excess Demand Charge	0.0	210.000	0.00
e. Excess Demand Charge(Peak)	0.0	210.000	0.00
f. Excess Demand Charge (Off	0.0	210.000	0.00
Sub Total (a+b+c+d+e+f)			**50400.00**
2.Total Energy Charges			
a. Energy charges - Normal	14088	5.850	82414.80
b. Energy charges - Peak	4504.0	8.775	39522.60
c. Energy charges - Off peak	7932.0	4.387	34801.65
Sub Total(a+b+c)			**156739.05**
3.PF Incentive / Disincentive			783.70
Total Energy Charge			**157522.75**
4.Energy Charges on Lighting load			
a.Factory Lighting	0	0.2	
b.Colony Lighting	0	0.2	0.00
Sub Total(a+b)			
5.Electricity Duty	156739	0.100	15673.91
6.Ele. Surcharge	26524	0.025	663.10
7.Duty on self generated energy	4125	0.012	49.50
8.Penalty for non-segn. of light load			

	Amount
9.Other Charges	
Reconnection Fee	0.00
Charges for Belated Payments	779.00
10.Total(add 1 to 9)	**225088.26**
Plus/Minus (Round off)	-0.26
UnDisputed Arr Amount	0.00
Less 1. Advance / Credit	
2. CD Interest	0.00
3. CD Refund	0.00
Net Payable	**225088.00**

(Rupees Two Lakh Twenty Five Thousand Eighty Eight Only)

E & O.E

Balance Advance at Credit, if any

Please follow our official Facebook page fb.com/ksebl for information & announcements.

(instructions

SPECIAL OFFICER (REVENUE)

Please Detach and enclose with the DD

1346360002582 **21028111001991** **Rs.225088.00** **September 2022**

ST.BERCHMANS COLLEGE

Date D D M M Y Y Y Y

DD/Payment Instruction

Name of the Bank

Signature

KERALA STATE ELECTRICITY BOARD LIMITED

Office of the Special Officer(Revenue), Pattom,Thiruvananthapuram

Hydel Year : Oct - 2022 - Sep - 2023 Month : Oct - 2022

SOLAR SB COLLEGE

Transmission 0 Wheeling 0 Banking Charges 0

SOLAR SB COLLEGE(1/4952)

Capacity .05

No. of Days Generated 30 From Date 01-Oct-2022 To Date 31-Oct-2022

Zone	*Export*	*Import*	*Solar Gen*	*Net units*	*Transmission*	*Wheeling*	*Balance*
Normal	178.00	16556.00	5700.00	0.00	0.00	0.00	0.00
Peak	2.00	4708.00	0.00	0.00	0.00	0.00	0.00
Offpeak	0.00	7940.00	0.00	0.00	0.00	0.00	0.00
Total	180.00	29204.00	5700.00	**0.00**	0.00	0.00	**0.00**

Banking Details

Zone	*Balance*	*Availble*	*Total Balance*	*Current*	*Banking*	*Balance in Bank*
Normal	0.00	0.00	0.00	0.00	0.00	0.00
Peak	0.00	0.00	0.00	0.00	0.00	0.00
Offpeak	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00	0.00	0.00	**0.00**	**0.00**	**0.00**

Adjustments

ST.BERCHMANS COLLEGE (1/4952)

Zone	Consumption kVA	Adjusted kVA	Billed kVA	Consumption kWH	Adjusted kWH	Billed kWH
Normal	104.00	0	0	16378.00	0	16378
Peak	0.00	0	0	4706.00	0	4706
Offpeak	0.00	0	0	7940.00	0	7940
Total		0.00		29024.00	0.00	29024.00

Total kWH Adjusted	0.00

Total Energy in Bank	0.00
MD Relief	0.0

Remarks

SPECIAL OFFICER (REVENUE)