GREEN AUDIT REPORT

M.E.S ASMABI COLLEGE

P.VEMBALLUR

Executed by

OTTOTRACTIONS
Energy - Engineering - Environment

2023

OTTOTRACTIONS
Energy - Engineering - Environment

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Bureau of Energy Efficiency
Government of India.

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P. VEMBALLUR

OTTOTRACTIONS
Energy-Engineering-Environment

Green Audit Report
M.E.S Asmabi College, P.Vemballur
Report No: EA 1076/GA
2023-October

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 2009" for the best performance as an Energy Auditor. Ottotractions is an ISO 9001-2015, ISO 17020-2012 and ISO 14001-2015 Certified organization, which ensures the quality of its services.

Acknowledgement

We were privileged to work together with the administration and staff of M.E.S Asmabi College, P.Vemballur. We are grateful to them for the 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.

SURESH BABU B V

Digitally signed by SURESH BABU B V
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B V Suresh Babu
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Government of India

Preface

Educational institutions always had an important leadership role in society in demonstrating types of changes that used to occur with respect to the prime issues of the time. All around the world, educational institutions are taking steps to declare themselves the next carbon neutral school as a part of the global trend of becoming sustainable. In 2007, Victoria University School of Architecture and Design declared themselves the first carbon neutral campus in the world through the purchase of carbon credits. This concept is not a sustainable model as it does not guarantee the capture of carbon forever and also it is expensive.

The potential for any academic institution- (may be a school in a remote village or a university in an urban setting) - to become the driver for change is huge. Its role of practicing leadership in its community can be utilized to encourage and influence carbon neutral living.

The biggest factors that contribute towards emission are Energy, Transportation and Waste. Any reduction in the carbon emission by the above sectors, starts with the behavioral changes (Low cost) and/or technological investments (High cost). In order to make these changes, the students are to be educated properly on the concept of carbon neutral campuses and methods to reduce it.

In India, the concept of carbon neutral campuses is gaining momentum. Green Audit in Campuses measures the amount of Green House Gases (GHG) emissions produced as a result of its operations through an accounting like inventory of all the sources of GHGs and carbon sequestration in the school campus. Based on this, the total carbon footprint is estimated. Measures are recommended to bring down the carbon footprint of the campus and to make it a carbon neutral campus.

B Zachariah
Director, OTTOTRACTIONS

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Introduction

Background

All across the developed countries, educational institutions are now moving to a sustainable future by becoming carbon neutral and greener spaces. They are taking responsibility for their environmental impact and are working to neutralize those effects. To become carbon neutral, institutions are working to reduce their emissions of greenhouse gases, cut their use of energy, use energy efficient equipment, use more renewable energy, plant and protect green cover and emphasize the importance of sustainable energy sources. Institutions that have committed to becoming carbon neutral have recognized the threat of global warming and are therefore committing to reverse the trend. Studies on this line has not struck roots in most of the developing countries-especially among students.

The Sustainable Development Goals (SDGs), launched by the United Nations in 2015, are an excellent vehicle for driving this change. They represent an action plan for the planet and society to thrive by 2030. The SDGs provide a window of opportunity for creating multidimensional operational approaches for climate change adaptation. They address poverty, hunger and climate change, among other issues central to human progress and sustainable development, such as gender equality, clean water and sanitation, and responsible consumption and production.

The Green Audit of **MES Asmabi College, P. Vemballur** aims to assist campus to reduce their carbon footprint and educate tomorrow's leaders about strategies for carbon mitigation using their campus as a model. Also, this audit covers institutes responses towards SDGs by covering SDG 3,6,7,11,13,15. The green audit also aims to educate students and teachers on the concept of carbon footprint and to enable the students to collect data pertaining to the carbon emissions and carbon sequestration in their campus and to calculate the specific carbon footprint of the campus.

The project also suggests plans to make the campus carbon neutral or even carbon negative by implementing carbon mitigation strategies in areas such as,

a. Energy
b. Transportation
c. Waste minimisation
d. Carbon Sequestration etc.

The major objectives of the audit are:

- To make aware students and teachers on the concept of carbon footprint.
- To calculate the specific carbon footprint of the campus and classify it as carbon negative, neutral or positive.
- To create carbon mitigation plans to reduce their footprint based on the data generated.

MES ASMABI COLLEGE, P. VEMBALLUR

M.E.S. Asmabi College, a premier educational institution managed by the Muslim Educational Society (Regd.) Calicut, owes its existence to the remarkable foresight and unremitting zeal of the late Dr. P.K. Abdul Gafoor, the late P.K. Abdulla I.A.S., Dr. M.A. Abdulla and late Dr. A.K. Siddiq Karikulam Azhikode.The institution was established in the year 1968 at P.Vemballur, Kodungallur, a remote coastal backward village in the S.N. Puram Panchayath, of Thrissur District. The main objective of the institution is to uplift the educationally backward community, especially Muslims of the area who had been denied of the right to education for generations. The college now caters to the needs of the students throughout Kerala

and Lakshadweep, cutting across the barriers of class, caste, creed and religion. Hajee Ismail Essa Sait of Cochin initially donated the land and building and the college was named after his mother "Asmabi".

The college which enjoys 2F and 12B status of the U.G.C. is affiliated to the Calicut University. At present it provides higher education to 2500 above students in seventeen Under Graduate Programmes, six Post Graduate Programmes and three Research centres. The College is re-accredited by the NAAC at B++ level in March 2019.

Occupancy Details					
Particulars	2018-19	2019-20	2020-21	2021-22	2022-23
Total Students	1896	2113	2360	2544	2566
Staffs	114	121	120	125	118
Total Occupancy of the college	2010	2234	2480	2669	2684

For calculating per capita carbon emission estimation, only the student strength is taken into account.

BASELINE DATA SHEET FOR GREEN AUDIT												
1	Name of the Organisation	M.E.S Asmabi College, P.Vemballur										
2	Address (include telephone, fax & e-mail)	M.E.S Asmabi College Thrissur P. Vemballur P.O., Kodungallur, Thrissur Dist., Kerala PIN-680671 0480 - 2850596, 2851171 Principal: 0480 - 2859032 principal.mesasmabi@gmail.com										
2	Year of Establishment	1968										
3	Name of building and Total No. of Electrical Connections/building	MES Asmabi College (5)										
4	Total Number of Students	Boys	-	Girls	-	Total	2566					
5	Total Number of Staff	118										
6	Total Occupancy	2684										
7	Total area of green cover	60%										
8	Type of Electrical Connection	HT	-	LT	4							
9	Total Connected Load (kW)	89										
10	Average Maximum Demand (KVA)	NA										
11	Total built up area of the building (M^2)	13358										
12	Number of Buildings	5										
13	Average system Power Factor	0.99										
14	Details of capacitors connected (kVAr)	NA										
15	Transformer Details (Nos., kVA, Voltage ratio)	TR 1										
		NA										
15	DG Set Details (kVA,)	DG1	DG2	DG3	DG4	DG5	Remarks					
		62.5										
16	Details of motors	Rating		Nos.		Remarks						
		5 to 10		3								
		10 to 50										
		Above 50										
17	Brief write-up about the firm and the energy/environmental conservation activities already undertaken.	20kWp Solar plant is installed, Environmental club, Water conservation activities, Energy conservation activities										
18	Contact Person & Telephone number	Dr. Mohammed Areej E. M										
		9496844901										

2
METHODOLOGY

2.1. Sensitisation

Low Carbon campus initiatives are successful when everyone in the campus is engaged including students, teachers and staff. A team of students, teachers and staff were formed to participate in the audit. A sensitisation among students and teachers on the concept of carbon footprint was conducted.

During the audit the students and staffs were sensitised on the project and trained to be a part of the data collection team. This helped in conducting the survey in a participatory mode so that the awareness will penetrate to the grass root level. During the data collection field visit it was stressed that the team will spread these ideas to their homes and friends. This will help in a horizontal and vertical spread of the message to a wider group. It is assumed that through 980 occupants of this campuses will reach same number of households. This message will spread to at least 3920 individuals approximately.

2.2 Estimation of carbon footprint

A carbon footprint is the amount of greenhouse gases—primarily carbon dioxide—released into the atmosphere by a particular human activity. A carbon footprint can be a broad measure or be applied to the actions of an individual, a family, an event, an organization, or even entire nation. It is usually measured as tons of CO_2 emitted

per year, a number that can be supplemented by tons of CO_2-equivalent gases, including methane, nitrous oxide, and other greenhouse gases.

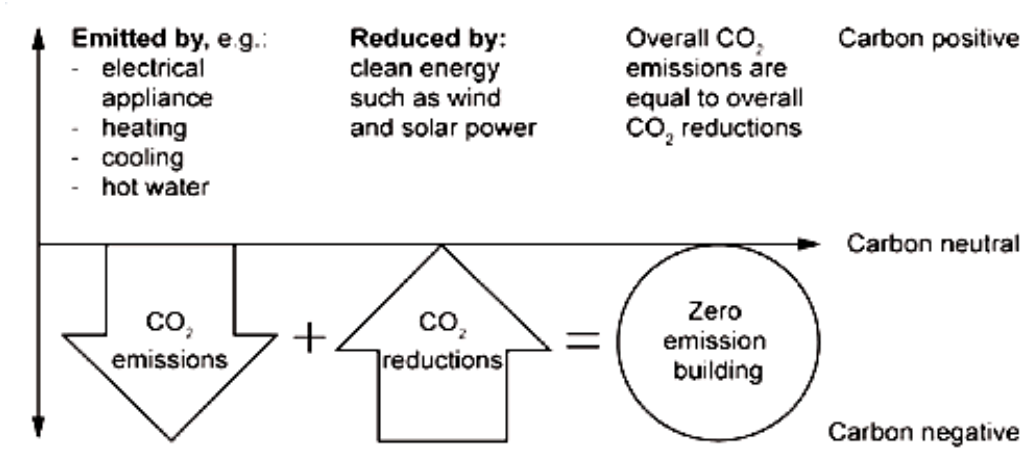
Global Warming Potential (GWP) is a measure of how much heat a greenhouse gas traps in the atmosphere up to a specific time horizon, relative to carbon dioxide. The Global Warming Potential (GWP) was developed to allow comparisons of the global warming impacts of different gases. Specifically, it is a measure of how much energy the emissions of one ton of a gas will absorb over a given period of time, relative to the emissions of one ton of carbon dioxide (CO_2).

Global Warming Potentials (IPCC Second Assessment Report)					
Species	Chemical formula	Lifetime (years)	Global Warming		
			20 years	100 years	500 years
Carbon dioxide	CO2	variable §	1	1	1
Methane *	CH4	12±3	56	21	6.5
Nitrous oxide	N2O	120	280	310	170
HFC-23	CHF3	264	9100	11700	9800
HFC-32	CH2F2	5.6	2100	650	200
HFC-41	CH3F	3.7	490	150	45
HFC-43-10mee	C5H2F10	17.1	3000	1300	400
HFC-125	C2HF5	32.6	4600	2800	920
HFC-134	C2H2F4	10.6	2900	1000	310
HFC-134a	CH2FCF3	14.6	3400	1300	420
HFC-152a	C2H4F2	1.5	460	140	42
HFC-143	C2H3F3	3.8	1000	300	94
HFC-143a	C2H3F3	48.3	5000	3800	1400
HFC-227ea	C3HF7	36.5	4300	2900	950
HFC-236fa	C3H2F6	209	5100	6300	4700
HFC-245ca	C3H3F5	6.6	1800	560	170
Sulphur hexafluoride	SF6	3200	16300	23900	34900
Perfluoromethane	CF4	50000	4400	6500	10000
Perfluoroethane	C2F6	10000	6200	9200	14000
Perfluoropropane	C3F8	2600	4800	7000	10100
Perfluorobutane	C4F10	2600	4800	7000	10100
Perfluorocyclobutane	c-C4F8	3200	6000	8700	12700
Perfluoropentane	C5F12	4100	5100	7500	11000
Perfluorohexane	C6F14	3200	5000	7400	10700

The methodology for carbon footprint calculations are still evolving and it is emerging as an important tool for green house management. In the present study carbon emission data from the campus is estimated under four categories viz.

a. Energy
b. Transportation
c. Waste minimisation
d. Carbon Sequestration

Carbon neutrality refers to achieving net zero GHG emission by balancing the measured amount of carbon released into atmosphere due to human activities, with an equal amount sequestrated in carbon sinks. It is crucial to restrict atmospheric concentrations of GHGs released from various socio-economic, developmental and life style activities using biological or natural processes. It is recognized that addressing climate change is not as simple as switching to renewable energy or offsetting GHG emissions. Rather, providing an opportunity for innovation in new developmental activities for viable and effective approach to address the problem.



Energy

In the campus carbon emission from energy consumption is categorised under two headings viz. energy from Electrical and Thermal. Energy used for transportation is calculated under transportation sector.

A detailed energy audit is conducted to understand the energy consumption of the campus. Information on total connected loads, their duration of usage and documents like electricity bills are evaluated. Connected loads are calculated by conducting a survey on electrical equipment on each location. Duration of usage was found out by surveying the users. The survey of equipment was conducted in a participatory mode.

The fuel consumption for cooking, like LPG, was studied by analysing the annual fuel bills and usage schedules during the study. Discussions were carried out with the concerned individuals who actually operate the cooking system.

Transportation

Carbon emission from transportation to be calculated by using the following formula:

Carbon Emission = Number of each type of vehicles × Avg. fuel consumed per year × Emission factors (based on the fuel used by the vehicle)

Waste Minimisation

The waste generated from the campus is also responsible for the greenhouse gas emission. So, in order to calculate the total carbon foot print of the campus it is necessary to estimate the greenhouse gas emission from the waste generated in the campus by the activity of the students, teachers and staffs.

The calculation of the waste generated has been conducted by keeping measuring buckets for collecting the waste generated in a day. This waste so generated was calculated by weighing it.

Carbon Sequestration

Carbon sequestration is the process involved in the long-term storage of atmospheric carbon dioxide. Trees remove carbon dioxide from the atmosphere through the natural process of photosynthesis and store the carbon in their leaves, branches, stems, bark, and roots.

Carbon sequestrated by a tree can be found out by using different methods. Since this study is employed the volumetric approach, the calculation consists of five processes.

- Determining the total weight of the tree
- Determining the dry weight of the tree
- Determining the weight of carbon in the tree
- Determining the weight of CO_2 sequestrated in the tree
- Determining the weight of CO_2 sequestrated in the tree per year

Detailed calculations and results are given below.

Step 1: Determine the total green weight of the tree

The green weight is the weight of the tree when it is alive. First, you have to calculate the green weight of the above-ground weight as follows:

W above-ground= 0.25 D2 H (for trees with D<11)

W above-ground= 0.15 D2 H (for trees with D>11)

W above-ground= Above-ground weight in pounds

D = Diameter of the trunk in inches

H = Height of the tree in feet

The root system weight is about 20% of the above-ground weight. Therefore, to determine the total green weight of the tree, multiply the above-ground weight by 1.2:

$W_{\text{total green weight}} = 1.2 * W_{\text{above-ground}}$

Step 2: Determine the dry weight of the tree

The average tree is 72.5% dry matter and 27.5% moisture. Therefore, to determine the dry weight of the tree, multiply the total green weight of the tree by 72.5%.

$W_{\text{dry weight}} = 0.725 * W_{\text{total green weight}}$

Step 3: Determine the weight of carbon in the tree

The average carbon content is generally 50% of the tree's dry weight total volume. Therefore, in determining the weight of carbon in the tree, multiply the dry weight of the tree by 50%.

$W_{\text{carbon}} = 0.5 * W_{\text{dry weight}}$

Step 4: Determine the weight of carbon dioxide sequestered in the tree

CO_2 has one molecule of Carbon and 2 molecules of Oxygen. The atomic weight of Carbon is 12 (u) and the atomic weight of Oxygen is 16 (u). The weight of CO_2 in trees is determined by the ratio of CO_2 to C is 44/12 = 3.67. Therefore, to determine the weight of carbon dioxide sequestered in the tree, multiply the weight of carbon in the tree by 3.67. $W_{\text{carbon-dioxide}} = 3.67 * W_{\text{carbon}}$

3

RESULTS AND DISCUSSIONS

3.1 CARBON FOOTPRINT ESTIMATION

3.1.1 ENERGY

a. Electricity

Electricity is purchased from KSEB under LT Connections, the details are given below.

Electricity Connection Details		
M.E.S Asmabi College, P.Vemballur		
1	Name of the Consumer	M.E.S Asmabi College, P.Vemballur
2	Tariff	LT-6A Ndom, LT-6F Ndom, LT-6B Ndom
3	Consumer Numbers	1156615000409, 1156611032948, 1156619000713, 1156616007485
5	Connected Load Total (kW)	89
6	Annual Electricity Consumption (kWh)	74999

Electricity Bill Analysis

Electricity Bill Details (2022-23)						
Name of the Consumer			**M.E.S Asmabi College, P.Vemballur**			
Connected Load (kW)			**65**	Consumer no	**1156615000409**	
Tariff		**LT-6A Ndom**		Section	**Mathilakom**	
Month	kWh	Fixed charge (Rs)	Energy charge (Rs)	Duty (Rs)	Meter rent (Rs)	Total amount to be paid (Rs)
Apr-22	4519	4620	30006	3001	70	38030
Jun-22	3120	4620	20717	2072	70	27709
Aug-22	3792	4620	25177	2518	70	32664
Sep-22	3243	4620	21531	2153	70	28613
Oct-22	3000	4620	19921	1992	70	26824
Nov-22	3549	4620	23568	2357	70	30877
Jan-23	3082	4620	20466	2047	70	27430
Feb-23	3374	4620	22406	2241	70	29585
Mar-23	4420	4620	29348	2935	70	37299

Electricity Bill Details (2022-23)						
Name of the Consumer			M.E.S Asmabi College, P.Vemballur			
Connected Load (kW)			12	Consumer no	1156611032948	
Tariff		LT-6F Ndom		Section	Mathilakom	
Month	kWh	Fixed charge (Rs)	Energy charge (Rs)	Duty (Rs)	Meter rent (Rs)	Total amount to be paid (Rs)
Apr-22	927	1680	6158	616	17.7	8540
May-22	2661	1680	17669	1767	17.7	21330
Jul-22	815	1680	5414	541	17.7	7713
Aug-22	818	1680	5432	543	17.7	7733
Nov-22	2152	1680	14288	1429	17.7	17573
Jan-23	783	1680	5196	520	17.7	7471
Feb-23	759	1680	5041	504	17.7	7299
Mar-23	1021	1680	6777	678	17.7	9228

Electricity Bill Details (2022-23)						
Name of the Consumer			M.E.S Asmabi College, P.Vemballur			
Connected Load (kW)			3	Consumer no	1156619000713	
Tariff		LT-6B Ndom		Section	Mathilakom	
Month	kWh	Fixed charge (Rs)	Energy charge (Rs)	Duty (Rs)	Meter rent (Rs)	Total amount to be paid (Rs)
May-22	939	480	6233	623	14.6	7420
Jul-22	543	480	3607	361	14.6	4502
Sep-22	1160	480	7703	770	14.6	9054
Nov-22	1088	480	7224	722	14.6	8521
Jan-23	905	480	6012	601	14.6	7175
Mar-23	914	480	6069	607	14.6	7238

Electricity Bill Details (2022-23)						
Name of the Consumer			M.E.S Asmabi College, P.Vemballur			
Connected Load (kW)			9	Consumer no	1156616007485	
Tariff		LT-6B Ndom		Section	Mathilakom	
Month	kWh	Fixed charge (Rs)	Energy charge (Rs)	Duty (Rs)	Meter rent (Rs)	Total amount to be paid (Rs)
May-22	1136	1440	7543	754	35.4	9857
Jul-22	283	480	1878	188	14.6	2581
Sep-22	294	480	1955	196	14.6	2667
Nov-22	416	480	2762	276	14.6	3564
Jan-23	453	480	3008	301	14.6	3837

Annual Electricity Consumption (kWh)						
Consumer No	**2018-19**	**2019-20**	**2020-21**	**2021-22**	**2022-23**	Connected Load (kW)
1156615000409	49566	20967	23737	36609	42799	65
1156611032948	29419	0	0	0	14904	12
1156619000713	23598	11293	1725	2773	11099	3
1156616007485	18607	12620	9948	9778	6198	9
Total	**121189**	**44880**	**35410**	**49160**	**74999**	**89**

b. Diesel

Diesel Consumption Details				
Year	Transportation	Generator	Total	cost
	in L	in L	in L	in Rs
18-19	225.0	25.0	249.9	23745
19-20	683.4	75.9	759.4	72140
20-21	181.6	20.2	201.8	19167
21-22	152.2	16.9	169.1	16064
22-23	1053.6	117.1	1170.7	111218

c. LPG

LPG Consumption Details					
	2018-19	2019-20	2020-21	2021-22	2022-23
No Cylinders in Lab	3	2	2	3	3
No Cylinders in Hostel/Canteen	20	18	12	22	24
Canteen/Lab LPG Consumption in kg	425	372	258	463	501
Total in kg	425	372	258	463	501

Base Line Energy Data						
M.E.S Asmabi College, P.Vemballur						
		2018-19	2019-20	2020-21	2021-22	2022-23
1	Electricity KSEB (kWh)	121189	44880	35410	49160	74999
2	Electricity DG (kWh)	75	228	61	51	351
3	Electricity Solar - Off grid (kWh)	5647	5771	5895	6260	6388
4	Electricity (KSEB + Off grid) kWh	126911	50878	41365	55471	81738
5	Electricity Grid Tied (kWh)	22586	23083	23579	25039	25550
6	Diesel (L)	250	759	202	169	1171
7	LPG (kg)	425.00	372.00	258.00	463.00	501.00
8	Biogas (m3)	4950	4950	4950	4950	4950

Energy Consumption Profile						
Sl No	Fuel	2018-19 (kCal)	2019-20 (kCal)	2020-21 (kCal)	2021-22 (kCal)	2022-23 (kCal)
1	Electricity	109143324	43755062	35574168	47704689	70294849
2	Diesel	2624447	7973368	2118458	1775495	12292516
3	LPG	5100000	4464000	3096000	5556000	6012000
4	Biogas	22638000	21483000	21021000	22638000	23100000
Total		139505771	77675430	61809626	77674184	111699365

Thermal Fuel Consumption					
M.E.S Asmabi College, P.Vemballur					
	2018-19	2019-20	2020-21	2021-22	2022-23
Annual LPG consumption in kg	425	372	258	463	501
Annual Diesel consumption in L	249.9	759.4	201.8	169.1	1170.7
Annual Biogas consumption in kg	4950	4950	4950	4950	4950

3.1.2 Renewable Energy

20kWp Solar Power plant

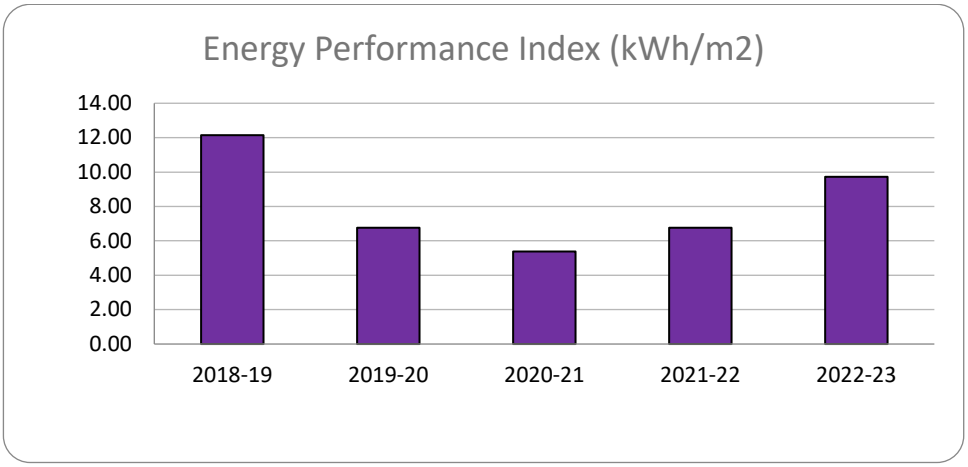
The installation of a 20kWp on-grid solar power plant in the campus is an exemplary initiative and one of the best practices adopted by the college. This solar power plant efficiently harnesses the abundant solar energy available, ensuring sustainable electricity generation. With an annual electricity generation capacity of 25550 units, this solar power plant not only meets a significant portion of the campus's energy needs but also helps in reducing the institution's carbon footprint. By mitigating approximately 20.95 tons of CO_2 emissions per year, the solar power plant plays a crucial role in promoting clean energy and environmental conservation within the college. It stands as a shining example of the college's commitment to renewable energy and serves as an inspiration for other institutions to follow suit.

Solar Power Plant					
Capacity (kWp)	2018-19	2019-20	2020-21	2021-22	2022-23
	Annual Generation				
20	22586	23083	23579	25039	25550

3.2 Specific Energy Consumption

OTTOTRACTIONS- ENERGY AUDIT						
M.E.S Asmabi College, P.Vemballur						
Energy Performance Index (EPI)						
Sl No	Particulars	2018-19	2019-20	2020-21	2021-22	2022-23
1	Total building area (m^2)	13358	13358	13358	13358	13358
2	Annual Energy Consumption (kCal)	139505771	77675430	61809626	77674184	111699365
3	Annual Energy Consumption (kWh)	162216	90320	71872	90319	129883
4	Total Energy in Toe	13.95	7.77	6.18	7.77	11.17
5	Specific Energy Consumption kWh/m^2	12.14	6.76	5.38	6.76	9.72

The specific energy consumption in 2022-23 may be taken as benchmark.



3.3. Waste Generation total

The major concern of waste management will be focused on the solid waste produced by the campus. Solid wastes produced in the campus are mainly of three types, food waste, paper waste, and plastic waste. Food wastes produced in the campus are mainly by two means. The vegetable wastes produced in the kitchen during the food preparation. The food waste produced by the students and staffs of the campus after the consumption of meals.

Degradable Waste

Degradable Waste Generation					
M.E.S Asmabi College, P.Vemballur					
Particulars	2018-19	2019-20	2020-21	2021-22	2022-23
Total Occupancy	2010	2234	2480	2669	2684
Waste generated in kg /day	40.2	44.68	49.6	53.38	53.68
Waste generated in kg /Yr	8844	9829.6	10912	11743.6	11809.6

Non-Degradable waste

Solid non degradable Waste Generation					
M.E.S Asmabi College, P.Vemballur					
Particulars	2018-19	2019-20	2020-21	2021-22	2022-23
Total Occupancy	2010	2234	2480	2669	2684
Waste paper generated in kg /day	0.402	0.4468	0.496	0.5338	0.5368
Waste plastic generated in kg /day	0.603	0.6702	0.744	0.8007	0.8052
Waste paper generated in kg /Yr	88.44	98.30	109.12	117.44	118.10
Waste plastic generated in kg /Yr	132.66	147.44	163.68	176.15	177.14

3.4. Transportation

The college have one Bus for logistics

3.5. Carbon Emission Profile (2022-23)

Carbon emissions in the campus due to the day-to-day activities are calculated and are discussed below. The emission factors considered for estimation and its units are given.

Emission Factors		
Item	Factor	Unit
Electricity	0.00082	tCo_2e/kWh
LPG	0.0015	tCo_2e/kg
Diesel	0.0032	tCo_2e/kg
Petrol	0.0031	tCo_2e/kg
Food Waste	0.00063	tCo_2e/kg
Paper Waste	0.00056	tCo_2e/kg
Plastic Waste	0.00034	tCo_2e/kg

Carbon Foot Print 2022-23

Carbon Foot Print							
Sl. No.	Particulars	2018-19	tCO2e	2019-20	tCO2e	2020-21	tCO2e
1	Electricity (kWh)	126910.8	104.1	50878.0	41.7	41365.3	33.9
2	Diesel (L)	249.95	0.8	759.37	2.4	201.76	0.6
3	LPG (kg)	425.00	0.6	372.00	0.6	258.00	0.4
4	Biogas (M^3)	4950	6.9	4950	6.9	4950	6.9
5	Degradable Waste in kg/yr.	8844.00	5.57	9829.60	6.19	10912.00	6.87
6	Paper Waste in kg/yr	88.44	0.05	98.30	0.06	109.12	0.06
Total Carbon Foot Print tCO2e/yr			**118.1**		**57.9**		**48.8**

Carbon Foot Print					
Sl. No.	Particulars	2021-22	tCO2e	2022-23	tCO2e
1	Electricity (kWh)	55470.6	45.5	81738.2	67.0
2	Diesel (L)	169.09	0.5	1170.72	3.7
3	LPG (kg)	463.00	0.7	501.00	0.8
4	Biogas (m^3)	4950	6.9	4950	6.93
5	Degradable Waste in kg/yr.	11743.60	7.40	11809.60	7.44
6	Paper Waste in kg/Yr	117.44	0.07	118.10	0.07
Total Carbon Foot Print tCO2e/yr			**61.12**		**86.0**

3.6. CARBON SEQUESTRATION

All the activities including energy consumption and waste management have their equivalent carbon emission and they positively contribute to the carbon footprint of the campus. Carbon sequestration is the reverse process, at which the emitted carbon dioxide will get sequestrated according to the type of carbon sequestration employed. Even though there are many natural sequestration processes are involved in a campus, the major type of sequestration among them is the carbon sequestration by trees.

Carbon Sequestration					
Particulars	2018-19	2019-20	2020-21	2021-22	2022-23
Total No of Trees	296	296	298	299	299
Carbon sequestrated by trees in the campus (tCO_2e)	14.9	14.9	14.89	14.89	15.20

Trees sequestrate carbon dioxide through the biochemical process of photosynthesis and it is stored as carbon in their trunk, branches, leaves and roots. The amount of carbon sequestrated by a tree can be calculated by different methods. In this study, the volumetric approach was taken into account, thus the details including CBH (Circumference at Breast Height), height, average age, and total number of the trees, are required. Details of the trees in the campus compound are given in the Table. Detailed table is included in the technical supplement.

Carbon sequestrated by a tree can be found out by using different methods. Since this study is employed the volumetric approach, the calculation consists of five processes.

- Determining the total weight of the tree
- Determining the dry weight of the tree
- Determining the weight of carbon in the tree
- Determining the weight of CO_2 sequestrated in the tree
- Determining the weight of CO_2 sequestrated in the tree per year

List of Trees in Campus

M.E.S Asmabi College, P.Vemballur			
List of Trees on the College Campus			
Sl.No	**Scientific Name**	**Common Name**	**Number of trees**
1	Acacia auriculiformis	Acacia tree	5
2	Albizia chinensis	Mottavaka	10
3	Araucaria heterophylla	Norfolk island pine	2
4	Artocarpus heterophyllus	Jackfruit tree	9
5	Artocarpus hirsutus	Wild jack	9
6	Azadirachta indica	Neem	5
7	Borassus flabellifer	Palm	50
8	Bougainvillea	Paper flower	1
9	Carica papaya	Papaya	2
10	Casuarina equisetifolia	Horsetail tree	17
11	Chrysophyllum oliviforme	Satinleaf	1
12	Cinnamomum zeylanicum	Dalchini	1
13	Cycas circinalis	Queen sago	2
14	Dracaena fragrans	Corn palm	46
15	Falcourtia jangomas	Indian plum	1
16	Ficus auriculata	Fig tree	1
17	Ficus religiosa	Bodhi tree	1
18	Gardenia taitensis	Tiare flower	1
19	Gmelina arborea	Beechwood	1
20	Hamelia patens	Scarlet bush	1
21	Licuala grandis	Ruffled fan palm	13
22	Mangifera indica	Mango	8
23	Manikara zapota	Sapota	2
24	Mimusops elengi	Spanish cherry	5
25	Muntingia calabura	Jamaica cherry	1
26	Murraya exotica	Orange jasmine	2
27	Ochlandra travancorica	Reed bamboo	49
28	Oroxylum indicum	Midnight horror	1
29	Phyllanthus emblica	Indian gooseberry	1
30	Polyalthia longifolia	False Ashoka	12
31	Pseuderanthemum maculatum	Yellow-vein eranthemum	1
32	Psidium guajava	Common guava	1
33	Roystonea regia	Royal palm	2
34	Senna siamea	Siamese cassia	3
35	Swietenia mahagoni	Mahagony	8
36	Syzygium cumini	Java plum	5

37	Syzygium jambos	Rose apple	7
38	Tamarindus indica	Tamarind tree	5
39	Tectona grandis	Teak	1
40	Terminalia bellirica	Bibhitaki	2
41	Terminalia catappa	Sea almond	2
42	Santalum album	White Indian sandalwood	2

CARBON FOOTPRINT OF THE CAMPUS (2022-23)

Various carbon emitting activities such as consumption of energy, transportation and waste generation leads to the total emission of **85.96tCO_2e** per year by the campus. The total carbon sequestration by trees in the campus compound is **15.20tCO_2e**. Thus, the current carbon footprint of the campus will be the difference of total carbon emission and total carbon sequestration/mitigation ie **42.88tCO_2e** The following table shows the carbon footprint level:

Specific CO_2 Footprint

Amount of Carbon to be mitigated for Low Carbon Campus						
Sl No	Particulars	2018-19	2019-20	2020-21	2021-22	2022-23
1	Total carbon emission tCO_2e	118.06	57.89	48.82	61.12	85.96
2	Total carbon sequestration tCO_2e	14.0	14.3	14.6	14.9	15.20
3	Amount of carbon mitigated through renewable energy tCO_2e	25.45	25.86	26.26	27.46	27.88
4	To be mitigated tCO_2e	78.59	17.73	7.96	18.76	42.88
5	Total No of Students	1896	2113	2360	2544	2566
6	Specific Carbon Footprint kg CO_2e/Student/Yr	41.45	8.39	3.37	7.37	16.71

The increased electricity consumption in 2022-23 is primarily attributed to ongoing building construction. In the year 2021-22, the total specific carbon footprint was estimated at **16.71** kg of CO_2e per student.

4

Carbon Mitigation Plans

The total emission of the carbon dioxide per student is **16.71** kg per year (2022-2023). Emission reduction plans were prepared to bring the existing per capita carbon footprint to zero or below so as to bring the campus a carbon neutral or carbon negative campus.

This can be achieved in many ways but, every alternate plan must be in such a way that, it must fulfill the actual purpose of each activity that is considered.

Here, three major methods are taken in to account as the plans for reducing the carbon emission of the campus.

- Resource optimisation
- Energy efficiency
- Renewable energy

RESOURCE OPTIMISATION

The effective use of resources can limit its unnecessary wastage. Optimal usage of the resources (such as fuels) can save the fuel and can also reduce the carbon emission due to its consumption. This technique can be effectively implemented in the 'transportation' and 'waste' sectors of the campus.

WASTE MINIMISATION

Optimal utilisation of paper and plastic stationaries can reduce the frequency of purchase of items. This can reduce the unnecessary wastage of money as well as the excess production of waste. In the case of food, proper food habits and housekeeping practices can optimise its usage.

Currently, the campus is taking an appreciable effort to reduce the unnecessary production of wastes. But the campus still has opportunities to reduce the generation of waste and can improve much more. Resource optimisation can be effectively implemented in all type of waste generated in the campus and the campus can expect about 50% reduction the total waste produced.

ENERGY EFFICIENCY

Energy efficiency is the practice of reducing the energy requirements while achieving the required energy output. Energy efficiency can be effectively implemented in all the sectors of the campus.

FUELS FOR COOKING

The campus uses biogas and commercial LPG cylinders for its cooking purpose. The campus can install a biogas plant to treat food waste and the biogas thus generated can be used in kitchen. Installation of a solar water heater to rise the water temperature to a much higher level, then it has to consume only very less amount of thermal energy for preparing the same amount of food is another method. This can make a positive benefit to the campus by saving money, energy and can reduce the carbon emission of the campus due to thermal energy consumed for cooking.

TRANSPORTATION

Energy efficiency of the transportation sector is mainly depended on the fuel efficiency of the vehicles used. Here mileage of the vehicle (kmpl - Kilometres per Litre) is calculated to assess the fuel efficiency of the vehicle.

Percentage of closeness is the ratio of actual mileage of the vehicle to its expected mileage. If the percentage of closeness of mileages of each vehicle is greater than that of its average, then the efficiency status of the vehicle is considered as ‘Above average’ and else, it is considered as ‘Below average’.

Carbon Mitigation Proposals

After analyzing the historical and measured data the following projects are proposed to make the campus carbon neutral. The projects are from energy efficiency and renewable energy. The further additions in the green cover increase will also give positive impact in the carbon mitigation.

OTTOTRACTIONS- ENERGY AUDIT						
M.E.S Asmabi College, P.Vemballur						
Greenhouse Gas Mitigation through Major Energy Efficiency Projects						
Sl No	Projects	Energy saved(Yearly)		Sustainability (Years)	First year ton of CO2 mitigated	Expected Tons of CO2 mitigated through out life cycle
		(kWh)	MWh	Years		
1	Energy Saving in Lighting by replacing existing 18 No's T12 (55W) Lamps to 18W LED Tube	392	0.39	10	0.29	2.86
2	Energy Saving in Lighting by replacing existing 11 No's T8 (40W) Lamps to 18W LED Tube	174	0.17	10	0.13	1.27
3	Energy Saving by replacing existing 285 No's in-efficient ceiling fans with Energy Efficient Five star fans	16197	16.20	10	11.82	118.24
Total		**16763**	**17**	**10**	**12.24**	**122.37**

OTTOTRACTIONS- ENERGY AUDIT						
M.E.S Asmabi College, P.Vemballur						
Greenhouse Gas Mitigation through Renewable Energy Projects						
Sl No	Projects	Energy saved(Yearly)		Sustainability (Years)	First year ton of CO2 mitigated	Expected Tons of CO2 mitigated throughout life cycle
		(kWh)	MWh	Years		
1	Installation of 35kWp Solar Power Plant	47906	47.91	25	34.97	874.29
	Total	47906	48	25	34.97	874

OTTOTRACTIONS- ENERGY AUDIT	
Energy Saving Proposal Code	
Energy Saving in Lighting by replacing existing 18 No's T12 (55W) Lamps to 18W LED Tube	
Existing Scenario	
18 numbers of T12(55 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 T12 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	18
Total load (kW)	0.99
Annual Energy Consumption (kWh)	713
Expected Annual Energy saving for replacing all fittings (kWh)	392
Cost of Power	8.72
Annual saving in Lakhs Rs (1st year)	0.03
Investment required for complete replacements [@Rs 300 per fittings](Lakhs Rs)	0.05
Simple Pay Back (in Months)	18.96

OTTOTRACTIONS- ENERGY AUDIT	
Energy Saving Proposal Code	
Energy Saving in Lighting by replacing existing 11 No's T8 (40W) Lamps to 18W LED Tube	
Existing Scenario	
11 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	11
Total load (kW)	0.44
Annual Energy Consumption (kWh)	317
Expected Annual Energy saving for replacing all fittings (kWh)	174
Cost of Power	8.72
Annual saving in Lakhs Rs (1st year)	0.015
Investment required for complete replacements [@Rs 300 per fittings](Lakhs Rs)	0.03
Simple Pay Back (in Months)	26.06

OTTOTRACTIONS- ENERGY AUDIT	
Energy Saving Proposal	
Energy Saving by replacing existing 285 No's in-efficient ceiling fans with Energy Efficient Five star fans	
Existing Scenario	
There are 285 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	285
Total load (kW)	22.80
Annual Energy Consumption (kWh)	43776
Expected Annual Energy saving, for total replacement(kWh)	16197
Cost of Power (Rs)	8.72
Annual saving in Lakhs Rs (1st year)	1.41
Investment required for a total replacement (Lakhs Rs)[@3000 Rs per Fan with 50W at full speed]	8.55
Simple Pay Back (in Months)	72.64

Energy Saving Proposal	
Installation of 35kWp Solar Power Plant	
Existing Scenario	
There is a good potential of solar power electricity generation. The availability of sunlight is very high. There are some canopies available in the proposed site, but by having proper trimming of trees this may be avoided. If the SPVs are place in the roof top it will help improving RTTV (Roof Thermal Transmit Value) of the building.	
Proposed System	
It is proposed to have a Solar Power Plant of 30kW at the beginning stage. The state and central government is pushing and giving good assistance to the installation. It can be installed as an internal grid connected system which is much cheaper than off grid system. Now days the technology provides trouble free grid interactive and connected system. The installation will provide 25yrs trouble free generation with only 20% efficiency loss at the 25th year.	
Financial Analysis	
Proposed Solar installed Capacity (kW)	35
Total average kWh per day expected (3.5kWh/day average)	131.25
Total annual Generating Capacity (kWh)	47906
Cost of energy generated annually Lakhs Rs	6.37
Investment required (INR lakh)(Approx)	19.25
Simple Pay Back (in Months)	36.26
Life cycle in Yrs	25
Total Saving in Life Cycle (Approx) RS lakh	159.29

Executive Summary					
Consolidated Cost Benefit Analysis of Energy Efficiency Improvement Projects					
M.E.S Asmabi College, P.Vemballur					
Sl No	Projects	Investment	Cost saving	SPB	Energy saved
		(Lakhs Rs)	(Rs)/Yr	Months	kWh/Yr
1	Energy Saving in Lighting by replacing existing 18 No's T12 (55W) Lamps to 18W LED Tube	0.05	0.03	18.96	392
2	Energy Saving in Lighting by replacing existing 11 No's T8 (40W) Lamps to 18W LED Tube	0.03	0.015	26.06	174
3	Energy Saving by replacing existing 285 No's in-efficent ceiling fans with Energy Efficient Five star fans	8.55	1.41	72.64	16197
4	Installation of 35kWp Solar Power Plant	19.25	6.37	36.26	47906
	Total	**27.89**	**7.83**	**153.92**	**64669.65**
(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.)					

5

CONCLUSION

The carbon emission from different sectors namely, Energy, Transportation and wastes were calculated using standard procedures. Carbon sequestration by the trees present in the campus was also estimated. From these the total carbon footprint of the campus was arrived at.

Net Carbon Emission after implementing Energy Efficiency projects and Renewable Energy Projects Proposed		
1	Total Carbon Foot Print tCO2e/yr	85.96
2	Carbon Sequestrated tCO2e/yr	15.20
3	Carbon mitigated by Renewable Energy tCO2e/yr (Installed)	27.88
4	Carbon mitigated by Renewable Energy tCO2e/yr (Proposed)	34.97
5	Carbon mitigated by Energy Efficiency (Proposed) tCO2e/yr	12.24
6	Effective Carbon footprint tCO2e/yr	-4.33
7	Total No of Students	2566
8	Specific Carbon Footprint kg CO2e/Student/Yr	-1.69

From this study it was found that carbon footprint of the campus to be **-1.69** kgCO_2e/ Student/ Year in place of current footprint i.e.,**16.71**kgCO_2e/ student/ Year. To achieve this, an investment of **27.89 Lakhs Rs** is required through energy efficiency and renewable energy projects proposed. It will be around **1087 Rs per student** to make the campus the carbon negative.

Cost to make the campus Carbon Negative		
1	Cost of implementation in Energy Efficiency Lakhs Rs	8.64
2	Cost of implementation in Renewable Energy Lakhs Rs	19.25
3	Total Lakhs Rs	27.89
4	Total number of students	2566
5	Cost per student to make the campus carbon negative Rs/ Student	1087

REFERENCES

Reports and Books

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OTTOTRACTIONS
Energy-Engineering-Environment

6

TECHNICAL SUPPLEMENT

M.E.S Asmabi College, P.Vemballur																							
Sl.No	Buildings	Location	Lights					Fans			IT				UPS				AC	Others			
			LED-T	LED B	LED(18W)	T8	T12	CF	BLDC	WF	Printer	Photostat	Projector	PC	1kVA	2kVA	3kVA	5kVA	1 TR	PA	Water Dispenser	Fridge	Grinder
1	Hostel Building	Kitchen	5					2														1	1
2		Store				1	1	2															
3		24 Rooms	24						24														
4		Corridor	10																				
5	Auditorium Building	Audtorium			36			20					1							1			
6		Library	11		40		1	15		5				16		1							
7	Bvoc Building	3 Classrooms	6										3										
8		Corridor	5																		1		
9		Staffroom Mass Communication Department	2					2						1									
10		Wash Room		1																			
11		Bvoc Department	2					2						1									
12		4 Classrooms	8					12					4										
13		3 Classrooms	6					6					3										
14	Commerce Block	Exam Hall			24			17												1			
15		2 Class Rooms	4					10					2										
16		Classroom	2					3					1										

17		Corridor	18																				
18		2 Class Rooms	2					4															
19		3 Hall	6					9															
20		Staffroom	2					4															
21		Computer Lab			13			12						90			1	1					
22		Classroom				4		2															
23		2 Class Rooms	4					4					2										
24		M Com Marketing	1				1	2					1										
25		Psychology	3					3					1										
26		Bcom Finance				2		2					1										
27		Department of Commerce	3					4	1		1			1									
28		Bcom Cooperation	2				1	2					1										
29		3 Classrooms	6					6					3										
30		Classroom	1			1		3															
31		2 Class Rooms	4					8					2										
32		Physics Lab	2					6															
33		Staffroom	2					3															
34		II BBA					2	2					1										
35		Psychology Lab	3				1	2					1										
36		Staffroom	2					1			1			1									
37		Classroom	2					2															
38		Lab	2					4						2									
39		III Bcom Cooperation	1				1	2					1										
40		III Bcom CA	2					2					1										
41		I Bcom CA	2			1		2															
42		Bvoc Fish Processing Technology Lab	4					5						1								1	
43	Abdul Kareem Block	Zoology Department	1	1		1		2			1			1									
44		Corridor	5																				

45		Bsc Aquaculture	1					22					1											
46		Zoology Lab	2				7	2																
47		Agriculture Department	3					4			1			1	1								1	
48		AquaCulture Lab	4					1																
49		3 Classrooms	6					6																
50	Main Building	IQAC	1	1				1			1			1										
51		Biochemistry	6																					
52		Corridor	7																					
53		Botany Lab		8				8																
54		Smart Class			14			7					1						2	1				
55		Botany Research	3					2			1			1										
56		Office			25			7			5	1		7										
57		Principal			8			2			1								1					
58		Exam Control Room			8			2				3		2		2								
59		Classroom	1			1		1																
60		Corridor	14																		1			
61		2 Labs	2					2																
62		Physics Lab	2	2			1	4																
63		Mathematics Dept	1	1				1						2										
64		3 Economics	6					6					3											
65		Classroom	1				1	2					1											
66		Economics Dept	2					2		1	1			1										
67		6 Classrooms	12					12					6											
68		Physics Classrooms	1				1	2					1											
		Total	240	14	168	11	18	285	25	6	13	4	42	129	1	3	1	1	3	3	2	3	1	

KERALA STATE ELECTRICITY BOARD LIMITED

DEMAND CUM DISCONNECTION NOTICE

(As per Regulation 122 & 123 of Kerala Electricity Supply Code 2014)

Section	[5661]-Electrical Section Mathilakom	Phone#	0480-2850155	Customer Care	1912
Consumer#	1156615000409	Reg. Mob# 808xxxx078		Regular CC Bill	KSEBL GSTIN: 32AAECK2277NBZ1

Name & Mailing Address

PRINCIPAL

M E S ASMABI COLLEGE, ASMABI

For redressing complaints/grievance approach the concerned CGRF

South: Chairperson,CGRF(South),KSEB Ltd, Vydythi Bhavanam,Kottarakkara-691506, Ph:0474-2060220

Central: Chairperson,CGRF(Central),KSEB Ltd, Power House Building Ernakulam-682018, Ph:0484-2394288

North: Chairperson,CGRF(North),KSEB Ltd,Gandhi Road,Kozhikode-32, Ph:0495-2367820

State Electricity Ombudsman, Pallikkavil Building,Mamangalam, Edappally, Kochi-682024 Ph:0484-2346488

Bill#	5661221009449	Bill Area	M02/1	DTR	ASMABI COLLAGE EAST
Billing Period	10/2022[Monthly]	Tariff/Phase	LT-6A/Three	Pole#	PA/108
Bill Date	12-10-2022	Due Date	22-10-2022	DC Date	07-11-2022
Contract Demand	(Nil) VA [75% : 0KV, 130% : 0KV]	Connected Load	65012 Watts	Security Deposit	Rs.42752.00

Meter#	L&T020180016497006	Average consumption(Monthly)	
Meter Digits	6.2	Power Unit/Zone	CUMULATIVE
Meter Type/Owner	NET Meter/KSEB	KWH	2840

Last Billed Rdg. Date	Prev. Rdg. Date	Prev. Meter Rdg. Status	Prst. Rdg. Date	Prst. Meter Rdg. Status
13-09-2022	13-09-2022	Working	12-10-2022	Working

Power Unit	Zone	Trading	Initial Reading(IR)	Final Reading(FR)	OMF	Units*
KWH	Cumulative	Import	4972.00	5123.30	20	3026
KWH	Cumulative	Export	707.00	707.00	20	0

Remarks :

Last Paid Amount - Rs.55437.00

Last Payment Date - 12-10-2022

Bill Details			[INR] Amount(Rs.)
a)	Fixed Charges	Fixed Charge[FC]	4620.00
		Sub Total	**4620.00**
b)	Energy Charges	Energy Charge[EC]	20122.90
		Sub Total	**20122.90**
c)	Other Charges	Electricity Duty[ED]	2012.29
		Meter Rent[MR]	70.00
		Sub Total	**2082.29**
d)	GST	MR-CGST	6.30
		MR-SGST	6.30
		Sub Total	**12.60**
e)	Round Off		0.21
f)	Total Amt.(Bill#5661221009449) *(a+b+c+d+e)*		**26838.00**
g)	Surcharge		0.00
h)	Reconnection Fee		0.00
i)	Interim Bills		0.00
j)	Arrears		0.00
k)	Less paid/adj.		-26838.00
l)	Less Advance		-0.00
	Net Payable *(f+g+h+i+j-k-l)*		**0.00**

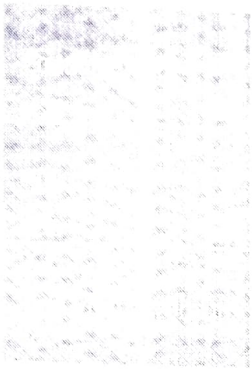
Demand for 10/2022 is Rupees Twenty Six Thousand Eight Hundred and Thirty Eight Only

E&OE **Payment Options:** *Cash,Cheque,DD,MO.* **Online:** *www.kseb.in (Debit/Credit Cards,Net Banking). Other Platforms: BBPS,Friends,Akshaya,CSC,NACH*

Senior Superintendent

OrumaNET Ver#2.3.5 dtd.30/08/2022 printed @ 13/10/2022 08:10:52

Solar OnGrid Consumer (Generator)



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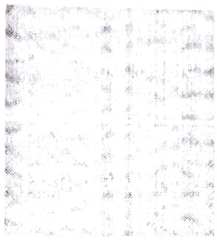
566100009

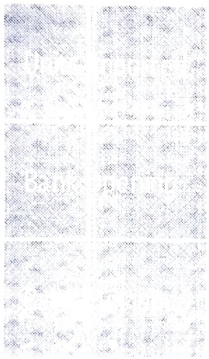
16-03-2018



PRINCIPAL

10 KW

Bank Statement for 202210 (Generator)



3026 kWh

0.000

0.000

0 kWh

3026 kWh